Food and Agriculture Organization of the United Nations
IFAD International Fund for Agricultural Development
unicef
WFP World Food Programme
World Health Organization

2023

THE STATE OF FOOD SECURITY AND NUTRITION IN THE WORLD

URBANIZATION, AGRIFOOD SYSTEMS TRANSFORMATION AND HEALTHY DIETS ACROSS THE RURAL–URBAN CONTINUUM

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THAILAND. Green sprouts with a city backdrop – urban and peri-urban agriculture in action.

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2023 THE STATE OF FOOD SECURITY AND NUTRITION IN THE WORLD

URBANIZATION, AGRIFOOD SYSTEMS TRANSFORMATION AND HEALTHY DIETS ACROSS THE RURAL–URBAN CONTINUUM

Food and Agriculture Organization of the United Nations
International Fund for Agricultural Development | United Nations Children's Fund
United Nations World Food Programme | World Health Organization

Rome, 2023

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FOREWORD

This report brings our organizations together again to reaffirm that, if we do not redouble and better target our efforts, our goal of ending hunger, food insecurity and malnutrition in all its forms by 2030 will remain out of reach. Although the world is recovering from the global pandemic, this is occurring unevenly across and within countries. On top of this, the world is grappling with the consequences of the ongoing war in Ukraine, which has shaken food and energy markets.

Agrifood systems remain highly vulnerable to shocks and disruptions arising from conflict, climate variability and extremes, and economic contraction. These factors, combined with growing inequities, keep challenging the capacity of agrifood systems to deliver nutritious, safe and affordable diets for all. These major drivers of food insecurity and malnutrition are our "new normal". We have no option but to redouble our efforts to transform agrifood systems and leverage them towards reaching the Sustainable Development Goal 2 (SDG 2) targets.

Global hunger is still far above pre-pandemic levels. It is estimated that between 690 and 783 million people in the world faced hunger in 2022. This is 122 million more people than before the COVID-19 pandemic. Nonetheless, the increase in global hunger observed in the last two years has stalled and, in 2022, there were about 3.8 million fewer people suffering from hunger than in 2021. The economic recovery from the pandemic has contributed to this, but there is no doubt that the modest progress has been undermined by rising food and energy prices magnified by the war in Ukraine. There is no room for complacency, though, as hunger is still on the rise throughout Africa, Western Asia and the Caribbean.

No doubt, achieving the SDG target of Zero Hunger by 2030 poses a daunting challenge. Indeed, it is projected that almost 600 million people will still be facing hunger in 2030. This is 119 million more people than in a scenario in which neither the COVID-19 pandemic nor the war in Ukraine had occurred, and around 23 million people more than in a scenario where the war had not happened.

Unfortunately, our worries are not only due to hunger. In 2022, 2.4 billion people, comprising relatively more women and people living in rural areas, did not have access to nutritious, safe and sufficient food all year round. The persisting impact of the pandemic on people's disposable income, the rising cost of a healthy diet and the overall rise in inflation also continued to leave billions without access to an affordable healthy diet. Millions of children under five years of age continue to suffer from stunting (148 million), wasting (45 million) and overweight (37 million). Despite progress in reducing child undernutrition – both stunting and wasting – the world is not on track to achieve the associated 2030 targets, and neither is any region on track to attain the 2030 target for low birthweight, so closely linked to the nutrition of women before and during pregnancy. Steady progress is only seen on levels of exclusive breastfeeding.

These numbers and trends may be a considerable disappointment for us, but for the children and people affected, they constitute an underlying fact of their lives, and this fuels our determination to keep finding solutions. Since 2017, when signs of increasing hunger first began to appear, our organizations, through this report, have provided in-depth analysis of the major drivers behind these concerning trends and evidence-based policy recommendations to address them.

FOREWORD

We have repeatedly highlighted that the intensification and interaction of conflict, climate extremes and economic slowdowns and downturns, combined with highly unaffordable nutritious foods and growing inequalities, are pushing us off track to meet the SDG 2 targets. While we must remain steadfast in taking bold targeted actions to build resilience against these adversities, other important megatrends must be considered.

Urbanization, for example, is one such megatrend that features as the theme of this year's report. By 2050, almost seven in ten people are projected to live in cities; but even today, this proportion is approximately 56 percent. Urbanization is shaping agrifood systems in ways we can only understand through a rural–urban continuum lens, encompassing everything from food production, food processing, and food distribution, marketing and procurement, to consumer behaviour. Due to population growth, small and intermediate cities and rural towns are increasingly bridging the space between rural areas and large metropolises. Hence, in our efforts to end hunger, food insecurity and malnutrition in an urbanizing world, we can no longer operate on the traditional assumption of a rural–urban divide.

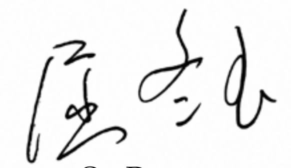
As the world is urbanizing, food demand and supply are changing rapidly across the rural–urban continuum, challenging our traditional thinking. In some contexts, food purchases are no longer high only among urban households but also among rural households living far from an urban centre. Moreover, consumption of highly processed foods is also increasing in peri-urban and rural areas of some countries, whereas consumption of vegetables, fruits, and fats and oils is becoming more uniform across the rural–urban continuum. These important changes are affecting people's food security and nutrition in ways that differ depending on where they live across this continuum.

To overcome the challenges and seize the opportunities that urbanization creates, our actions, policy interventions and investments will have to be informed by a clear understanding of how the rural–urban continuum and agrifood systems interact, and how, given such interaction, urbanization affects access to affordable healthy diets, and consequently food security and nutrition. The policy approach must go beyond rural or urban silos and administrative borders and will require strong and well-coordinated governance mechanisms and institutions.

The theme of this year's report is also timely and relevant for several other reasons. The policy recommendations can inform countries on what programmes, investments and actions can be effective and innovative for meeting the SDG 2 targets in the context of urbanization. They are also relevant for the achievement of other SDGs, including not only SDG 11 (Sustainable Cities and Communities), but also SDG 1 (No Poverty), SDG 3 (Good Health and Well-Being), SDG 10 (Reduced Inequalities) and SDG 12 (Responsible Consumption and Production).

Recent discussions at the United Nations General Assembly have raised the importance of achieving Sustainable Cities and Communities (SDG 11), as this is closely related to other important interconnected issues, including poverty eradication, climate action, migration, land degradation, economic prosperity and creation of peaceful societies. Nonetheless, the related links between urbanization and the affordability of healthy diets, and the resulting implications for food security and nutrition, have not been explored in these discussions, and we hope this report helps bridge this important gap. The report's theme is also aligned with the New Urban Agenda, endorsed by the United Nations General Assembly in 2016, and represents a unique contribution to create awareness about the importance of improving access to affordable healthy diets as a critical component in pursuing sustainable urbanization.

Finally, we hope that this report informs other ongoing efforts, clearly those of the coalitions of action established after the United Nations Food Systems Summit as we move towards the global stocktaking meeting to review progress in implementing the outcomes of the Summit on 24–26 July 2023, not least the Urban Food Systems Coalition, the Coalition of Action on Healthy Diets from Sustainable Food Systems for Children and All, the School Meals Coalition, and the Zero Hunger Coalition; as well as the Scaling Up Nutrition Movement. ■



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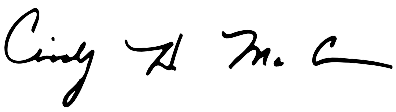

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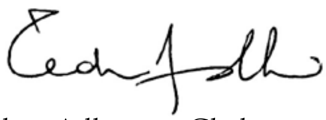

Tedros Adhanom Ghebreyesus
WHO Director-General

METHODOLOGY

The State of Food Security and Nutrition in the World 2023 has been prepared by the FAO Agrifood Economics Division in collaboration with the Statistics Division of the Economic and Social Development stream and a team of technical experts from the Food and Agriculture Organization of the United Nations (FAO), the International Fund for Agricultural Development (IFAD), the United Nations Children's Fund (UNICEF), the World Food Programme (WFP) and the World Health Organization (WHO).

A senior advisory team consisting of designated senior managers of the five UN publishing partners guided the production of the report. Led by FAO, this team decided on the outline of the report and defined its thematic focus. Further, it gave oversight to the technical writing team composed of experts from each of the five co-publishing agencies. Background technical papers were prepared to support the research and data analysis undertaken by the members of the writing team.

The writing team produced a number of interim outputs, including an annotated outline, first draft and final draft of the report. These were reviewed, validated and cleared by the senior advisory team at each stage in the preparation process. The final report underwent a rigorous technical review by senior management and technical experts from different divisions and departments within each of the five UN agencies, both at headquarters and decentralized offices. Finally, the report underwent executive review and clearance by the heads of agency of the five co-publishing partners.

ACKNOWLEDGEMENTS

The State of Food Security and Nutrition in the World 2023 was jointly prepared by the Food and Agriculture Organization of the United Nations (FAO), the International Fund for Agricultural Development (IFAD), the United Nations Children's Fund (UNICEF), the World Food Programme (WFP) and the World Health Organization (WHO).

The publication was carried out under the direction of Marco V. Sánchez Cantillo and José Rosero Moncayo, with the overall coordination of Cindy Holleman, the Editor of the publication, and the overall guidance of Máximo Torero Cullen, all of whom are from the FAO Economic and Social Development stream. The development of the report was guided by a Steering Committee consisting of agency representatives from the five co-publishing partners: Marco V. Sánchez Cantillo (Chair), Sara Savastano (IFAD), Victor Aguayo (UNICEF), Arif Husain (WFP) and Francesco Branca (WHO). Tisorn Songsermsawas (IFAD), Chika Hayashi and Vilma Tyler (UNICEF), Eric Branckaert (WFP) and Luz De Regil (WHO) contributed to the coordination and provided technical support. Valuable comments and final approval of the report were provided by the executive heads and senior staff of the five co-authoring agencies.

Chapter 1 of the report was written by Cindy Holleman (FAO), with inputs from Marco V. Sánchez Cantillo, Anne Kepple, José Rosero Moncayo, Lynnette Neufeld, Pilar Santacoloma and Trudy Wijnhoven (FAO), Sarah Lowder (IFAD), Eric Branckaert (WFP), Chika Hayashi (UNICEF), and Katrina Lundberg and Karen McColl (WHO).

Chapter 2 of the report was coordinated by Anne Kepple (FAO). Section 2.1 was written by Carlo Cafiero, Anne Kepple, José Rosero Moncayo and Sara Viviani with key inputs from Piero Conforti, Valentina Conti and Firas Yassin (FAO). Section 2.2 was written by Valentina Conti, with inputs from Veronica Boero, Carlo Cafiero, Anne Kepple and Michele Vollaro (FAO), and Yan Bai (World Bank). Olivier Lavagne d'Ortigue (FAO) provided data visualization and editorial support for Sections 2.1 and 2.2. Section 2.3 was written by Robert Johnston and Chika Hayashi (UNICEF), with inputs from Julia Krasevec, Vrinda Mehra and Yoshito Kawakatsu (UNICEF), Elaine Borghi, Richard Kumapley, Katrina Lundberg and Karen McColl (WHO), and Anne Kepple (FAO). Nona Reuter (UNICEF) provided support for data visualization in Section 2.3. José Rosero Moncayo provided technical guidance and editorial support to the sections of this chapter.

Chapter 3 of the report was written by Cindy Holleman and Sophie de Bruin (FAO), with inputs from Giovanni Carrasco Azzini, Andrea Cattaneo, Lucia Latino, Theresa McMenomy, Pilar Santacoloma, Kostas Stamoulis and Trudy Wijnhoven (FAO), Florence A. Benn, Alessandra Garbero and Sarah Lowder (IFAD), Vilma Tyler (UNICEF), Sabrina Kuri and Isis Nuñez Ferrera (WFP), Katrina Lundberg, Karen McColl, Lina Mahy and Marjolein Smit-Mwanamwenge (WHO), and Tom Reardon and Lenis Saweda Onipede Liverpool-Tasie (Michigan State University). Marco V. Sánchez Cantillo provided technical guidance and editorial support to the sections of this chapter.

Chapter 4 of the report was coordinated by Cindy Holleman (FAO). Section 4.1 was written by Cindy Holleman (FAO), with inputs from Michael Dolislager (Messiah University), and Lenis Saweda Onipede Liverpool-Tasie and Tom Reardon (Michigan State University). Further inputs were provided by Agnieszka Balcerzak, Carlo Cafiero, Giles Hanley-Cook, Bridget Holmes, Adeeba Ishaq, Lucia Latino, Ana Moltedo, Lynnette Neufeld, Pilar Santacoloma and Trudy Wijnhoven (FAO), Sarah Lowder, Jyotsna Puri and Alessandro Rosi (IFAD), Isis Nuñez Ferrera (WFP), Vilma Tyler (UNICEF), and Katrina Lundberg and Karen McColl (WHO). Section 4.2 was written by Lucia Latino and Cindy Holleman (FAO), with inputs from Carlo Cafiero, Adeeba Ishaq, Anne Kepple, Ana Moltedo, Pilar Santacoloma, Sara Viviani and Trudy Wijnhoven (FAO), Isis Nuñez Ferrera and Sabrina Kuri (WFP), Chika Hayashi, Robert Johnston, Yoshito Kawakatsu and Vilma Tyler (UNICEF), and Katrina Lundberg, Karen McColl and Jason Montez (WHO). Marco V. Sánchez Cantillo provided technical guidance and editorial support to the sections of this chapter.

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Chapter 6 of the report was written by Marco V. Sánchez Cantillo, with inputs from Giovanni Carrasco Azzini, Cindy Holleman, Anne Kepple and José Rosero Moncayo (FAO).

Numerous colleagues from different technical units and departments across the five co-publishing agencies provided valuable technical comments and input to the report. An agency-wide technical clearance process facilitated a comprehensive review by many technical experts from the five co-authoring agencies. Listing each of the contributions would be challenging and furthermore increase the risk of important omissions.

Data inputs

Firas Yassin and Sara Viviani (FAO) were responsible for preparing undernourishment and food security data, respectively, in Section 2.1 and Annex 1A, with inputs from Filippo Gheri, Adeeba Ishaq, Talent Manyani, Ana Moltedo, María Rodríguez and Abdul Sattar, and under the supervision of Carlo Cafiero (FAO). Supporting data were provided by the Food Balance Sheets team, led by Salar Tayyib of the FAO Statistics Division. Carlo Cafiero prepared the 2030 projections of undernourishment, with the assistance of Adeeba Ishaq and with key input provided by David Laborde (FAO). Valentina Conti (FAO) was responsible for preparing the analysis of the cost and affordability of a healthy diet in Section 2.2 and Annex 3, with inputs from Veronica Boero, Carlo Cafiero and Michele Vollaro (FAO), and Samuel Kofi Tetteh Baah, Yan Bai, Daniel Gerszon Mahler, Nishant Yonzan and Christoph Lakner (World Bank). Vrinda Mehra, Robert Johnston, Julia Krasevec and Chika Hayashi (UNICEF) were responsible for the analyses in Section 2.3. Vrinda Mehra and Julia Krasevec (UNICEF), and Richard Kumapley and Monica Flores (WHO) were responsible for consolidating nutrition data in Annex 2. The systematic literature review of evidence from scientific studies for Sections 3.2 and 5.1 was conducted using an integrated research tool developed by FAO's Data Lab for Statistical Innovation and implemented by Marco Scarnò, with Carola Fabi, Craig Matadeen and Christian Mongeau (FAO). The demand analysis in Section 4.1 was conducted by Michael Dolislager (Messiah University), with inputs from Lenis Saweda Onipede Liverpool-Tasie and Tom Reardon (Michigan State University), and Agnieszka Balcerzak, Giles Hanley-Cook, Cindy Holleman, Bridget Holmes, Lynnette Neufeld and Trudy Wijnhoven (FAO). Caleb Reichert (Messiah University) provided geospatial analysis and mapping used in Sections 4.1 and 4.2. Lucia Latino conducted the analysis of the subnational cost and affordability of a heathy diet in Section 4.2, with inputs from Carlo Cafiero, Cindy Holleman and Ana Moltedo (FAO). Sara Viviani (FAO) conducted the survey analysis for the calculation of moderate or severe food insecurity based on the Food Insecurity Experience Scale in Section 4.2, with inputs from Vaishali Bansal (FAO). Yoshito Kawakatsu and Robert Johnston (UNICEF) conducted the survey analysis for the calculation of the malnutrition indicators in Section 4.2.

Support for report production came from Andrew Park (consulting editor) and Daniela Verona in the FAO Economic and Social Development stream.

The FAO Meeting Branch and Language Branch of the Governing Bodies Servicing Division carried out the translations, in addition to the contributors mentioned above. The translations of the report benefited from a technical review by Ahmad Sadiddin and Firas Yassin (Arabic), Lan Li (Chinese), Olivier Lavagne d'Ortigue, Thibault Meilland and Aurelien Mellin (French), Evgeniya Koroleva (Russian), and Verónica Boero and Giovanni Carrasco Azzini (Spanish), all of whom are from FAO.

The FAO Publications and Library Branch of the Office of Communications provided editorial support, design and layout, as well as production coordination, for editions in all six official languages.

ABBREVIATIONS

AARR	average annual rate of reduction
ADER	average dietary energy requirement
ARIMAX	Autoregressive Integrated Moving Average with External Explanatory Variable
BMI	body mass index
CEA	controlled environment agriculture
CoAHD	cost and affordability of a healthy diet
CONSIAL	Food System Council of Metropolitan Lima
CPI	consumer price index
CV	coefficient of variation
CV|r	CV due to energy requirements
CV|y	CV due to income
DEC	dietary energy consumption
DEGURBA	Degree of Urbanization
DES	dietary energy supply
DHS	demographic and health survey
EUROSTAT	Statistical Office of the European Union
FAO	Food and Agriculture Organization of the United Nations
FBDGs	food-based dietary guidelines
FBS	Food Balance Sheet
FIES	Food Insecurity Experience Scale
FIES-SM	Food Insecurity Experience Scale Survey Module
$FI_{mod+sev}$	prevalence of moderate or severe food insecurity
FI_{sev}	prevalence of severe food insecurity
FLAG	food liaison advisory group
FOP	front-of-package
GDP	gross domestic product
GHS-POP	Global Human Settlement Population
GIFT	Global Individual Food consumption data Tool
GRFC	Global Report on Food Crises
GWP	Gallup© World Poll
HDB	Healthy Diet Basket
HICs	high-income countries
ICP	International Comparison Program
IFAD	International Fund for Agricultural Development
IFPRI	International Food Policy Research Institute
ILO	International Labour Organization
IMF	International Monetary Fund
IPC/CH	Integrated Food Security Phase Classification/Cadre Harmonisé
JME	Joint Child Malnutrition Estimates
LICs	low-income countries
LMICs	lower-middle-income countries
LSMS	Living Standards Measurement Study
LUPPA	Urban Laboratory of Public Food Policies
MDER	minimum dietary energy requirement
MICs	middle-income countries
NCD	non-communicable disease
NoU	number of undernourished
OECD	Organisation for Economic Co-operation and Development

PAL	physical activity level
pdf	probability density function
PEAC	Strategic Food Plan for Catalonia
PIP	Poverty and Inequality Platform
3PL	third-party logistics
PoU	prevalence of undernourishment
PPP	purchasing power parity
R&D	research and development
RUFSAT	Rapid Urban Food Systems Appraisal Tool
SD	standard deviation
SDGs	Sustainable Development Goals
SICTs	small and intermediate cities and towns
SMEs	small and medium enterprises
UMICs	upper-middle-income countries
UN	United Nations
UN-Habitat	United Nations Human Settlements Programme
UNICEF	United Nations Children's Fund
UPA	urban and peri-urban agriculture
URCA	Urban Rural Catchment Areas
URCAs	urban–rural catchment areas
WDI	world development indicators
WFP	World Food Programme
WHA	World Health Assembly
WHO	World Health Organization
WPP	World Population Prospects
WTO	World Trade Organization

KEY MESSAGES

➔ Global hunger, measured by the prevalence of undernourishment (Sustainable Development Goal [SDG] Indicator 2.1.1), remained relatively unchanged from 2021 to 2022 but is still far above pre-COVID-19-pandemic levels, affecting around 9.2 percent of the world population in 2022 compared with 7.9 percent in 2019.

➔ It is estimated that between 691 and 783 million people in the world faced hunger in 2022. Considering the midrange (about 735 million), 122 million more people faced hunger in 2022 than in 2019, before the global pandemic.

➔ From 2021 to 2022, progress was made towards reducing hunger in Asia and in Latin America, but hunger is still on the rise in Western Asia, the Caribbean and all subregions of Africa.

➔ It is projected that almost 600 million people will be chronically undernourished in 2030. This is about 119 million more than in a scenario in which neither the pandemic nor the war in Ukraine had occurred, and around 23 million more than if the war in Ukraine had not happened. This points to the immense challenge of achieving the SDG target to eradicate hunger, particularly in Africa.

➔ The prevalence of moderate or severe food insecurity at the global level (SDG Indicator 2.1.2) remained unchanged for the second year in a row after increasing sharply from 2019 to 2020. About 29.6 percent of the global population – 2.4 billion people – were moderately or severely food insecure in 2022, of which about 900 million (11.3 percent of people in the world) were severely food insecure.

➔ Worldwide, food insecurity disproportionately affects women and people living in rural areas. Moderate or severe food insecurity affected 33.3 percent of adults living in rural areas in 2022 compared with 28.8 percent in peri-urban areas and 26.0 percent in urban areas. The gender gap in food insecurity at the global level, which had widened in the wake of the pandemic, narrowed from 3.8 percentage points in 2021 to 2.4 percentage points in 2022.

➔ More than 3.1 billion people in the world – or 42 percent – were unable to afford a healthy diet in 2021. While this represents an overall increase of 134 million people compared to 2019, before the pandemic, the number of people unable to afford a healthy diet actually fell by 52 million people from 2020 to 2021.

➔ Worldwide in 2022, an estimated 148.1 million children under five years of age (22.3 percent) were stunted, 45 million (6.8 percent) were wasted, and 37 million (5.6 percent) were overweight. The prevalence of stunting and wasting was higher in rural areas, while overweight was slightly more prevalent in urban areas.

➔ Steady progress has been made on increasing exclusive breastfeeding for the first six months of life and reducing stunting among children under five years of age, but the world is still not on track to achieve the 2030 targets. Child overweight and low birthweight have changed little, and the prevalence of wasting is more than double the 2030 target.

➔ Increasing urbanization, with almost seven in ten people projected to live in cities by 2050, is driving changes in agrifood systems across the rural–urban continuum. These changes represent both challenges and opportunities to ensure everyone has access to affordable healthy diets.

➔ Challenges include a greater availability of cheaper, convenience, pre-prepared and fast foods, often energy dense and high in fats, sugars and/or salt that can contribute to malnutrition; insufficient availability of vegetables and fruits to meet the daily requirements of healthy diets for everyone; exclusion of small farmers from formal value chains; and loss of lands and natural capital due to urban expansion.

➔ But urbanization also presents opportunities, as it results in longer, more formal and complex food value chains that expand income-generating activities in off-farm employment, especially for women and youth, and increase the variety of nutritious foods. Farmers often gain better access to agricultural inputs and services as urban areas grow closer to rural areas.

➔ Understanding the changes occurring throughout agrifood systems (i.e. from food production, food processing, and food distribution and procurement, to consumer behaviour) requires a rural–urban continuum lens, reflecting the growing connectivity and interlinkages across urban, peri-urban and rural areas.

➔ While already quite advanced in Asia and Latin America, changes in food demand and supply across the rural–urban continuum are accelerating in Africa, where the shares of the population that are food insecure and unable to afford a healthy diet are among the highest in the world. Here the expansive growth in off-farm employment and interconnected food markets and food supply chains is driving a diet transition across the rural–urban continuum.

➔ New evidence for 11 Western, Eastern and Southern African countries challenges the traditional thinking that food purchases make up a small share of rural households' food consumption in Africa. Food purchases are high among urban households in these countries, but they are also surprisingly high across the rural–urban continuum, even among rural households living far from an urban centre.

➔ New evidence also challenges the conventional thinking that purchase patterns between urban and rural areas differ markedly. In the 11 African countries studied, although consumption of processed foods, including highly processed foods, is higher in urban areas, it only declines gradually moving to peri-urban and rural areas. Moreover, consumption of vegetables, fruits, and fats and oils is fairly uniform across the rural–urban continuum relative to total food consumption.

➔ The affordability of a healthy diet is becoming more critical to households living in peri-urban and rural areas because they rely more on food purchases. In the 11 African countries studied, despite the lower cost of a healthy diet in these areas, affordability is still lower than in urban centres. Low-income households living in peri-urban and rural areas are especially disadvantaged, as they would need to more than double their food expenditure to secure a healthy diet.

➔ In many of these African countries studied, food security is not exclusively a rural problem, as moderate or severe food insecurity across urban areas (large, intermediate and small cities and towns) and peri-urban areas (less than 1 hour travel to large, intermediate and small cities) is similar to and sometimes even slightly higher than in rural areas.

➔ The prevalence of child overweight is at risk of increasing with the emerging problem of high consumption of highly processed foods and food away from home in urban centres, which is increasingly spreading into peri-urban and rural areas.

➔ Increasing access to affordable healthy diets and achieving food security and nutrition for all require a policy approach and legislation that leverage the increasing connectivity between rural and peri-urban areas and cities of various sizes.

➔ The closer linkages among agrifood systems segments create opportunities for win–win situations in terms of greater economic development and access to affordable healthy diets, which can be seized through investments in infrastructure, public goods and enhanced capacities that improve rural–urban connectivity. Such investments should support the essential role of small and medium enterprises in agrifood systems, particularly in small and intermediate cities and towns.

➔ Public investment in research and development needs to be increased to develop technologies and innovations for healthier food environments and for increasing the availability and affordability of nutritious foods. Technology can be particularly important to boost the capacity of urban and peri-urban agriculture to supply nutritious foods in cities and towns.

➔ Leveraging connectivity across the rural–urban continuum will require adequate governance mechanisms and institutions to coordinate coherent investment beyond sectoral and administrative boundaries. To this end, subnational governments can play a key role in designing and implementing policies beyond the traditional top-down approach. Approaches to agrifood systems governance should ensure policy coherence among local, regional and national settings through the engagement of relevant agrifood systems stakeholders at all levels.

EXECUTIVE SUMMARY

This year, the update to the global assessment of food security and nutrition reflects a particular moment in history. While the pandemic, the ensuing economic rebound, the war in Ukraine, and soaring prices of food, agricultural inputs and energy have all played out differently across regions with differing impacts, new estimates indicate hunger is no longer on the rise at the global level but is still far above pre-COVID-19-pandemic levels and far off track to achieve Sustainable Development Goal (SDG) 2.

As past editions of this report have highlighted, the intensification of the major drivers of food insecurity and malnutrition – conflict, climate extremes, economic slowdowns and downturns, and growing inequality – often occurring in combination, is challenging our efforts to achieve the SDGs. There is no question these threats will continue, requiring that we remain steadfast to build resilience against them. However, there are still important megatrends that must be fully understood when devising policies to meet the SDG 2 targets.

One such megatrend, and the focus of this year's report, is urbanization. As urbanization increases, rural and urban areas are becoming more intertwined, and the spatial distinction between them is becoming more fluid. The changing pattern of population agglomerations across this rural–urban continuum is driving changes throughout agrifood systems, creating both challenges and opportunities to ensure everyone has access to affordable healthy diets.

After presenting the latest updates of the food security and nutrition situation around the world, the report then examines the drivers, patterns and dynamics of urbanization through a rural–urban continuum lens and presents new analysis on how urbanization is changing food supply and demand across the rural–urban continuum. Complementing this, further analyses for selected countries explore differences in the cost and affordability of a healthy diet, and in food insecurity and different forms of malnutrition across the rural–urban continuum.

Building on these insights, the report identifies policies, investments and new technologies to address the challenges, and capitalize on the opportunities, that urbanization brings for ensuring access to affordable healthy diets for everyone, across the rural–urban continuum.

FOOD SECURITY AND NUTRITION AROUND THE WORLD

Food security indicators – latest updates and progress towards ending hunger and ensuring food security

The global assessment of the state of food security and nutrition in 2022 is a snapshot of the world still recovering from a global pandemic and now grappling with the consequences of the war in Ukraine, which has rattled food and energy markets. Encouraging signs of economic recovery from the pandemic and projections of a decline in poverty and hunger have been tempered by rising food and energy prices.

Global hunger in 2022, measured by the prevalence of undernourishment (SDG Indicator 2.1.1), remained far above pre-pandemic levels. The proportion of the world population facing chronic hunger in 2022 was about 9.2 percent, compared with 7.9 percent in 2019. After increasing sharply in 2020 in the midst of the global pandemic, and rising more slowly in 2021 to 9.3 percent, the prevalence of undernourishment ceased to increase from 2021 to 2022. It is estimated that hunger affected between 691 million and 783 million people in the world in 2022. Considering the projected midrange (about 735 million in 2022), 122 million more people faced hunger in 2022 than in 2019, before the pandemic.

The economic recovery from the pandemic helped to stem the rising tide of hunger at least at the global level. However, the positive effect could have been even larger without the countervailing winds caused by the global repercussions of the war in Ukraine and rising prices of food, agricultural inputs and energy, together with other drivers of food insecurity such as conflicts and weather-related events.

The relative lack of change in hunger at the global level from 2021 to 2022 hides substantial differences at the regional level. Progress was made towards reducing hunger in most subregions in Asia and in Latin America, but hunger is still on the rise in Western Asia, the Caribbean and all subregions of Africa. The proportion of the population facing hunger is much larger in Africa compared with the other regions of the world – nearly 20 percent compared with 8.5 percent in Asia, 6.5 percent in Latin America and the Caribbean, and 7.0 percent in Oceania.

Updated projections show that almost 600 million people will be chronically undernourished in 2030, pointing to the immense challenge of achieving the SDG target to eradicate hunger. This is about 119 million more undernourished people than in a scenario in which neither the pandemic nor the war in Ukraine had occurred, and around 23 million more than in a scenario in which the war had not happened.

SDG Target 2.1 challenges the world not only to end hunger, but also to work to ensure access for all people to safe, nutritious and sufficient food all year round. SDG Indicator 2.1.2 – the prevalence of moderate or severe food insecurity in the population, based on the Food Insecurity Experience Scale (FIES) – tracks progress towards this ambitious goal.

New estimates of the prevalence of food insecurity based on the FIES confirm that for 2022 no progress was made on food insecurity at the global level. Following a sharp increase from 2019 to 2020, the global prevalence of moderate or severe food insecurity remained unchanged for the second year in a row, far above pre-COVID-19-pandemic levels. In 2022, an estimated 29.6 percent of the global population – 2.4 billion people – were moderately or severely food insecure, meaning they did not have access to adequate food. This is still 391 million more people than in 2019, before the pandemic.

The prevalence of moderate or severe food insecurity rose slightly in Africa and in Northern America and Europe, and decreased non-significantly in Asia from 2021 to 2022. The only region showing encouraging progress was Latin America and the Caribbean, mainly in South America, although the food security situation deteriorated in the Caribbean subregion.

A comparison of food insecurity in rural, peri-urban and urban populations at the global, regional and subregional levels using the Degree of Urbanization (DEGURBA) classification, a new international standard, shows that at the global level, food security improves as the degree of urbanization increases. Moderate or severe food insecurity affected 33.3 percent of adults living in rural areas in 2022 compared with 28.8 percent in peri-urban areas and 26.0 percent in urban areas.

Persistent gender inequalities are revealed by the new FIES data. Food insecurity is more prevalent among adult women than men in every region of the world, although the gap narrowed considerably at the global level from 2021 to 2022. In 2022, 27.8 percent of adult women were moderately or severely food insecure, compared with 25.4 percent of men, and the proportion of women facing severe food insecurity was 10.6 percent compared with 9.5 percent of men.

Cost and affordability of a healthy diet

The revised analysis presented in this year's report shows that almost 3.2 billion people worldwide could not afford a healthy diet in 2020, with a slight improvement in 2021 (a decrease of 52 million people). The cost of a healthy diet increased globally by 6.7 percent between 2019 and 2021, with a notable single-year increase of 4.3 percent in 2021. The cost increased by more than 5 percent between 2020 and 2021 in Africa, Asia, Latin America and the Caribbean, and Oceania, but only marginally in Northern America and Europe.

In many countries, the increase in the cost of a healthy diet occurred in combination with a decline in disposable income following the persisting effects of the pandemic. Lockdowns, economic downturns, and other pandemic-related disruptions in 2020 led to job losses and reduced incomes for many people, affecting low-income households the most as they spend a higher share of income on food.

A slight turnaround occurred in 2021, when the number of people unable to afford a healthy diet declined by 52 million compared to 2020, but this is still 134 million more people than in 2019 before the pandemic. Most of the people unable to afford a healthy diet in 2021 lived in Southern Asia, and in Eastern and Western Africa.

The state of nutrition: progress towards global nutrition targets

Nutrition is mentioned specifically in SDG 2 but is central to the achievement of all 17 SDGs. This section presents an assessment of progress towards global nutrition targets for stunting, wasting and overweight among children under five years of age, exclusive breastfeeding and low birthweight. Updated data were not available for anaemia in women aged 15 to 49 years and for adult obesity.

Stunting, the condition of being too short for one's age, undermines the physical and cognitive development of children. Stunting and other forms of undernutrition early in life may also predispose children to being overweight and developing non-communicable diseases (NCDs) later in life. Globally, the prevalence of stunting among children under five years of age has declined steadily, from an estimated 33.0 percent (204.2 million) in 2000 to 22.3 percent (148.1 million) in 2022.

Child wasting is a life-threatening condition caused by insufficient nutrient intake, poor nutrient absorption and/or frequent or prolonged illness. Affected children are dangerously thin, with weakened immunity and a higher risk of mortality. The prevalence of wasting among children under five years of age declined from 8.7 percent in 2000 to 6.8 percent in 2022. The estimated number of children with wasting declined from 54.1 million in 2000 to 45.0 million in 2022.

Children who are overweight or obese face both immediate and potentially long-term health impacts, including a higher risk of NCDs later in life. Child overweight has been on the rise in many countries, hastened by increasingly inadequate levels of physical activity and increased access to highly processed foods. Globally, the prevalence of overweight among children under five years of age showed a non-significant increase from 5.3 percent (33.0 million) in 2000 to 5.6 percent (37.0 million) in 2022.

The latest estimate for low birthweight revealed that 14.7 percent of newborns (19.8 million) were born with low birthweight (less than 2 500 g) in 2020, a non-significant decline from the 16.6 percent (22.1 million) in 2000. Infants born weighing less than 2 500 g are approximately 20 times more likely to die than those with adequate birthweight, and those who survive face long-term development and health consequences.

Optimal breastfeeding practices, including exclusive breastfeeding for the first six months of life, are critical for child survival and the promotion of health and cognitive development. Globally, the prevalence of exclusive breastfeeding among infants under six months of age has risen from 37.0 percent (24.3 million) in 2012 to 47.7 percent (31.2 million) in 2021. Worldwide, over half of all infants under six months of age did not receive the protective benefits of exclusive breastfeeding.

Low- and lower-middle-income countries bear the greatest burden of stunting, wasting and low birthweight but also have the largest proportion of exclusively breastfed children. Most overweight children live in these country income groups. At the global level, the prevalence of stunting and wasting was higher in rural areas than in urban areas while overweight was more commonly found in urban areas.

The results from these analyses help to identify vulnerable population groups, contributing to evidence to inform decision-making and effective action through the appropriate targeting and design of policies and programmes. Sound nutrition is fundamental to the achievement of the Sustainable Development Goals and must be central in government policy and supported by key stakeholders, including civil society and the private sector.

URBANIZATION IS TRANSFORMING AGRIFOOD SYSTEMS AND AFFECTING ACCESS TO AFFORDABLE HEALTHY DIETS ACROSS THE RURAL–URBAN CONTINUUM

Drivers, patterns and dynamics of urbanization

Urbanization is the result of urban population growth, urban expansion (i.e. reclassification of rural areas to peri-urban or urban) and migration from rural to urban areas. This process is fast-changing, context specific and driven by intertwined factors.

Many parts of the world have rapidly urbanized, with the urban share of the world's population rising from 30 percent in 1950 to 57 percent in 2021. It is projected to reach 68 percent by 2050. In most regions, this has been largely driven by structural transformation, which entails an economic transformation from mainly agriculture to a more diversified national economy, in the process attracting rural people to urban areas.

While urbanization often goes hand in hand with economic growth and structural transformation, this does not hold for all countries and regions. Urbanization without economic growth can be linked to poor rural living conditions, including poverty, lack of employment or underemployment, lack of infrastructure, lack of access to services, and food insecurity.

Another factor that may contribute to urbanization is climate change and/or environmental degradation, which can affect rural-to-urban migration movements. Populations that depend on natural resources for their livelihoods can be compelled to migrate to urban areas in search of work, due to the effects of climate change and biodiversity loss. There is also an increasing occurrence of forced displacement from rural areas to urban areas, often as a result of disasters and/or conflict.

With urban expansion and improving road and communication infrastructure across larger parts of rural areas, the distinction between rural and urban areas is increasingly blurred. A large share of the new urban dwellers are expected to live in peri-urban areas, as well as in small cities and interconnected towns. Increasingly, rural and urban areas are less separate spaces in their own right, but rather two ends of a spectrum, connected via numerous linkages across a rural–urban continuum.

Almost half of the global population (47 percent) live in peri-urban areas (less than 1 hour to large, intermediate and small cities or towns) and rural areas (1 to 2 hours or more to an urban centre). Given the increasing connectivity of peri-urban and rural areas and the convergence of high food purchases in both, it is clear that peri-urban and rural markets are significant drivers of agrifood systems transformation.

The degree of connectivity between rural and urban areas shapes agrifood systems, and thus the availability of affordable healthy diets, and the livelihoods of urban and rural primary producers, processors and traders. Depending on where urban growth takes place, whether in large, intermediate and small cities or towns, there will be different effects on rural populations' access to services, markets and inputs. A rural–urban continuum framework is therefore critical to understand the links between urbanization and agrifood systems changes and how these changes are affecting the availability and affordability of healthy diets, and in turn, food security and nutrition.

Urbanization affects agrifood systems, creating challenges and opportunities to ensure access to affordable healthy diets

Urbanization, combined with other contextual factors such as rising incomes, growing employment and changing lifestyles, is driving changes throughout agrifood systems across the rural–urban continuum. Increases in food demand in urban areas are occurring simultaneously with increases in the amount of food that agrifood systems have to produce, process and distribute, which, together with changes in consumer behaviour, are being seen across the rural–urban continuum. These changes may also lead to disparities across the rural–urban continuum, with both positive and negative effects on the availability and affordability of healthy diets, and in turn, on food security and nutrition outcomes.

One of the most important pathways through which urbanization is driving changes in agrifood systems is through a shift in **consumer behaviour and diets**. Higher average incomes, combined with changing lifestyles and employment, are driving a diet transition characterized by changes in the types and quantities of food consumed, with diets shifting beyond traditional grains into dairy, fish, meat, vegetables and fruits. There is a diffusion of food purchases in rural areas, more so than is commonly understood. The diet in these areas has shifted from mainly home-produced foods to increasingly market-purchased products.

However, urbanization has also contributed to the spread and consumption of processed and highly processed foods, which are increasingly cheaper and more readily available and marketed. Changes in the lifestyles and employment profiles of both women and men, as well as increasing commuting times, are resulting in greater demand for convenience, pre-prepared and fast foods. The diet transition is also occurring in rural areas, though lagged and to a lesser extent compared to urban and peri-urban areas.

Urbanization is also leading to changes in **midstream and downstream food supply chains**, which have become longer, more formal and more complex following rising consumer demand and increased regulation of agrifood systems. Importantly, growing midstream and downstream activities provide important off-farm employment opportunities, which can provide steady and liveable incomes, increasing the affordability of healthy diets.

Supply-side factors, coupled with an increase in demand for readily available foods, have contributed to a substantial expansion of supermarkets and hypermarkets that use modern food technology. While these markets can be linked to increased access to nutritious foods – through reduced waste, enhanced sanitation and reduced adverse effects of seasonality, for example – they have also been associated with increased supply of energy-dense and highly processed foods.

Urbanization, in particular, by increasing the connectivity of rural and urban areas, also affects agrifood systems through changes in **agricultural production**. While urbanization is often associated with a diversification of diets, the availability of vegetables and fruits, in particular, is insufficient to meet the daily dietary requirements in almost every region of the world.

As urban areas become better connected to rural areas, rural producers may also have better access to agricultural inputs and services, allowing for improved productivity that typically increases income levels. However, urban expansion can lead to land-use change. In some countries, farmers receive high compensation for selling their land, whereas in others, dispossession of agricultural land is not compensated, resulting in loss of livelihoods and potential issues around land rights.

Access to affordable healthy diets is generally better and food security and nutrition levels are higher in cities than in rural areas because of the better availability of food, higher average purchasing power in urban areas, and better access to health care, education and other services that are essential for health and nutrition. However, this does not always hold true given the transformations underway in agrifood systems, the stark inequalities that exist within urban populations, and the increasingly spatial and functional connectivity between cities, towns and rural catchment areas.

THE INTERPLAY OF FOOD SUPPLY AND DEMAND AND THE COST AND AFFORDABILITY OF HEALTHY DIETS ACROSS THE RURAL–URBAN CONTINUUM

Understanding food supply and demand across the rural–urban continuum

Urbanization, combined with rising incomes, increases in the opportunity cost of time related to work, lifestyle changes and demographic shifts, is changing food demand. These factors together with many supply-side considerations, including food pricing, marketing and promotion, among others, in turn are changing agrifood systems, so there is a reinforcing compounding effect on the food produced, supplied and consumed.

Most notably, rapid urbanization is leading to rising and changing food demand, and shifts in patterns of food supply – especially in sub-Saharan Africa and Southern Asia, the two regions exhibiting the highest urbanization rates. Projections of overall food expenditure estimate an approximate 2.5-fold increase in sub-Saharan Africa and a 1.7-fold increase in Southern Asia by 2050.

Analysis of food demand, defined as household food consumption (at market value), across the rural–urban continuum in selected countries was conducted and revealed interesting patterns. This was made possible by applying the newly available geospatial Urban Rural Catchment Areas (URCA) dataset combined with georeferenced data from nationally representative Living Standards Measurement Study (LSMS) surveys. For reasons of data availability, the surveys used covered the period 2018/19 for Benin, Burkina Faso, Côte d'Ivoire, Ethiopia, Guinea-Bissau, Mali, the Niger, Nigeria, Senegal and Togo, and 2019/20 for Malawi.

Given it is expected that diets become more diversified with higher levels of food consumption, income and employment, the 11 countries were classified into two groups according to their food budget (i.e. the market value of their total food consumption per capita per day): high-food-budget countries (average 2.3 PPP dollars per capita per day) and low-food-budget countries (average 1.6 PPP dollars per capita per day).

New empirical evidence from this analysis, challenges traditional thinking and reveals important food consumption patterns, including dietary convergence across the rural–urban continuum. For example, across the 11 countries, food purchases form the majority of total food consumption in value terms, including food for home consumption and food away from home.

While high shares of food purchases in urban areas are to be expected (78–97 percent), shares are surprisingly high even for rural households living 1 to 2 hours from a small city or town (56 percent on average) and for those living more than 2 hours travel to any urban centre (52 percent on average). The finding that in most of the countries analysed, the "majority" of household food consumption in rural households comes from purchases is a major deviation from the traditional image of rural subsistence households.

Own production never becomes the main source for food – not even in rural areas. In rural areas, the average share of own production represents only 37 percent and 33 percent of total consumption in high- and low-food-budget countries, respectively. Given that rural households in the 11 African countries do not produce the majority of the food value they consume, the affordability of healthy diets is equally critical across the rural–urban continuum.

While the diffusion of processed foods, including highly processed foods, is already advanced in Asia and Latin America, it is spreading quickly in Africa as well. In the 11 African countries studied, the analysis clearly shows a diffusion of purchases of processed foods across the rural–urban continuum. While highly processed foods are a small proportion of total purchases and their consumption is higher in urban areas, the results highlight the penetration of highly processed foods in rural areas, even those living 1 to 2 hours or more from a city or town. The econometric analysis indicates that higher levels of household income and more non-farm employment are associated with a higher consumption value share of highly processed foods in the 11 African countries.

In the 11 African countries, looking at household food composition in terms of the value shares of food consumption by food group, a diet transition is clearly occurring across the rural–urban continuum, with increases in the consumption of more expensive food items, like animal source foods and fruits. The econometric analysis indicates that animal source food consumption value shares are strongly driven by income across the rural–urban continuum, while the consumption value shares of fruits and vegetables are driven more by access and availability.

Cost and affordability of a healthy diet, and food security and nutrition across the rural–urban continuum

On average, across the 11 countries in Africa analysed, the cost of a healthy diet in urban centres is much higher (on average 1.2 times higher) than in peri-urban areas and it then decreases the smaller the city size and moving closer to rural areas. The higher cost of animal source foods, compared to the other food groups, drives up the cost of a healthy diet across the rural–urban continuum, especially in urban and remote rural areas.

The cost of a healthy diet exceeds average food expenditure for low- and middle-income households in both high- and low-food-budget countries in the 11 countries analysed. Low-income households living in peri-urban and rural areas are especially disadvantaged, as they would need to more than double their current expenditure on food to secure a healthy diet.

Although the cost of a healthy diet in peri-urban areas is lower than in urban areas, this does not translate into a more affordable healthy diet in the former. On average, the percentage of the population unable to afford a healthy diet in peri-urban areas is 1.5 times higher than in urban centres and similar to rural areas.

An analysis of food insecurity based on the FIES for 9 of the 11 African countries shows that in many of these countries, the prevalence of moderate or severe food insecurity in urban and peri-urban areas is similar to that in rural areas, and in some cases, slightly higher, indicating that food insecurity is not exclusively a rural problem.

The prevalence of malnutrition across the ten URCA categories was only estimated for 3 of the 11 countries, due to data limitations. In the three countries (Benin, Nigeria and Senegal), generally the prevalence of stunting in children under five years of age gradually increases as cities become smaller and as one moves away from urban centres.

The prevalence of wasting in children under five years of age is lower than that of stunting in all three countries and exhibits less evident trends across the rural–urban continuum. Nevertheless, there are hints of increased wasting in some peri-urban and rural areas in Nigeria and Senegal. Similarly, the prevalence overweight among children is low in all countries and does not present a clear trend across the rural–urban continuum. However, it is worth noting there is a suggestion towards lower overweight in peri-urban areas and higher overweight in some rural areas compared to urban areas.

POLICIES AND SOLUTIONS TO LEVERAGE AGRIFOOD SYSTEMS TRANSFORMATION FOR HEALTHY DIETS ACROSS THE RURAL–URBAN CONTINUUM

The increased links across the rural–urban continuum coupled with closer interactions between the components of agrifood systems create a number of opportunities and challenges for the availability and affordability of healthy diets. Such interactions also create a number of policy and programme entry points to support agrifood systems transformation towards affordable healthy diets.

Policies and investments for healthy diets across the rural–urban continuum

Supporting healthier food outlets will be key for enabling access to healthy diets, as this has shown positive impacts on dietary quality. Policy incentives are necessary to encourage shops to stock and sell greater amounts of fresh and minimally processed foods, for instance, by improving their cold storage facilities, while the availability of healthier food outlets in particular areas across the rural–urban continuum can be improved through land-use planning and zoning regulations; tax credits or exemptions; and licensing agreements.

In urban and peri-urban settings, an estimated 2.5 billion people worldwide consume street foods every day, which are especially convenient for low-income workers and households who may not have the resources, facilities and/or time to prepare dishes at home. However, street foods do not always contribute to healthy diets. There are multiple infrastructure and regulatory gaps that need to be addressed to improve the nutritional quality and safety of these foods. These include ensuring a supply of water of acceptable quality for food preparation, clean places for preparation and consumption of food, sanitary facilities for workers, training for street vendors and consumer education.

Given that one-fourth of the global population live in peri-urban areas of small and intermediate cities and towns (SICTs), investing in these can have a more significant impact on healthy diets for their populations compared to the benefits that trickle down from growth in large cities. Addressing some of the challenges faced by SICTs can allow agrifood systems to be the driver of inclusive rural development, and create development opportunities for small and medium enterprises (SMEs).

The presence of processed foods in household diets across the whole rural–urban continuum constitutes a driving force for the expansion of the services provided by SMEs. Strengthening their efficiency and expansion can also contribute to gains in production of nutritious foods, and a parallel reduction in the cost of food for consumers.

Building rural infrastructure, including quality rural and feeder roads to connect remote farms and enterprises to main road networks, is essential for unlocking the productive potential of SICTs and their catchment areas. Other public investments to support linkages between (mainly small) farms and SMEs could include warehousing, cold storage, dependable electrification, access to digital tools and water supply.

Finally, considering that the availability of fruits and vegetables per capita per day is insufficient to meet the requirements of a healthy diet in most parts of the world, it is essential to boost the production of nutritious foods and, in general terms, support the diversification of food production.

Technology and innovation: a key enabler for agrifood systems transformation under urbanization

In an urbanizing world, the strategic deployment of technology and innovation can be a critical catalyst of agrifood systems transformation.

Countries have varied needs and capacities, and while there is a plethora of technologies and innovations available, no single “silver bullet” technology or innovation will meet all needs in all contexts across the rural–urban continuum.

Whether these technologies and innovations are inclusive for all depends not only on their adoption and impact, but also on how research and development (R&D) is shaped. Between 1981 and 2016, there was a doubling of global public investment in agricultural R&D, with significant increases in larger middle-income countries (MICs); however, smaller lower-middle-income countries (LMICs) continue to have insufficient investment compared to other components of general services support such as infrastructure investments.

In urbanizing contexts, where consumers are increasingly exposed to highly processed foods, different technological and innovative food environment solutions can contribute to reducing their consumption. For instance, behavioural science is an essential innovation that enables governments, scientists and the public to work together to develop evidence-based approaches to increase access to affordable healthy diets, as well as empower consumers to choose healthy diets.

As already noted, urbanization is leading to a growing demand for packaged and pre-prepared foods. Innovations in food packaging can maintain the quality, safety and nutritional value of food products, meet consumer needs and preferences, reduce food loss and waste, and reduce the cost of nutritious foods, especially across longer distribution chains.

Finally, there are numerous technologies and innovations that can be leveraged for enhancing productivity in rural, urban and peri-urban areas, as well as for closing the productivity gap in LMICs, especially in the face of the climate crisis and the disappearance of natural resources. For example, vertical farming requires only a small plot of land and can be carried out indoors, allowing for the cultivation of food in urban and industrial spaces, and leading to shorter supply chains.

Integrated planning and governance mechanisms across the rural–urban continuum

Transformative policies, technologies and innovations require adequate governance mechanisms that, while engaging multiple actors, can coherently address the challenges and leverage the opportunities created in agrifood systems under urbanization.

Due to the multisectoral nature of the challenges and opportunities that urbanization creates across the rural–urban continuum, subnational governments are important actors for formulating and implementing coherent policies that go beyond agrifood systems and outside normal administrative borders. These governments are in close contact with local stakeholders and can ensure that policies are adapted to local conditions by promoting advantages and addressing bottlenecks.

An important starting point towards streamlining governance across the rural–urban continuum is the development of locally based agreements between multiple administrative zones and multistakeholder platforms and networks. Among such mechanisms, food policy councils serve as advisory bodies to local or subnational governments, support policy design and implementation, promote stakeholder engagement, and facilitate monitoring and evaluation of progress in policy implementation, effectiveness, efficiency and impact.

The design and implementation of local agrifood systems policies, investments and legislation for addressing multiple agrifood systems challenges and opportunities requires working outside “silos” and bridging the gaps between policy areas in order to achieve systemic changes.

Policy coherence at national and subnational levels remains a key challenge in establishing the appropriate enabling environment. Therefore, these policies and investments will require strong multilevel governance across national and regional agrifood systems policies. The establishment of national networks engaging various levels of governments appears an important starting point to initiate such multilevel governance mechanisms.

CONCLUSION

Hunger at the global level did not worsen between 2021 and 2022, but there are many places in the world where hunger is on the rise – where people are still struggling to recover income losses in the wake of the COVID-19 pandemic, or have been hit by climbing food and energy prices, or whose lives and livelihoods have been disrupted by conflicts or extreme weather events. Progress on important indicators of child nutrition is to be celebrated, and some regions are on track to achieve some of the nutrition targets by 2030. However, rising overweight and obesity in many countries portends growing burdens of non-communicable diseases.

Urbanization has featured as the theme of this year's report. With almost seven in ten people projected to live in cities by 2050, this megatrend is shaping agrifood systems and, as a consequence, their capacity to deliver affordable healthy diets for all and to help eradicate hunger, food insecurity and malnutrition.

A key conclusion is that the ways in which urbanization is shaping agrifood systems can only be understood through a rural–urban continuum lens; the simple concept of a rural–urban divide is no longer useful to understand the growing links across urban, peri-urban and rural areas. This growing connectivity across the rural–urban continuum is a key aspect today to understand the functioning of value chains. Only then can the challenges and the opportunities that urbanization creates for agrifood systems be clearly mapped onto appropriate policy, technology and investment solutions.

Implementing these solutions requires that the agrifood systems governance mechanisms and institutions cross sectoral and administrative boundaries and rely on subnational and local governments. Local governments in particular are fundamental actors in leveraging multilevel and multistakeholder mechanisms that, as shown with concrete examples in this report, have proved effective in implementing essential policies and solutions for making healthy diets available and affordable for all. ■

UZBEKISTAN
A woman street vendor selling different varieties of apples along the road in the rural Jizzakh region.
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CHAPTER 1
INTRODUCTION

This report regularly monitors global, regional and national progress towards the targets of ending both hunger and food insecurity (Sustainable Development Goal [SDG] Target 2.1) and all forms of malnutrition (SDG Target 2.2) in the context of the 2030 Agenda for Sustainable Development. This year, the global assessment of the state of food security and nutrition in 2022 reflects a particular moment in history. In 2022, the world was beginning to recover from the COVID-19 pandemic when the war broke out in Ukraine, shaking commodity and energy markets. The pandemic, the ensuing economic rebound, the war in Ukraine, and the soaring prices of food, agricultural inputs and energy due in part to the war have all played out differently across regions and populations, with differing impacts on hunger and food insecurity. While new estimates presented in **Chapter 2** indicate hunger was no longer on the rise at the global level in 2022, this indicator was still far above pre-COVID-19-pandemic levels. Moreover, food crises were still unfolding in many parts of the world. Many population groups were not buoyed up by the economic recovery or were bearing the brunt of higher prices of food, inputs and energy – or both. For these reasons, we are still far off track to meet the SDG 2 targets.

Beyond the global assessment of food security and nutrition in 2022, this report provides in-depth analysis of the major drivers behind these trends which are challenging our efforts to achieve the SDGs in the context of the 2030 Agenda. Past editions have repeatedly highlighted the intensification of the major drivers of food insecurity and malnutrition – conflict, climate extremes, economic slowdowns and downturns, and growing inequality – often occurring in combination, which have pushed us off track to meet the SDG 2 targets. There is no question these threats will continue, requiring that we remain steadfast in taking bold actions to build resilience against them. However, there are still important megatrends that must be factored into the analysis to fully understand the challenges to and opportunities for meeting the SDG 2 targets.

One such megatrend, and the thematic focus of this year's report, is urbanization. As urbanization increases, rural and urban areas are becoming more intertwined, and the spatial distinction between them is becoming more fluid. Population growth in small and medium-sized cities and rural towns now increasingly "bridges" the space between the rural hinterland and large metropolises.[1, 2] The changing pattern of population agglomerations across this rural–urban continuum is driving changes throughout agrifood systems, creating both challenges and opportunities to ensure everyone has access to affordable healthy diets. Overcoming the challenges and leveraging the opportunities will require actions and policy interventions that are informed by a clear understanding of how the rural–urban continuum and agrifood systems interact.

While rates of urbanization vary across countries, with the rate of any given country often linked to its stage of structural transformation, urbanization overall is accelerating. By 2050, almost seven in ten people are projected to live in cities; but even today this proportion is already approximately 56 percent.[a] In low- and middle-income countries, the urban population is growing more than three times faster than the rural population (3.08 percent compared with 0.89 percent annually, from 2015 to 2020).[3] By 2030, the urban population in these countries is projected to exceed 4 billion; that is, it will have more than doubled in size since the year 2000. In contrast, the rural population of low- and middle-income countries is projected to increase much less, to at least 3 billion by 2050 – only slightly higher than the 2.95 billion figure of 2000. While rural populations are still increasing rapidly in some regions such as the African drylands, in most other regions rural populations are declining, including in Latin America and Europe.

The areas currently experiencing the most rapid urbanization are those where the link between urbanization, economic growth and structural transformation is weaker – regions like sub-Saharan Africa and Southern Asia, which have some of the highest numbers of individuals who are hungry, food insecure and malnourished. These two subregions are projected to experience the most rapid increases in urbanization, while at the same time facing the biggest challenges regarding poverty, food insecurity and access to affordable healthy diets. Sub-Saharan Africa's urban population is projected to almost quadruple in size by 2050, reaching 1.3 billion, compared with 306 million in 2010.[4] At the same time, the rural population is projected to increase less rapidly but still profoundly, from 540 million in 2010 to 909 million in 2050. In Asia, the urban population is projected to increase by 83 percent, from 1.9 billion to 3.5 billion, while the rural population is projected to decline by 540 million, from 2.3 billion to 1.8 billion. But in Southern Asia, the urban population is projected to more than double, increasing by 120 percent, from 555 million to 1.3 billion.

Urbanization arises from a combination of rural push factors (e.g. poverty, inequitable land distribution, environmental degradation, and forced displacement due to disasters or conflict) and urban pull factors (e.g. urban employment, higher wages, better social services and educational opportunities), which vary depending on the country and specific context. This leads to increased food supply and demand, direct and indirect land-use change, and more complex agrifood market linkages among producers, midstream supply chain processors and distributors, and consumers.[5] While living in urban areas has often been associated with higher standards of living overall, these areas may also have pockets of abject poverty compared to rural areas, and their services are often stretched to the limit. This can result in lack of access to affordable healthy diets, as well as increases in poverty and food insecurity and multiple forms of malnutrition.

Across the entire rural–urban continuum, the majority of food consumed is purchased from markets. Hence, the type of diet that households consume is determined by cost and affordability,

a The United Nations Department of Economic and Social Affairs (UN DESA) does not apply its own definition of "urban" population, but instead follows the definition used in each country. The definitions are generally those used by national statistical offices in carrying out the latest available census. Each country applies its own population criteria for classifying cities as urban.[3]

which in turn depend on the structure of agrifood systems, including food supply and value-added chains. These factors must be taken into consideration in designing effective policies and investments to ensure rural, peri-urban and urban populations have access to affordable healthy diets. A policy approach that goes beyond sectoral silos and administrative borders will be needed to shape how regions urbanize and affect agrifood systems across the rural–urban continuum.

After presenting the main trends in the global assessment of food security and nutrition, and the cost and affordability of a healthy diet around the world (**Chapter 2**), this report explores the linkages between urbanization and changing agrifood systems across the rural–urban continuum.

To begin, **Chapter 3** examines the drivers, patterns and dynamics of urbanization through a rural–urban continuum lens. It presents a conceptual framework showing the pathways through which urbanization is affecting agrifood systems, and in turn enabling or hampering access to affordable healthy diets, with implications for food security and malnutrition in all its forms.

Looking at this process, one of the key transitions that stands out occurs through the interplay of food supply and demand, as well as the resulting changes in what people are eating across the rural–urban continuum. To better understand this, **Chapter 4** presents new analysis precisely on how urbanization is changing food demand, utilizing a unique Urban Rural Catchment Areas (URCA) global dataset combined with georeferenced household survey data. This is followed by additional analysis for selected countries exploring differences in the cost and affordability of a healthy diet, and in food insecurity and different forms of malnutrition across the rural–urban continuum.

Finally, building on the insights from the previous chapters, **Chapter 5** identifies the policies, new technologies, and associated investments that can be adapted to address the challenges – and capitalize on the opportunities – that urbanization brings for ensuring access to affordable healthy diets for everyone, across the rural–urban continuum. The chapter describes the governance mechanisms and institutions that are needed to achieve a more coherent and integrated approach for implementing these policies and solutions.

Such timely evidence and recommendations are relevant to the New Urban Agenda, endorsed by the United Nations General Assembly in 2016, as well as other global processes such as the United Nations Food Systems Summit and the establishment of the Urban Food Systems Coalition in 2021. They are also considered highly relevant for the efforts towards achieving SDGs beyond Zero Hunger, not least SDG 11 (Sustainable Cities and Communities), but also SDG 1 (No Poverty), SDG 3 (Good Health and Well-being), SDG 10 (Reduced Inequalities) and SDG 12 (Responsible Consumption and Production). ■

KENYA
Fresh vegetables for sale in Limuru vegetable market – addressing the root causes of migration by creating employment opportunities in agribusiness.
©FAO/Luis Tato

CHAPTER 2
FOOD SECURITY AND NUTRITION AROUND THE WORLD

The global assessment of the state of food security and nutrition in 2022 presented in this edition of the report is a snapshot of the world still recovering from a global pandemic and now grappling with the consequences of the war in Ukraine, which has further rattled food and energy markets. The impact of the COVID-19 pandemic on lives and livelihoods was devastating, producing a global economic recession that ended three decades of global progress in poverty reduction, contributing to an estimated increase of close to 90 million people facing hunger in just one year (from 2019 to 2020). The year 2021 marked a partial recovery from the pandemic-induced contractions that was highly uneven, across countries and within countries; the pace of recovery was much slower in low- and lower-middle-income countries, and disadvantaged segments of the population everywhere were still struggling to recover from the income losses suffered during the peak of the pandemic the previous year. This contributed to a further increase of about 38 million in the estimated number of people experiencing hunger in 2021. In February 2022, just as the weight of the pandemic was beginning to lift, the war in Ukraine erupted involving two major producers of agricultural commodities in the world, sending shockwaves through commodity and energy markets, weakening the recovery and adding even greater uncertainty.[1]

It is in this context of continued slow and uneven recovery from the pandemic and global repercussions of the war in Ukraine that this assessment of the state of food security and nutrition in 2022 is presented. Encouraging signs of economic recovery from the pandemic and projections of a decline in poverty and hunger have been tempered by rising prices of food, agricultural inputs and energy.

This chapter presents an annual update of the global assessment of food security and nutrition up to the year 2022 and a report on progress towards meeting Sustainable Development Goal (SDG) 2 with a special focus on SDG Targets 2.1 and 2.2: end hunger and ensure access by all people to safe, nutritious and sufficient food all year round; and end all forms of malnutrition by 2030.

Section 2.1 presents an assessment of progress towards achieving the SDG 2 targets for hunger and food insecurity. It includes global, regional and subregional updates of the two Target 2.1 indicators: the prevalence of undernourishment (PoU) and the prevalence of moderate or severe food insecurity based on the Food Insecurity Experience Scale (FIES), revised up to 2022 based on the most recent data available to FAO at the time of writing this report. Updated projections of what the global PoU may be in 2030 are also provided. A comparison of the food insecurity status of men and women is presented, as well as, for the first time, a look at differences in food insecurity among rural, peri-urban and urban populations.

Section 2.2 presents updated estimates of the indicators of the cost and affordability of a healthy diet (CoAHD). These indicators provide evidence regarding people's economic access to diverse, nutritious foods, which is one critical aspect of achieving healthy diets. In this year's edition of the report, the cost and affordability indicators are updated to 2021. Lack of recent data on estimated income distributions, purchasing power parities (PPPs), and detailed food prices at the country level prevents an update to 2022.

Section 2.3 presents an assessment of the state of nutrition and progress towards the global nutrition targets defined by the World Health Assembly (WHA) in 2012 and the 2030 Agenda for Sustainable Development (SDG 2.2). Updates are provided for five nutrition targets: low birthweight, exclusive breastfeeding, and stunting, wasting and overweight in children under five years of age.

2.1 FOOD SECURITY INDICATORS – LATEST UPDATES AND PROGRESS TOWARDS ENDING HUNGER AND ENSURING FOOD SECURITY

KEY MESSAGES

➔ Global hunger, measured by the prevalence of undernourishment (PoU) (SDG Indicator 2.1.1), remained relatively unchanged from 2021 to 2022 but is still far above pre-COVID-19-pandemic levels, affecting around 9.2 percent of the world population in 2022 compared with 7.9 percent in 2019.

➔ It is estimated that between 691 and 783 million people in the world faced hunger in 2022. Considering the midrange (about 735 million), 122 million more people faced hunger in 2022 than in 2019, before the pandemic.

➔ The economic recovery from the pandemic observed in 2021 slowed in 2022. Rising prices of food, agricultural inputs and energy, magnified by the impact of the war in Ukraine, undermined the recovery of employment and incomes of the most vulnerable people, hindering a decline in hunger.

➔ The relative lack of change in hunger between 2021 and 2022 at the global level hides substantial differences at the regional and subregional levels. While progress was made towards reducing hunger in Asia and in Latin America, hunger was still on the rise in Western Asia, the Caribbean and all subregions of Africa.

➔ The PoU in Africa rose from 19.4 percent in 2021 to 19.7 percent in 2022, driven mostly by increases in Northern and Southern Africa. The number of people facing hunger in Africa has increased by 11 million people since 2021 and by more than 57 million people since the outbreak of the pandemic.

➔ The PoU in Asia fell from 8.8 percent in 2021 to 8.5 percent in 2022 – a decrease of more than 12 million people, mostly in Southern Asia. However, this is still 58 million above pre-pandemic levels. There were improvements in every subregion except Western Asia, where the PoU increased from 10.2 percent in 2021 to 10.8 percent in 2022.

➔ A turnaround also occurred in Latin America and the Caribbean, where the PoU fell from 7.0 percent in 2021 to 6.5 percent in 2022 – a decrease of 2.4 million in the number of people facing hunger, but still 7.2 million more than in 2019. The decrease was driven by South America and masks a notable increase in the Caribbean, from 14.7 percent in 2021 to 16.3 percent in 2022.

➔ A much larger proportion of the population in Africa faces hunger compared to the other regions of the world – nearly 20 percent compared with 8.5 percent in Asia, 6.5 percent in Latin America and the Caribbean, and 7.0 percent in Oceania.

➔ It is projected that almost 600 million people will be chronically undernourished in 2030, pointing to the immense challenge of achieving the SDG target to eradicate hunger. This is about 119 million more than in a scenario in which neither the pandemic nor the war in Ukraine had occurred, and around 23 million more than if the war in Ukraine had not happened. Most progress is expected to occur in Asia, whereas no progress is foreseen in Latin America and the Caribbean, and hunger is projected to increase significantly in Africa by 2030.

➔ Following a sharp increase from 2019 to 2020, the prevalence of moderate or severe food insecurity at the global level (SDG Indicator 2.1.2) remained unchanged for the second year in a row but was still far above the pre-pandemic level of 25.3 percent. About 29.6 percent of the global population – 2.4 billion people – were moderately or severely food insecure in 2022, 391 million more than in 2019.

➔ The prevalence of severe food insecurity at the global level declined slightly from 11.7 percent in 2021 to 11.3 percent in 2022, the equivalent of 27 million fewer people. However, the number of severely food-insecure people was still about 900 million in 2022, which is 180 million more than in 2019.

➔ The prevalence of moderate or severe food insecurity rose slightly in Africa and in Northern America and Europe, and decreased non-significantly in Asia from 2021 to 2022. The only region showing encouraging progress is Latin America and the Caribbean, where moderate or severe food insecurity decreased from 40.3 percent in 2021 to 37.5 percent in 2022, the equivalent of 16.5 million fewer people in one year, mainly in South America.

➔ A comparison of food insecurity among rural, peri-urban and urban populations reveals that global food insecurity, at both levels of severity, is lower in urban areas. Moderate or severe food insecurity affected 33.3 percent of adults living in rural areas in 2022 compared with 28.8 percent in peri-urban areas and 26.0 percent in urban areas.

➔ Food insecurity affects women more than men in every region of the world. However, the gender gap in food insecurity at the global level, which had widened in the wake of the COVID-19 pandemic, narrowed from 3.8 percentage points in 2021 to 2.4 percentage points in 2022, suggesting that the disproportionate impacts of the pandemic on women's food insecurity have eased globally and in some regions. The gender gap diminished notably in Asia and in Latin America and the Caribbean, but widened in Africa and in Northern America and Europe.

Estimates of how many people are facing hunger in the world are always the best possible approximations given the information available. The COVID-19 pandemic disrupted normal data collection activities in 2020 and 2021, creating additional challenges for the assessment of the state of food insecurity in the world and inducing greater uncertainty around the estimates. While the main effects of the pandemic have receded, and data collection activities have begun to normalize, data reporting by countries was still not fully back up to speed by 2022. Thus, estimates of the global PoU (SDG Indicator 2.1.1) are presented as ranges beginning in 2020 to reflect the additional uncertainty since the pandemic.

As always, the PoU estimates for the most recent year (2022) are obtained by nowcasting the values of the three needed parameters using the most recent information available to FAO regarding the food supply and based on reasonable assumptions on the extent of inequality in access to food (**Annex 2, Section A**).

The assessments of the prevalence of moderate or severe food insecurity based on the FIES (SDG Indicator 2.1.2) are informed by official estimates as reported by countries, whenever available, and by FAO estimates based on data collected annually by the Organization through data collection service providers in over 140 different countries (see **Annex 1B**).

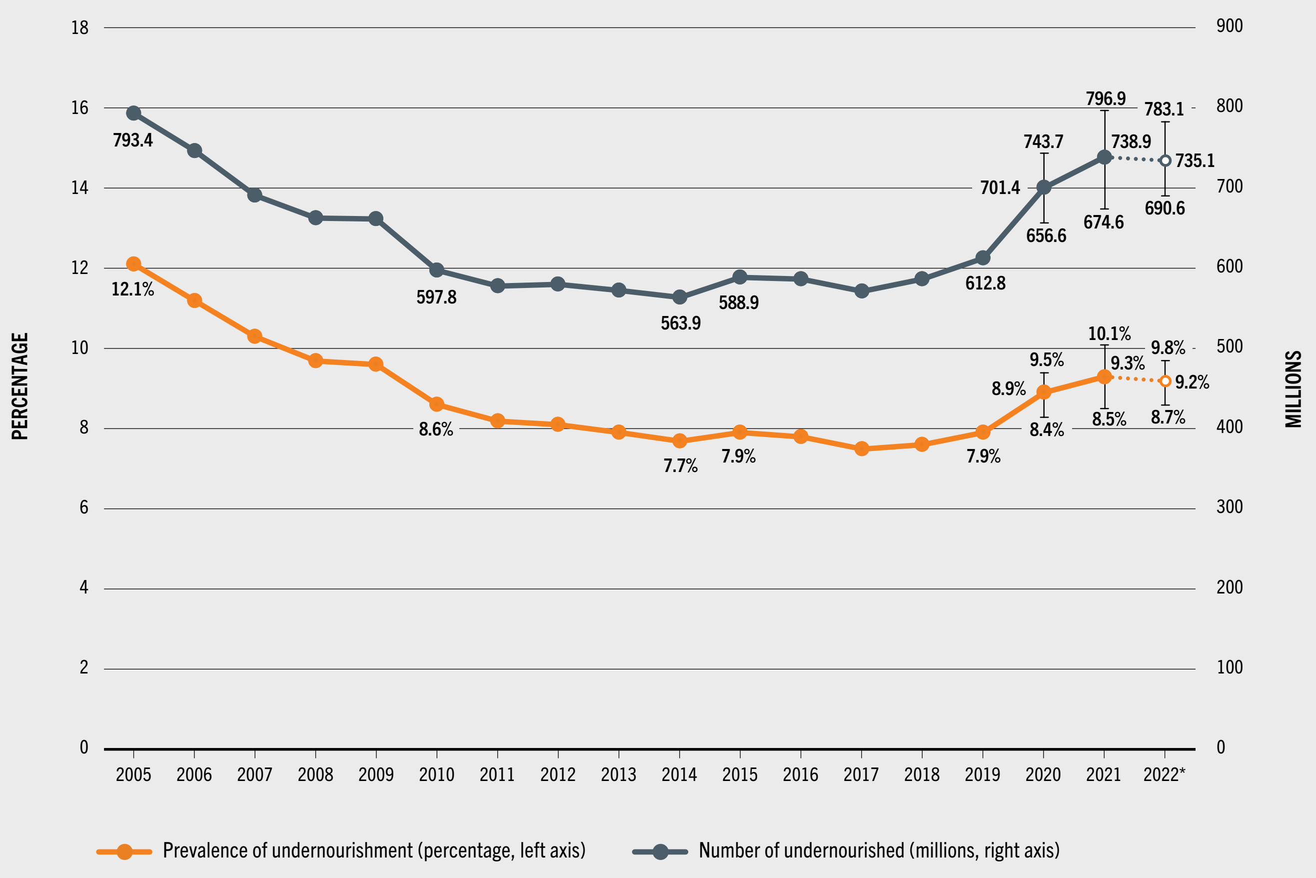
SDG Indicator 2.1.1 Prevalence of undernourishment

The assessment of global hunger in 2022, measured by the PoU (SDG Indicator 2.1.1), reveals that it remained far above pre-pandemic levels. The proportion of the world population facing chronic hunger in 2022 was about 9.2 percent, compared with 7.9 percent in 2019 (Figure 1). After increasing sharply in 2020 in the midst of the global pandemic, and rising more slowly in 2021 to 9.3 percent, the PoU ceased to increase from 2021 to 2022, providing some hope of a possible turnaround.[b]

It is estimated that hunger affected between 691 and 783 million people in the world in 2022.

b The entire series of PoU values is revised with each new edition of this report to reflect new data and information that FAO has obtained since the release of the previous edition. As this process usually implies backward revisions of the entire PoU series, readers should refrain from comparing series across different editions of this report and should always refer to the current edition, including for values in past years.

FIGURE 1 **GLOBAL HUNGER REMAINED VIRTUALLY UNCHANGED FROM 2021 TO 2022 BUT IS STILL FAR ABOVE PRE-COVID-19-PANDEMIC LEVELS**



NOTES: * Projections based on nowcasts for 2022 are illustrated by dotted lines. Bars show lower and upper bounds of the estimated range.
SOURCE: FAO. 2023. FAOSTAT: Suite of Food Security Indicators. In: *FAO*. [Cited 12 July 2023]. www.fao.org/faostat/en/#data/FS

Considering the projected midrange (about 735 million in 2022), 122 million more people faced hunger in 2022 than in 2019, before the pandemic.

The relative lack of change in hunger at the global level from 2021 to 2022 hides substantial differences at the regional level (Table 1, Table 2 and Figure 2). Many places in the world are still facing serious food crises (Box 1). Hunger has been on the rise in **Africa** since 2010, with a sharp increase in all subregions in 2020 followed by a gentler rise in 2021. In 2022, the PoU in Africa continued to rise from 19.4 percent in 2021 to 19.7 percent – the equivalent of 11 million more people in one year and nearly 57 million more since the outbreak of the pandemic. Moreover, hunger increased throughout all subregions of Africa in 2022. The PoU in Northern Africa rose from 6.9 percent to 7.5 percent, equivalent to nearly 2 million more people facing hunger in 2022. In sub-Saharan Africa, hunger increased from 22.2 percent to 22.5 percent, which translates into 9 million more people compared to 2021. The largest increase in PoU occurred in Southern Africa, at 1.1 percentage points, followed by Middle Africa with an increase of 0.6 percentage points. Marginal increases of 0.1 percentage points occurred in Western and Eastern Africa from 2021 to 2022.

TABLE 1 PREVALENCE OF UNDERNOURISHMENT, 2005–2022

	Prevalence of undernourishment (%)									
	2005	2010	2015	2016	2017	2018	2019	2020*	2021*	2022*
WORLD	**12.1**	**8.6**	**7.9**	**7.8**	**7.5**	**7.6**	**7.9**	**8.9**	**9.3**	**9.2**
AFRICA	**19.2**	**15.1**	**15.8**	**16.6**	**16.5**	**16.6**	**17.0**	**18.7**	**19.4**	**19.7**
Northern Africa	6.2	4.7	5.4	5.7	6.0	6.0	5.8	6.0	6.9	7.5
Sub-Saharan Africa	22.5	17.6	18.2	19.1	18.9	19.1	19.5	21.6	22.2	22.5
Eastern Africa	31.7	23.8	24.6	26.2	26.2	26.0	26.7	28.1	28.4	28.5
Middle Africa	31.9	22.5	23.3	24.7	23.7	24.4	24.8	27.6	28.5	29.1
Southern Africa	5.1	7.2	9.3	8.3	7.8	7.7	8.3	9.5	10.0	11.1
Western Africa	12.2	10.8	10.6	10.7	10.6	11.1	11.0	13.7	14.5	14.6
ASIA	**13.9**	**9.3**	**8.0**	**7.5**	**7.0**	**7.1**	**7.4**	**8.5**	**8.8**	**8.5**
Central Asia	13.8	6.6	4.0	3.8	3.5	3.1	2.8	3.3	3.2	3.0
Eastern Asia	6.8	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
South-eastern Asia	17.3	11.1	7.5	6.5	5.8	5.5	5.3	5.3	5.3	5.0
Southern Asia	20.2	15.4	14.0	12.9	12.2	12.3	13.3	15.6	16.4	15.6
Western Asia	7.9	6.5	9.1	10.0	9.8	10.3	10.3	10.5	10.2	10.8
Western Asia and Northern Africa	*7.1*	*5.7*	*7.4*	*8.0*	*8.1*	*8.3*	*8.2*	*8.4*	*8.7*	*9.2*
LATIN AMERICA AND THE CARIBBEAN	**9.3**	**6.2**	**5.3**	**6.1**	**5.8**	**5.9**	**5.6**	**6.5**	**7.0**	**6.5**
Caribbean	18.4	14.7	13.2	13.5	13.2	14.0	14.2	15.2	14.7	16.3
Latin America	8.6	5.6	4.7	5.5	5.2	5.3	4.9	5.9	6.4	5.8
Central America	8.1	6.8	6.7	6.2	6.1	6.1	5.1	4.8	5.0	5.1
South America	8.8	5.1	3.9	5.2	4.9	5.0	4.9	6.3	7.0	6.1
OCEANIA	**6.9**	**6.5**	**6.2**	**6.1**	**6.1**	**6.4**	**6.4**	**6.0**	**6.6**	**7.0**
NORTHERN AMERICA AND EUROPE	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5

NOTES: * Projected values are based on the projected midranges. The full ranges of the 2020, 2021 and 2022 values can be found in **Annex 2**. For country compositions of each regional/subregional aggregate, see Notes on geographic regions in statistical tables at the end of the report.
SOURCE: FAO. 2023. FAOSTAT: Suite of Food Security Indicators. In: *FAO*. [Cited 12 July 2023]. www.fao.org/faostat/en/#data/FS

In terms of numbers of people facing hunger, these percentage-point increases are equivalent to about 1 million more people in Southern Africa, 3 million more in Middle Africa and also in Eastern Africa, and 2 million more in Western Africa. All subregions in Africa registered either a prevalence or a number of undernourished people well above pre-pandemic levels.

The PoU estimate for **Asia** for 2022 points to a turnaround in the trend of hunger, which had been on the rise in the region since 2017. The PoU fell from 8.8 percent in 2021 to 8.5 percent in 2022 – a decrease of more than 12 million people, mostly in Southern Asia. However, this is still 58 million above pre-pandemic levels. Every subregion except Western Asia experienced a turnaround, with the largest improvement in Southern Asia, the subregion with the highest PoU (15.6 percent in 2022). In Western Asia, more than 2 million additional people were facing hunger in 2022 compared to 2021 – an increase of 0.6 percentage points, from 10.2 percent to 10.8 percent.

A turnaround also occurred in **Latin America and the Caribbean**, where the PoU fell from 7.0 percent in 2021 to 6.5 percent in 2022 –

TABLE 2 NUMBER OF UNDERNOURISHED PEOPLE, 2005–2022

	Number of undernourished people (millions)									
	2005	2010	2015	2016	2017	2018	2019	2020*	2021*	2022*
WORLD	**793.4**	**597.8**	**588.9**	**586.4**	**571.8**	**586.8**	**612.8**	**701.4**	**738.9**	**735.1**
AFRICA	**178.2**	**159.2**	**189.6**	**204.1**	**207.9**	**215.6**	**225.1**	**254.7**	**270.6**	**281.6**
Northern Africa	11.7	9.8	12.3	13.4	14.4	14.6	14.4	15.1	17.6	19.5
Sub-Saharan Africa	166.5	149.5	177.3	190.7	193.5	201.0	210.6	239.6	253.0	262.0
Eastern Africa	94.2	81.5	96.8	106.1	108.6	110.8	116.9	126.4	131.2	134.6
Middle Africa	36.3	30.1	36.7	40.1	39.8	42.3	44.4	51.0	54.2	57.0
Southern Africa	2.8	4.2	5.9	5.3	5.1	5.1	5.5	6.4	6.8	7.6
Western Africa	33.2	33.6	37.9	39.2	40.1	42.9	43.8	55.8	60.8	62.8
ASIA	**551.9**	**392.8**	**357.8**	**336.0**	**319.3**	**325.2**	**343.9**	**396.2**	**414.1**	**401.6**
Central Asia	8.2	4.2	2.8	2.6	2.5	2.2	2.0	2.5	2.4	2.3
Eastern Asia	104.2	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.
South-eastern Asia	97.6	66.7	47.9	41.6	37.4	36.5	35.0	35.2	36.0	34.1
Southern Asia	325.4	267.9	260.3	242.8	232.2	236.2	258.6	307.7	326.0	313.6
Western Asia	16.6	15.4	24.1	27.0	27.0	28.7	29.1	30.0	29.6	31.6
Western Asia and Northern Africa	*28.3*	*25.2*	*36.3*	*40.4*	*41.3*	*43.3*	*43.6*	*45.1*	*47.2*	*51.2*
LATIN AMERICA AND THE CARIBBEAN	**51.9**	**36.7**	**32.9**	**38.2**	**36.6**	**37.9**	**36.0**	**42.3**	**45.6**	**43.2**
Caribbean	7.4	6.1	5.6	5.8	5.7	6.1	6.2	6.7	6.5	7.2
Latin America	44.6	30.6	27.3	32.4	30.9	31.8	29.8	35.6	39.1	36.0
Central America	11.7	10.6	11.2	10.5	10.4	10.5	9.0	8.5	8.9	9.1
South America	32.8	20.0	16.1	21.9	20.5	21.3	20.8	27.1	30.3	26.8
OCEANIA	**2.3**	**2.4**	**2.5**	**2.5**	**2.5**	**2.7**	**2.8**	**2.7**	**2.9**	**3.2**
NORTHERN AMERICA AND EUROPE	**n.r.**	**n.r.**	**n.r.**	**n.r.**	**n.r.**	**n.r.**	**n.r.**	**n.r.**	**n.r.**	**n.r.**

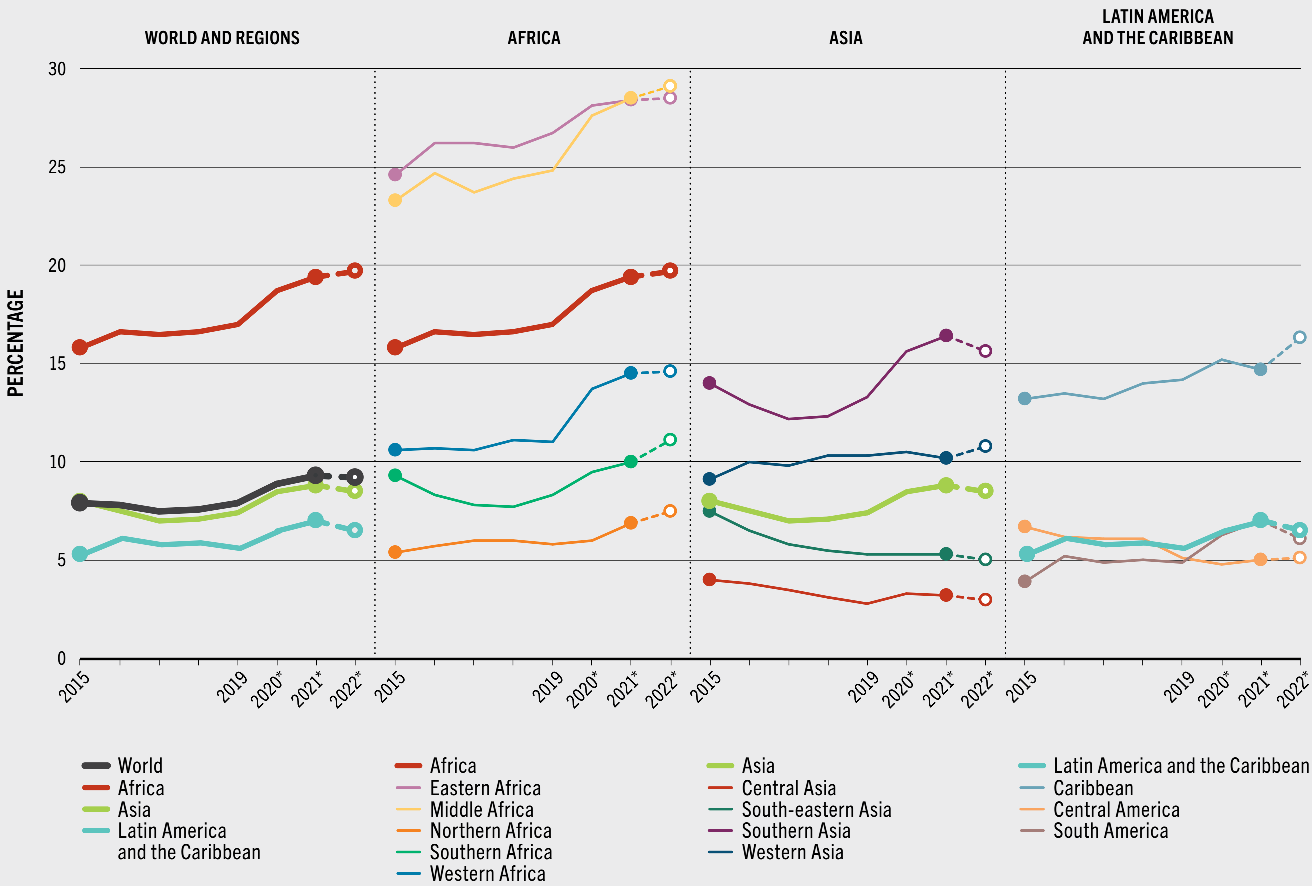
NOTES: * Projected values are based on the projected midranges. The full ranges of the 2020, 2021 and 2022 values can be found in **Annex 2**. n.r. = not reported, as the prevalence is less than 2.5 percent. Regional totals may differ from the sum of subregions, due to rounding and non-reported values. For country compositions of each regional/subregional aggregate, see Notes on geographic regions in statistical tables at the end of the report.
SOURCE: FAO. 2023. FAOSTAT: Suite of Food Security Indicators. In: *FAO*. [Cited 12 July 2023]. www.fao.org/faostat/en/#data/FS

a decrease of more than 2.4 million in the number of people facing hunger, though still 7.2 million more compared to 2019. There was a sharp increase in the Caribbean subregion from 14.7 percent in 2021 to 16.3 percent in 2022. However, notable improvements occurred in South America in the same period, where the PoU decreased from 7.0 percent to 6.1 percent, equivalent to 3.5 million people, but still 6 million above 2019 levels.

The proportion of the population facing hunger is much larger in Africa compared to the other regions of the world – nearly 20 percent compared with 8.5 percent in Asia, 6.5 percent in Latin America and the Caribbean, and 7.0 percent in Oceania (Table 1).

While the regional prevalence estimates reveal the magnitude of the burden of hunger in each region, converting them into numbers of people indicates where most of the people facing hunger in the world live (Table 2 and Figure 3). While the PoU in Asia is less than half that in Africa, Asia is nevertheless home to the majority of people facing hunger – 402 million, representing

FIGURE 2 PROGRESS WAS MADE TOWARDS REDUCING HUNGER IN MOST SUBREGIONS IN ASIA AND IN LATIN AMERICA, BUT HUNGER IS STILL ON THE RISE IN WESTERN ASIA, THE CARIBBEAN AND ALL SUBREGIONS OF AFRICA



NOTES: Eastern Asia is not shown because the prevalence of undernourishment has been consistently below 2.5 percent since 2010. * Values are based on the projected midranges. The full ranges of the 2020, 2021 and 2022 values can be found in **Annex 2**.
SOURCE: FAO. 2023. FAOSTAT: Suite of Food Security Indicators. In: *FAO*. [Cited 12 July 2023]. www.fao.org/faostat/en/#data/FS

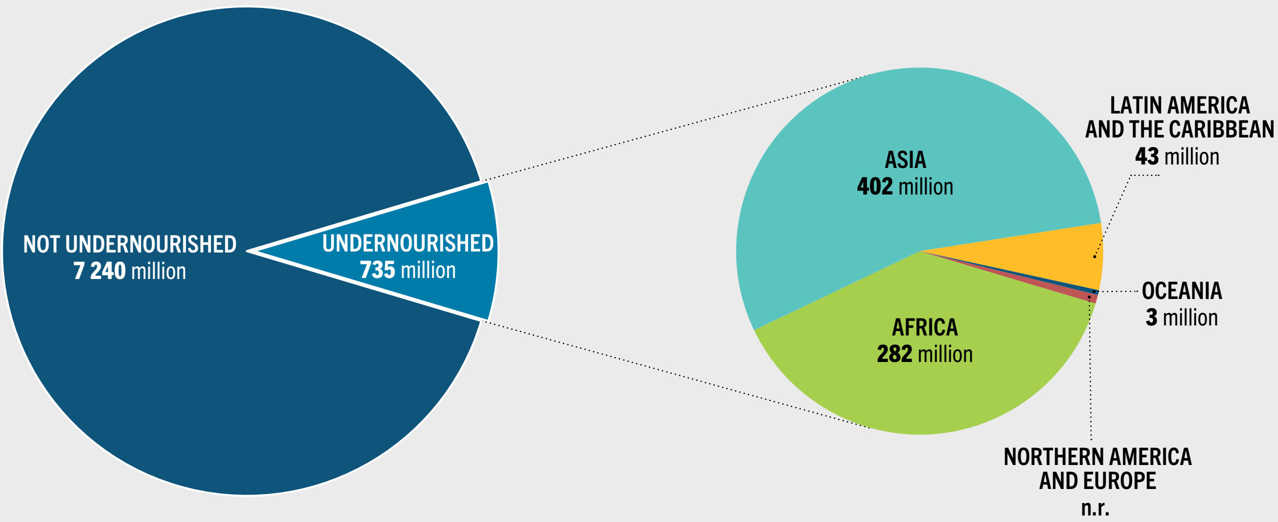
55 percent of the total number of undernourished people in 2022. About 38 percent (282 million) of undernourished people live in Africa and about 6 percent (43 million) in Latin America and the Caribbean.

Economic recovery hampered by new challenges to food security

At the end of 2021, global food security was on high alert due to lingering effects of the COVID-19 pandemic as well as new and ongoing conflicts and weather-related shocks. A combination of an unequal economic recovery after a dramatic decrease in economic activity observed in 2020, and rising food, fuel and transportation prices produced by the recovery itself, thwarted progress in food security.

Just as global economic conditions appeared to be more favourable for 2022 and the prospects of a reduction in hunger and food insecurity towards pre-pandemic levels seemed possible, the outbreak of the war in Ukraine sent another shock through the global economy. As a result,

FIGURE 3 IN 2022, ASIA WAS HOME TO 55 PERCENT (402 MILLION) OF THE PEOPLE IN THE WORLD AFFECTED BY HUNGER, WHILE MORE THAN 38 PERCENT (282 MILLION) LIVED IN AFRICA



NOTES: Projected values are based on the projected midranges. The full ranges of the projected 2022 values can be found in **Annex 2**.
n.r. = not reported, as the prevalence is less than 2.5 percent.
SOURCE: FAO. 2023. FAOSTAT: Suite of Food Security Indicators. In: *FAO*. [Cited 12 July 2023]. www.fao.org/faostat/en/#data/FS

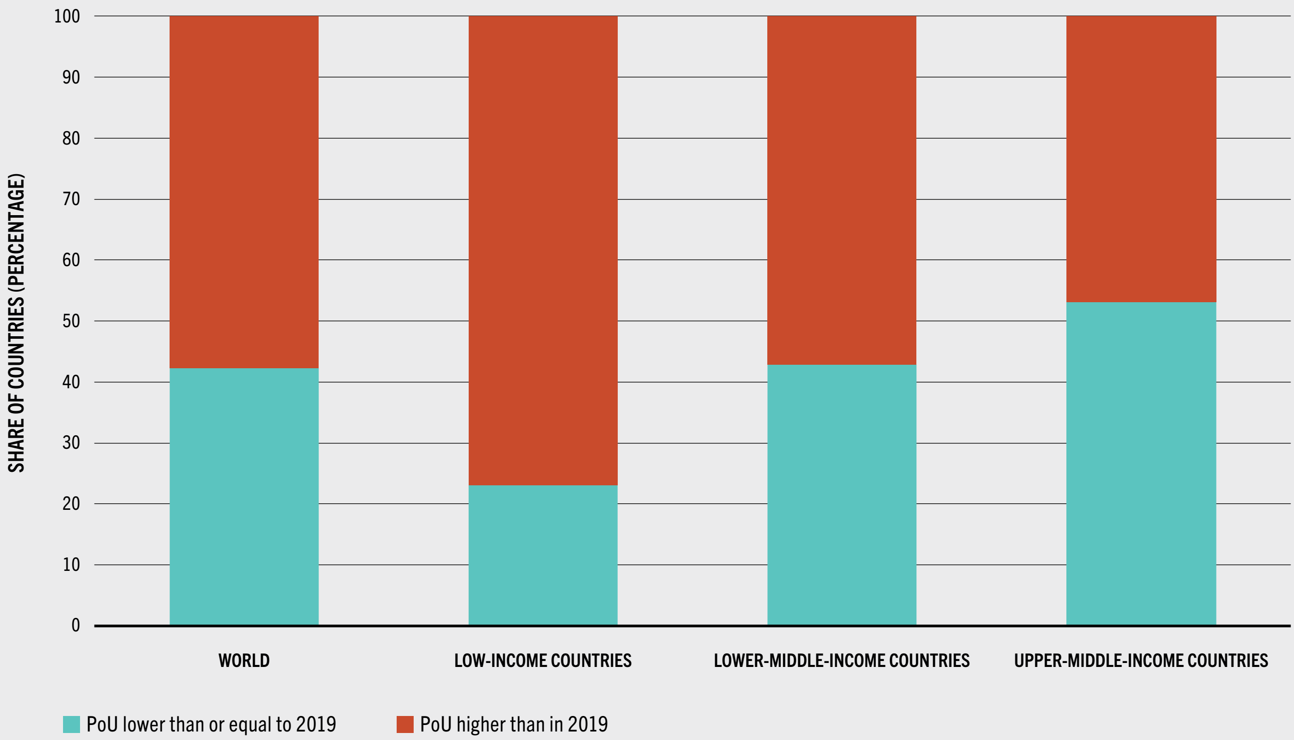
the recovery observed in 2021 slowed further in 2022 and global gross domestic product (GDP) grew in 2022 by 3.4 percent, one percentage point more slowly than predicted at the beginning of 2023.[3]

The shock caused by the war acted mainly through the global food and agricultural markets, as it involved two major global producers of agricultural commodities: the Russian Federation and Ukraine. In 2021, either the Russian Federation or Ukraine (or both) ranked among the top three global exporters of wheat, maize, rapeseed, cake of sunflower seed, and sunflower oil.[c, 4] The Russian Federation is also a prominent exporter of fertilizers. In this context, one of the main impacts of the war has been to increase international prices of food.

Although global food commodity prices were rising steadily even before the war, the added uncertainty induced by the war contributed to a surge in food prices. The FAO Food Price Index jumped to an all-time high in March 2022, and although the index steadily declined throughout the year, it remained much higher than before the pandemic.[5] As a result of the high international food prices, import costs of food rose, affecting especially countries that are highly dependent on food imports. The world food import bill was estimated to have reached an all-time high in 2022 of nearly USD 2 trillion, an increase of 10 percent (nearly USD 181 billion) from the 2021 level, driven mostly by higher prices.[6] World fertilizer prices also soared, mainly as a result of rising energy and natural gas prices. The global agricultural input import bill was estimated to increase by 48 percent in 2022 to USD 424 billion.[7] All of these factors have contributed to higher prices of food at the local and national levels, which in turn have contributed heavily to overall inflation. Inflation rose throughout 2022 in almost all economies,

c The two countries combined accounted for 19 percent of global output of barley, 14 percent of wheat, and 4 percent of maize, between 2016/17 and 2020/21. Their contribution to the global production of oilseeds was particularly important for sunflower oil, with just over half of world output, on average, originating in the two countries during this period.

FIGURE 4 THE PREVALENCE OF UNDERNOURISHMENT (PoU) IS STILL HIGHER IN 2022 THAN BEFORE THE PANDEMIC IN 58 PERCENT OF COUNTRIES, AND THE SITUATION IS WORSE IN LOW-INCOME COUNTRIES (77 PERCENT)



SOURCE: FAO. 2023. FAOSTAT: Suite of Food Security Indicators. In: *FAO*. [Cited 12 July 2023]. www.fao.org/faostat/en/#data/FS

and global headline inflation exceeded 9 percent in the second half of the year, the highest level since 1995.[8]

In this context, global trends in hunger reflect the combination of two factors interplaying at the household level. First, an income effect produced by the economic recovery in 2022 likely contributed to an increase in household disposable income and improved access to food, particularly for the poorest households that suffered heavy income losses during the pandemic. Globally, employment increased by 2.3 percent in 2022 from a meagre annual growth of 0.2 percent in the period from 2020 to 2021.[9] Employment growth was faster in low-income countries (LICs) and lower-middle-income countries (LMICs) than in upper-middle-income countries (UMICs) and high-income countries (HICs). Concomitantly, global unemployment declined significantly in 2022 to 205 million, down from 216 million in 2021 and 235 million in 2020, but still above its 2019 level.[9]

The second factor affecting the trend in hunger is the price effect. Increases in food prices and general inflation can erode income gains and worsen access to food. In the short term, this is particularly true for the poorest segments of the population who spend a larger share of their income on food. In the long term, however, some households may manage to adapt their consumption patterns to lessen the impacts, and poor rural populations engaged in

BOX 1 HOW DOES THE EVIDENCE ON CHRONIC FOOD INSECURITY ALIGN WITH THE EVIDENCE ON ACUTE FOOD INSECURITY IN FOOD CRISIS COUNTRIES?

The evidence presented in this report points to the fact that, although the prevalence of undernourishment (PoU) at the global level remained relatively unchanged from 2021 to 2022, hunger was on the rise in many parts of the world. The negative impacts on food security of the war in Ukraine (and other conflicts), soaring food prices and extreme weather events were felt more strongly in some places than in others. Consistent with this, the most recent edition of the *Global Report on Food Crises* (GRFC)[2] reinforces these conclusions.

The GRFC and this report are both multipartnership efforts that provide international assessments of food security; however, their objectives and geographical scope are distinct, and they rely on different data and methodologies. On the one hand, this report has the broad objective of monitoring chronic food insecurity in the entire world, on a regular basis, by reporting on SDG Indicators 2.1.1 and 2.1.2. Chronic food insecurity is defined as a structural, long-term situation of food deprivation. The PoU, for example, measures hunger (chronic undernourishment) defined as the long-term or persistent inability to meet minimum dietary energy requirements and, within a country, it is estimated to be representative of the whole population. The GRFC, on the other hand, focuses more narrowly on acute food insecurity in countries experiencing food crises for the purpose of guiding immediate humanitarian response. Acute food insecurity refers to a short-term (possibly temporary) inability to meet dietary energy requirements, related to sporadic crises that may sometimes be protracted and are of a severity that threatens lives or livelihoods. Assessments of food insecurity prioritize the use of the Integrated Food Security Phase Classification/ *Cadre Harmonisé* (IPC/CH), applied in a set of countries that are susceptible to food crisis situations and, therefore, potentially in need of humanitarian assistance.* These assessments are not statistical measurements, but rather the result of a process of convergence of evidence reached by a country team of analysts, based on the most recent available information from various sources. Within a country, rough estimates of the number of people facing crisis levels of acute food insecurity are presented that refer to the specific populations covered by the analysis, and not necessarily to the whole population at the national level.

Because of these conceptual and measurement differences, a direct comparison of figures from both reports is not possible. However, acute and chronic food insecurity are not unrelated phenomena. Repeated shocks and persistent crises can provoke situations of chronic food insecurity. Because of this, one expects some alignment, at least in trends, of the results of the two reports.

Having this in mind, the 2023 GRFC[2] points to an increase of around 37 million people facing acute food insecurity (IPC/CH Phase 3 or above) from 2021 to 2022 in the same 48 countries analysed in both years.** That is equivalent to an increase in the prevalence of acute food insecurity from 21.8 percent to 22.5 percent of the analysed population. An analysis of hunger (PoU) restricted to the same group of 48 countries analysed by the GRFC shows an increase of 14 million in the number of people facing chronic undernourishment, equivalent to an increase in the PoU from 20.8 percent to 21.3 percent of the combined populations of those 48 countries (Figure A). This reveals convergence in the assessments of the trends and points to the existence of persistent food crises in many parts of the world, reinforcing the need to better understand the nexus between acute and chronic food insecurity, particularly in food crisis countries.

NOTES: * When recent IPC/CH is not available, alternative sources are used such as the Consolidated Approach for Reporting Indicators of Food Security or the Famine Early Warning Systems Network. These are used to approximate populations facing crisis or worse (IPC/CH 3+).
** In the 48 countries analysed in both years in the GRFC, there were differences in analysis coverage at the country level, resulting in a 15.5 percent increase in the analysed population between the two years in these countries.

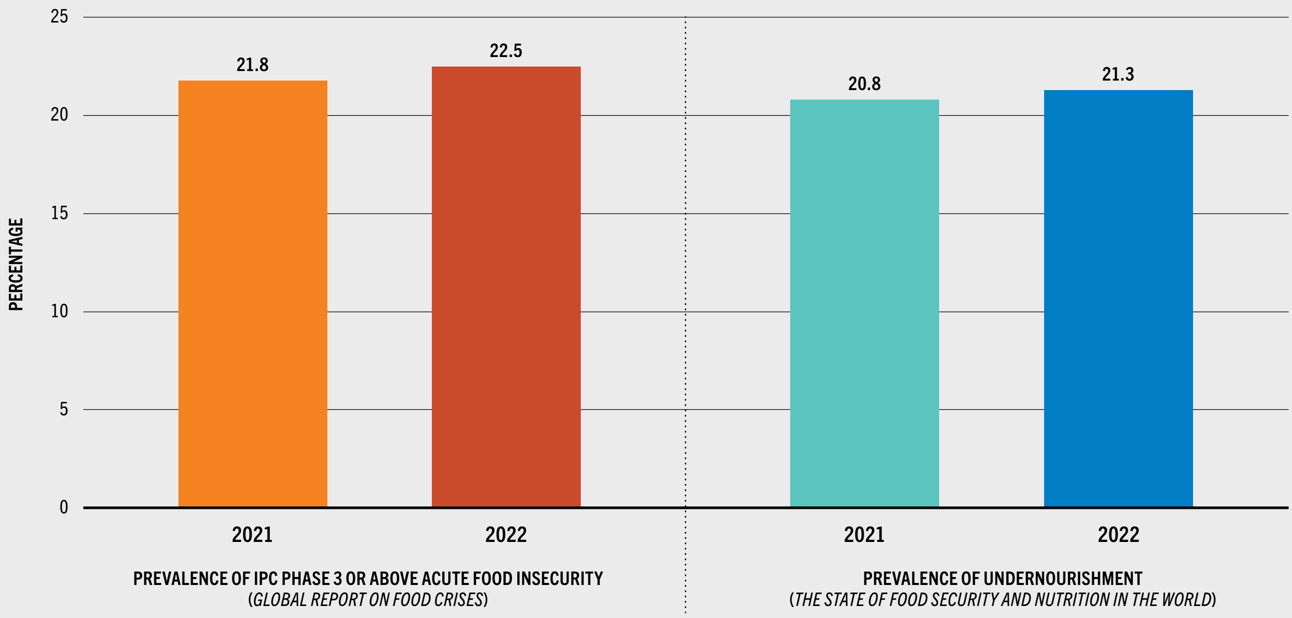
agriculture may even benefit from higher prices for their agricultural products.[d, 10]

The stalled situation in global hunger observed for 2022 is thus the result of the interaction of these two factors. The economic recovery helped to stem the rising tide of hunger at least at the global level. However, the positive effect could have been even greater without the countervailing winds caused by the global

d Poverty assessments conducted during the food price crises of 2008 and 2011 demonstrated that higher food prices have the potential to boost agricultural income growth and wages.[10]

BOX 1 (Continued)

FIGURE A ESTIMATES OF ACUTE FOOD INSECURITY FROM THE GRFC AND OF CHRONIC UNDERNOURISHMENT BASED ON THE PoU IN THE SAME 48 COUNTRIES SHOW SIMILAR TRENDS FROM 2021 TO 2022



SOURCES: Food Security Information Network & Global Network Against Food Crises. 2023. *Global Report on Food Crises (GRFC) 2023*. Rome. www.fsinplatform.org/global-report-food-crises-2023; FAO. 2023. FAOSTAT: Suite of Food Security Indicators. In: *FAO*. [Cited 12 July 2023]. www.fao.org/faostat/en/#data/FS

repercussions of the war in Ukraine and the price inflation for food, agricultural inputs and energy, together with other drivers of food insecurity such as conflicts and weather-related events. As a result, hunger remains far above pre-pandemic levels globally and in all regions.

At the regional level, this dynamic of income and price effect is visible in multiple subregions, with varying results. In **Southern Africa**, for instance, the uptick of hunger in 2022 stemmed from increasing inflation, following the upsurge in international commodity prices, as well as domestic challenges such as persistently high levels of unemployment and vulnerability to shocks.[11] Although there was sustained GDP growth in 2022, this often did not translate into improved socioeconomic conditions for the poor. Agricultural production, at the same time, suffered from severe droughts and floods, and the surge in international fertilizer prices. In **Middle Africa**, the increase in hunger has mainly resulted from food inflation and increasing food import bills, as well as extreme climate events, which have counteracted the positive effects of economic growth, driven by buoyant oil export revenues in some countries.[11]

In **Western Asia**, many countries benefited from increased oil revenues, but these did not always translate into lower levels of hunger in 2022. Political instability in some countries and conflicts have continued to disrupt food supplies, markets and distribution systems, resulting in higher food prices and food shortages. In addition, domestic inflation has soared in several countries, making access to food more difficult.[12] In **Southern Asia**, on the other hand, the outcome of sustained economic growth, especially in agriculture, has likely prevailed over inflation, thus contributing to an overall improvement in food security conditions. More than one country in the region has also enacted policy measures that have contributed to this overall improvement, including supplying fertilizers to farmers, providing cereal subsidies to vulnerable population groups, and reducing customs duties on imported cereals.[13]

In the **Caribbean**, more than one small island developing state has suffered from high food inflation and increased import bills, given the widespread dependence of the subregion on imported food and agricultural products. At the same time, export revenues have been declining in key sectors, including tourism, resulting in reduced disposable income and increased food insecurity.[14] On the contrary, the observed decline in hunger in 2022 in **South America**, a net exporter of food and agricultural products, stemmed largely from positive development in labour markets, which counteracted the surge in inflation, as well as from social protection policies.[14] Additionally, some countries in the region have benefited from the surge in oil and gas prices that boosted export revenues. This has translated into improved public budget resources (which could be used to finance social protection programmes) and investment in agriculture and food distribution systems.

At the country level, these countervailing forces have played out in different ways with unequal impacts on trends in hunger. A comparison across country income groups of changes in the PoU between 2019 and 2022 shows that LICs are still struggling the most to recover. Globally, 58 percent of countries had a PoU in 2022 that was still above pre-pandemic levels. However, the percentage is much higher in LICs; 77 percent of LICs have not returned to PoU levels observed in 2019, in contrast to 47 percent of UMICs (Figure 4).

The halt in the rise in global hunger observed in 2022 is also consistent with nowcasts of poverty available for 2022.[10] Projections for 2022 are that, despite an expected reduction in poverty between 2021 and 2022, the pace of reduction will further stall given the downward revised prospects of global growth in 2022 and higher prices of food, agricultural inputs and energy. It is estimated that the number of people in extreme poverty will have decreased by 5 million from 2021 to 2022, based on a scenario that takes into consideration the relatively greater impact of high food inflation among the poor.

Towards ending hunger (SDG Target 2.1): projections to 2030

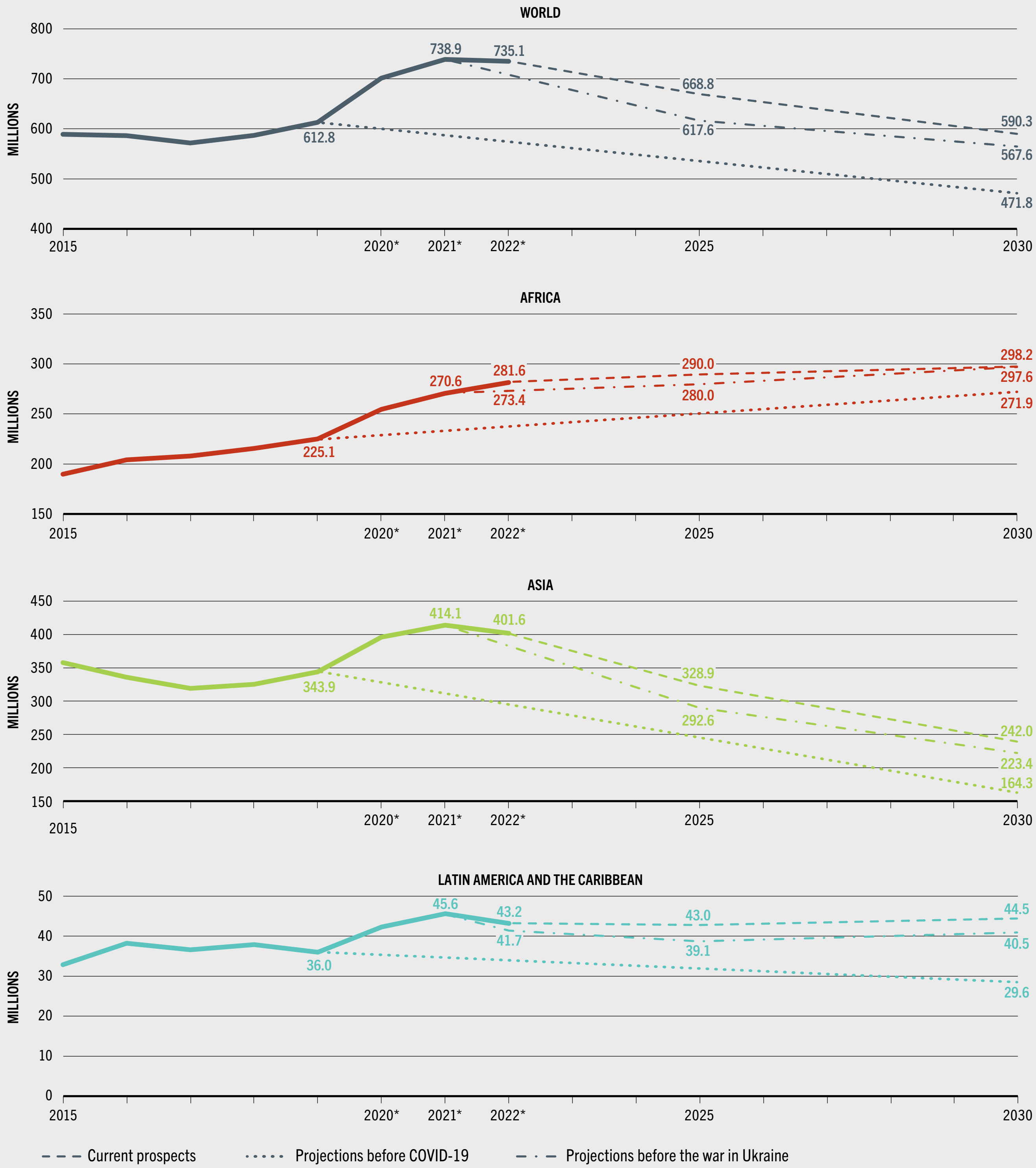
As in previous editions of the report, an exercise was conducted to project how many people may be facing hunger in 2030 based on what can be inferred from available forecasts of fundamental demographic and economic variables. The projections were obtained by separately projecting each of the parameters that inform the model used to estimate the PoU (see **Annex 2, Section B**).

Trajectories are presented under three scenarios: "current prospects", which aims to capture current projections of the PoU in 2030 based on the world economic prospects presented in the April 2023 edition of the International Monetary Fund World Economic Outlook database;[3] "projections before COVID-19", calibrated to reflect the situation of the world economy before the pandemic, as described by the *World Economic Outlook* published in October 2019;[15] and "projections before the war in Ukraine", which does the same but considering the October 2021 edition of the same publication[16] before the outbreak of the war.

The current scenario shows that almost 600 million people will be chronically undernourished in 2030, pointing to the immense challenge of achieving the SDG target to eradicate hunger (Figure 5). This is about 119 million more undernourished people than in the scenario in which neither the pandemic nor the war in Ukraine had occurred (the "projections before COVID-19" scenario) and around 23 million more than in the scenario where the war had not happened (the "projections before the war in Ukraine" scenario). The latter provides an indication of the additional setback the war may have caused in the global fight against hunger.

Figure 5 also shows how the situation is currently expected to evolve in Asia, Africa, and Latin America and the Caribbean. The different trajectories are evident, demonstrating that practically all the progress in the fight against hunger is expected to be made in Asia, where the number of undernourished is projected to fall from the current 402 million to 242 million people by 2030. The number of undernourished

FIGURE 5 PROJECTED NUMBERS OF UNDERNOURISHED INDICATE THAT THE WORLD IS FAR OFF TRACK TO ACHIEVE ZERO HUNGER BY 2030



NOTE: * The 2020, 2021 and 2022 values are based on the projected midranges which can be found in **Annex 2**.
SOURCE: Authors' (FAO) own elaboration.

is expected to remain constant in Latin America and the Caribbean and to increase significantly in Africa, where it is projected that close to 300 million people may be facing hunger in 2030. Much stronger efforts are needed to address the fundamental structural problems that afflict the African continent.

SDG Indicator 2.1.2 Prevalence of moderate or severe food insecurity in the population, based on the Food Insecurity Experience Scale

SDG Target 2.1 challenges the world not only to end hunger, but also to work to ensure access for all people to safe, nutritious and sufficient food all year round. SDG Indicator 2.1.2 – the prevalence of moderate or severe food insecurity in the population, based on the FIES – tracks progress towards this ambitious goal.

New estimates of the prevalence of food insecurity based on the FIES confirm that for 2022 no progress was made on food insecurity at the global level. Following a sharp increase from 2019 to 2020, the global prevalence of moderate or severe food insecurity remained unchanged for the second year in a row, far above pre-COVID-19-pandemic levels (Figure 6 and Table 3). In 2022, an estimated 29.6 percent of the global population – 2.4 billion people – were moderately or severely food insecure, meaning they did not have access to adequate food (Table 3 and Table 4). This is still 391 million more people than in 2019, before the pandemic, and 745 million more compared to 2015 when the 2030 Sustainable Development Agenda was launched.

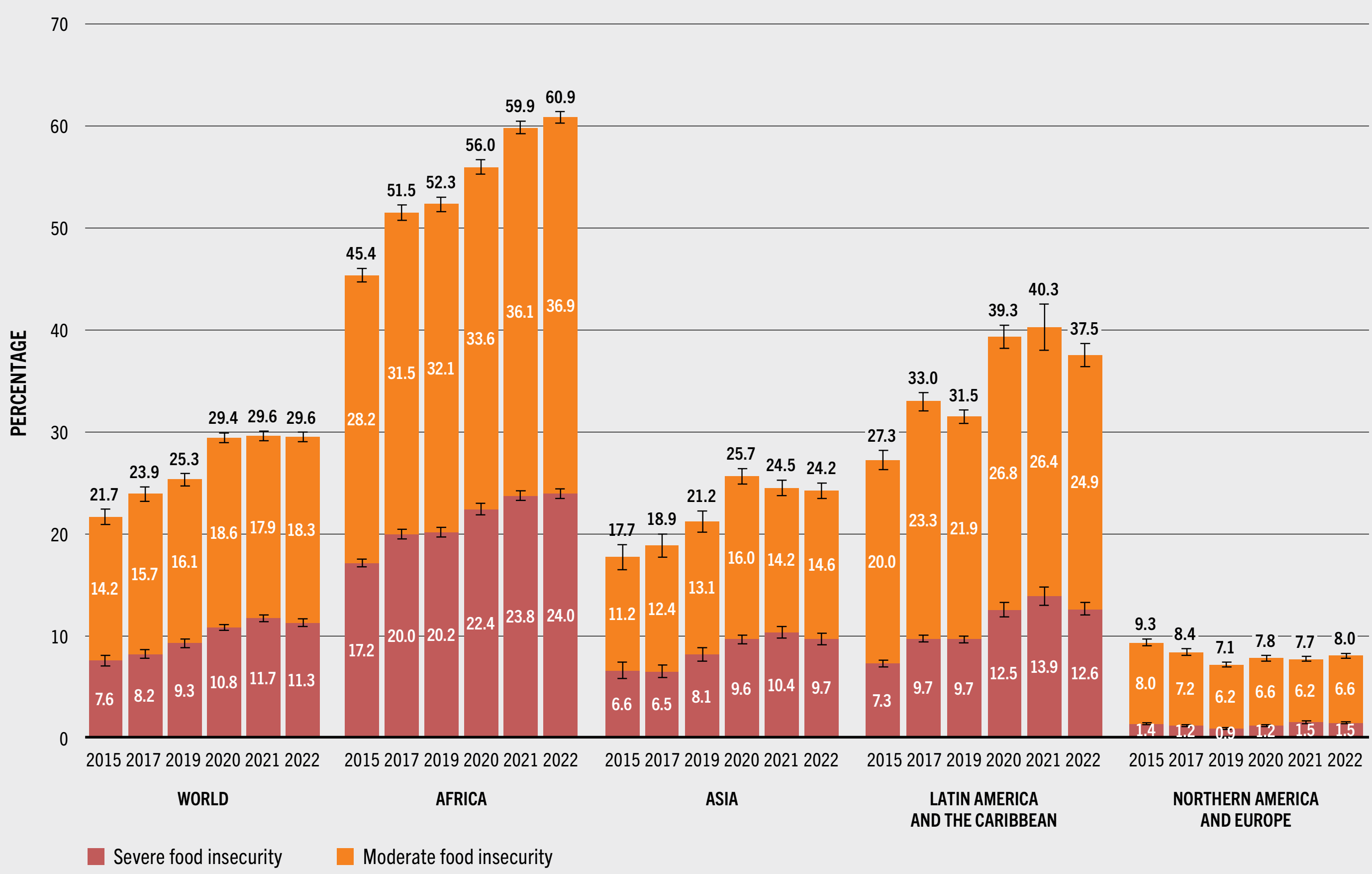
More than one-third (38 percent) of people facing moderate or severe food insecurity in the world in 2022 – over 900 million – were severely food insecure, indicating that they had run out of food at times during the year and, at worst, gone an entire day or more without eating. The prevalence of severe food insecurity at the global level showed a marginal decline from 11.7 percent in 2021 to 11.3 percent in 2022, the equivalent of 27 million fewer people (Figure 6, Table 3 and Table 4). While it is encouraging that the upward trend in severe food insecurity of the past six years has not continued, the global prevalence is still far above pre-pandemic levels – equivalent to 180 million more people compared to 2019 (Table 3 and Table 4). At the global level, the slight decrease in severe food insecurity, and unchanged prevalence of moderate or severe food insecurity, suggest that the gravity of the food insecurity situation of some people may have transitioned from severe to moderate from 2021 to 2022.

As expected, the global trends in the prevalence of severe food insecurity are similar to the trends for the PoU (Table 1). This is because people experiencing severe food insecurity are unlikely to be able to acquire enough food to continuously fulfil their dietary energy requirements, and thus may become chronically undernourished. Both indicators provide evidence regarding the proportion of the population facing severe constraints on food access, albeit based on very different methodologies and sources of data (see **Annex 1B**).

Despite the lack of change in the prevalence of food insecurity at the global level, there were divergent trends at the regional level. Improvements in some regions were offset by worsening situations in others (Figure 6, Table 3 and Table 4).

The prevalence of moderate or severe food insecurity in **Africa** increased by one percentage point in one year to 60.9 percent in 2022. The increase is much smaller compared to the previous year, when it rose by 4 percentage points. From 2021 to 2022, the prevalence of moderate or severe food insecurity rose in Eastern Africa, Middle Africa and Southern Africa by 2.4, 3.0 and 1.2 percentage points, respectively. The prevalence in 2022 ranged from 25.9 percent in Southern Africa to 78.4 percent in Middle Africa. The increase in moderate or severe food insecurity in Africa from 2021 to 2022 is mostly due to more people facing moderate food insecurity, as the rise in severe food insecurity in the region was marginal. Nevertheless, nearly one in four people in Africa (24.0 percent) was facing severe food insecurity in 2022. The prevalence of severe food insecurity rose in Northern Africa, Middle Africa, Southern Africa and Western Africa by 0.8, 1.3, 1.5 and 0.3 percentage points, respectively – the equivalent of 2.4 million more people in Northern Africa, 4.8 million more in Middle

FIGURE 6 MODERATE OR SEVERE FOOD INSECURITY REMAINED UNCHANGED AT THE GLOBAL LEVEL FROM 2021 TO 2022, WITH WORSENING FOOD INSECURITY LEVELS IN AFRICA AND IN NORTHERN AMERICA AND EUROPE, AND IMPROVEMENTS IN ASIA AND IN LATIN AMERICA AND THE CARIBBEAN



NOTE: Differences in totals are due to rounding of figures to the nearest decimal point.
SOURCE: FAO. 2023. FAOSTAT: Suite of Food Security Indicators. In: *FAO*. [Cited 12 July 2023]. www.fao.org/faostat/en/#data/FS

Africa, 1.1 million more in Southern Africa, and 3.6 million more in Western Africa facing severe food insecurity in 2022 compared to 2021.

A non-significant decrease in food insecurity was registered in **Asia**, where 24.2 percent of the population was facing moderate or severe food insecurity in 2022 compared with 24.5 percent in 2021. The situation improved somewhat in Central Asia and Western Asia, where the prevalence of moderate or severe food insecurity fell by 2.7 and 3.2 percentage points, respectively, even as severe food insecurity increased slightly in Western Asia. Moderate or severe food insecurity remained virtually unchanged in the other subregions of Asia, although there are still large differences in prevalence between subregions. The percentage of people facing moderate or severe food insecurity ranged from 6.2 percent in Eastern Asia to 40.3 percent in Southern Asia, which is home to more than one-third of the world's moderately or severely food-insecure population – about 809 million people. Southern Asia also has the highest prevalence of severe food insecurity on the continent, although this did decrease »

TABLE 3 PREVALENCE OF FOOD INSECURITY AT SEVERE LEVEL ONLY, AND AT MODERATE OR SEVERE LEVEL, BASED ON THE FOOD INSECURITY EXPERIENCE SCALE, 2015–2022

	Prevalence of severe food insecurity (%)						Prevalence of moderate or severe food insecurity (%)					
	2015	2017	2019	2020	2021	2022	2015	2017	2019	2020	2021	2022
WORLD	**7.6**	**8.2**	**9.3**	**10.8**	**11.7**	**11.3**	**21.7**	**23.9**	**25.3**	**29.4**	**29.6**	**29.6**
AFRICA	**17.2**	**20.0**	**20.2**	**22.4**	**23.8**	**24.0**	**45.4**	**51.5**	**52.3**	**56.0**	**59.9**	**60.9**
Northern Africa	9.0	10.5	8.7	9.5	11.2	12.0	26.2	33.1	28.8	30.2	34.0	32.4
Sub-Saharan Africa	19.1	22.2	22.8	25.4	26.6	26.6	49.8	55.8	57.7	61.8	65.7	67.2
Eastern Africa	22.0	26.1	25.0	28.1	28.7	27.7	56.8	64.6	63.5	66.5	66.8	69.2
Middle Africa	n.a.	n.a.	n.a.	36.0	37.8	39.1	n.a.	n.a.	n.a.	70.1	75.4	78.4
Southern Africa	9.0	9.4	9.3	11.0	11.0	12.5	21.7	22.1	22.1	24.7	24.7	25.9
Western Africa	11.4	14.3	16.6	19.9	21.7	22.0	39.8	46.2	51.7	59.0	66.7	66.4
ASIA	**6.6**	**6.5**	**8.1**	**9.6**	**10.4**	**9.7**	**17.7**	**18.9**	**21.2**	**25.7**	**24.5**	**24.2**
Central Asia	1.4	2.8	2.3	4.8	5.0	4.6	9.1	13.9	13.5	17.8	20.1	17.4
Eastern Asia	0.8	1.7	1.3	2.0	1.0	1.0	5.9	10.0	7.4	7.8	6.1	6.2
South-eastern Asia	1.9	2.0	1.8	2.1	2.6	2.6	14.5	15.7	14.5	15.5	16.9	16.8
Southern Asia	13.2	11.8	16.3	18.8	21.0	19.4	27.7	26.1	34.3	43.1	40.6	40.3
Western Asia	9.0	9.6	8.9	9.6	10.2	10.3	30.9	30.9	29.9	35.1	38.7	35.5
Western Asia and Northern Africa	*9.0*	*10.0*	*8.8*	*9.5*	*10.7*	*11.1*	*28.7*	*31.9*	*29.4*	*32.8*	*36.5*	*34.1*
LATIN AMERICA AND THE CARIBBEAN	**7.3**	**9.7**	**9.7**	**12.5**	**13.9**	**12.6**	**27.3**	**33.0**	**31.5**	**39.3**	**40.3**	**37.5**
Caribbean	n.a.	n.a.	n.a.	32.4	25.7	28.2	n.a.	n.a.	n.a.	65.4	59.5	60.6
Latin America	5.5	8.1	8.2	11.1	13.0	11.5	24.8	30.9	29.4	37.5	38.9	35.9
Central America	6.7	6.3	7.3	7.3	8.0	8.6	30.3	27.9	28.2	34.2	34.1	34.5
South America	5.0	8.9	8.5	12.7	15.1	12.7	22.6	32.1	29.9	38.8	40.9	36.4
OCEANIA	**2.6**	**4.1**	**3.8**	**2.6**	**4.5**	**3.4**	**10.0**	**14.4**	**13.6**	**12.1**	**13.0**	**13.0**
NORTHERN AMERICA AND EUROPE	**1.4**	**1.2**	**0.9**	**1.2**	**1.5**	**1.5**	**9.3**	**8.4**	**7.1**	**7.8**	**7.7**	**8.0**
Europe	1.6	1.4	1.0	1.4	1.9	1.9	8.8	8.3	6.9	7.5	7.8	8.2
Eastern Europe	1.5	1.1	0.8	1.4	1.7	2.0	11.7	10.3	8.3	10.2	10.5	10.9
Northern Europe	1.8	2.2	1.0	1.2	1.8	2.0	6.8	6.0	5.1	4.2	4.5	6.6
Southern Europe	1.7	2.0	1.6	2.4	2.8	1.6	9.6	10.6	8.7	9.3	8.6	7.5
Western Europe	1.4	0.9	0.7	0.8	1.7	1.8	5.0	4.6	4.3	3.9	4.9	5.7
Northern America	1.0	0.8	0.8	0.7	0.7	0.7	10.3	8.6	7.6	8.3	7.5	7.7

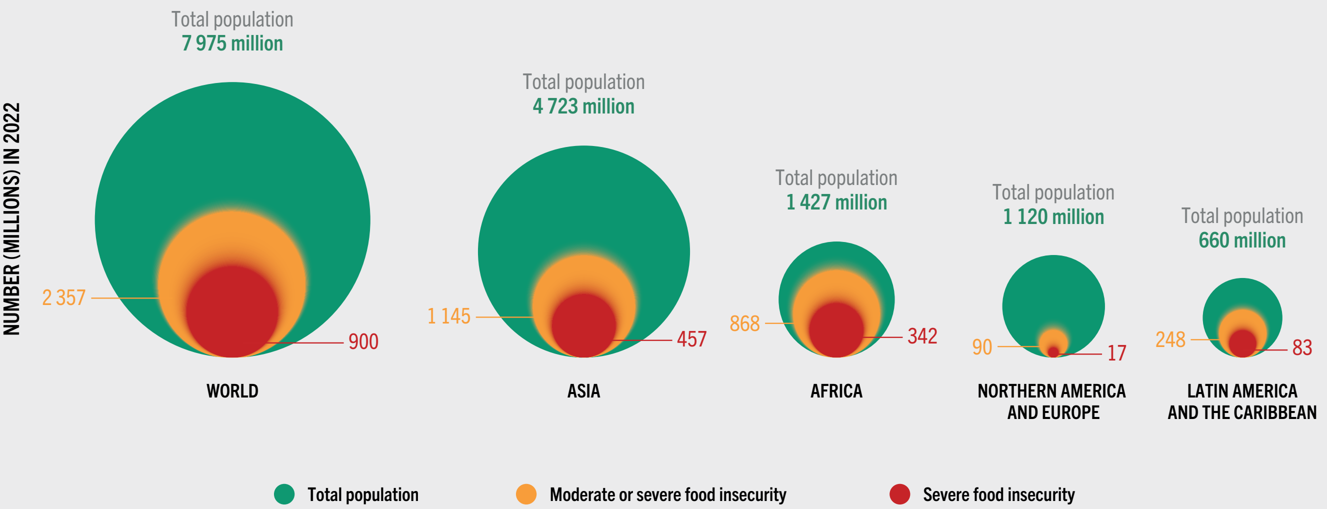
NOTES: n.a. = not available, as data are available only for a limited number of countries, representing less than 50 percent of the population in the region. The estimates for Latin America and the Caribbean from 2014 to 2019 include Caribbean countries whose combined populations represent only 30 percent of the population of that subregion, while the 2020, 2021 and 2022 estimates include Caribbean countries whose combined populations represent between 60 percent and 65 percent of the subregional population. The countries included in the 2022 estimate for the Caribbean subregion are: Antigua and Barbuda, Bahamas, Barbados, Dominica, Dominican Republic, Grenada, Haiti, Jamaica, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, and Trinidad and Tobago.
SOURCE: FAO. 2023. FAOSTAT: Suite of Food Security Indicators. In: *FAO*. [Cited 12 July 2023]. www.fao.org/faostat/en/#data/FS

TABLE 4 NUMBER OF PEOPLE EXPERIENCING FOOD INSECURITY AT SEVERE LEVEL ONLY, AND AT MODERATE OR SEVERE LEVEL, BASED ON THE FOOD INSECURITY EXPERIENCE SCALE, 2015–2022

	Number of severely food-insecure people (millions)						Number of moderately or severely food-insecure people (millions)					
	2015	2017	2019	2020	2021	2022	2015	2017	2019	2020	2021	2022
WORLD	**561.5**	**623.8**	**719.8**	**850.7**	**927.3**	**900.1**	**1 612.4**	**1 817.0**	**1 966.4**	**2 307.2**	**2 342.5**	**2 356.9**
AFRICA	**206.3**	**252.2**	**268.1**	**305.0**	**331.1**	**341.8**	**544.8**	**650.6**	**695.0**	**761.7**	**834.5**	**868.3**
Northern Africa	20.5	25.0	21.5	23.8	28.7	31.1	59.9	78.8	71.2	75.9	86.9	84.3
Sub-Saharan Africa	185.8	227.2	246.6	281.2	302.4	310.6	484.9	571.9	623.7	685.8	747.6	783.9
Eastern Africa	86.6	108.2	109.3	126.2	132.1	130.9	223.5	267.9	277.9	298.8	308.2	327.4
Middle Africa	n.a.	n.a.	n.a.	66.5	71.9	76.7	n.a.	n.a.	n.a.	129.4	143.5	153.7
Southern Africa	5.7	6.1	6.2	7.4	7.5	8.6	13.8	14.3	14.7	16.6	16.8	17.8
Western Africa	41.0	53.9	66.1	81.1	90.8	94.4	142.7	174.5	205.7	240.8	279.1	285.1
ASIA	**293.7**	**295.0**	**377.3**	**449.5**	**486.1**	**456.9**	**791.0**	**857.4**	**981.8**	**1 196.8**	**1 151.5**	**1 144.9**
Central Asia	1.0	2.0	1.7	3.6	3.8	3.5	6.3	9.9	9.9	13.3	15.3	13.4
Eastern Asia	12.4	27.9	21.4	33.4	17.0	16.0	95.7	164.3	123.0	129.0	102.3	103.4
South-eastern Asia	11.9	13.3	12.2	13.9	17.7	17.8	92.5	101.9	96.0	104.0	114.2	114.4
Southern Asia	244.7	225.4	316.9	371.3	417.9	389.2	514.7	496.6	668.1	849.8	807.6	809.2
Western Asia	23.8	26.4	25.1	27.4	29.7	30.3	81.8	84.6	84.8	100.7	112.1	104.4
Western Asia and Northern Africa	*44.3*	*51.4*	*46.6*	*51.2*	*58.4*	*61.4*	*141.7*	*163.4*	*156.0*	*176.6*	*199.0*	*188.7*
LATIN AMERICA AND THE CARIBBEAN	**45.3**	**61.7**	**62.5**	**81.8**	**91.1**	**83.4**	**169.8**	**209.7**	**203.8**	**256.4**	**264.3**	**247.8**
Caribbean	n.a.	n.a.	n.a.	14.2	11.4	12.5	n.a.	n.a.	n.a.	28.7	26.3	26.9
Latin America	32.0	48.2	49.3	67.5	79.7	70.8	144.0	183.1	177.6	227.7	238.0	220.8
Central America	11.2	10.9	12.8	12.9	14.3	15.4	50.7	47.8	49.3	60.3	60.6	61.9
South America	20.8	37.3	36.5	54.7	65.5	55.4	93.3	135.3	128.3	167.4	177.4	159.0
OCEANIA	**1.1**	**1.7**	**1.7**	**1.1**	**2.0**	**1.5**	**4.0**	**6.0**	**5.9**	**5.3**	**5.8**	**5.9**
NORTHERN AMERICA AND EUROPE	**15.1**	**13.2**	**10.3**	**13.3**	**17.0**	**16.5**	**102.8**	**93.3**	**79.8**	**87.0**	**86.4**	**90.0**
Europe	11.6	10.4	7.3	10.5	14.3	13.8	65.6	61.7	51.5	56.1	58.1	61.1
Eastern Europe	4.5	3.2	2.4	4.0	4.9	5.7	34.3	30.3	24.4	29.9	30.6	31.4
Northern Europe	1.9	2.2	1.0	1.3	1.9	2.1	7.0	6.3	5.4	4.4	4.7	7.1
Southern Europe	2.5	3.1	2.4	3.6	4.3	2.4	14.7	16.2	13.4	14.2	13.1	11.4
Western Europe	2.7	1.8	1.4	1.6	3.2	3.6	9.6	8.9	8.3	7.7	9.6	11.2
Northern America	3.5	2.9	3.0	2.7	2.7	2.8	37.2	31.5	28.4	30.9	28.3	28.9

NOTES: n.a. = not available, as data are available only for a limited number of countries, representing less than 50 percent of the population in the region. The estimates for Latin America and the Caribbean from 2014 to 2019 include Caribbean countries whose combined populations represent only 30 percent of the population of that subregion, while the 2020, 2021 and 2022 estimates include Caribbean countries whose combined populations represent between 60 percent and 65 percent of the subregional population. The countries included in the 2022 estimate for the Caribbean subregion are: Antigua and Barbuda, Bahamas, Barbados, Dominica, Dominican Republic, Grenada, Haiti, Jamaica, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, and Trinidad and Tobago.
SOURCE: FAO. 2023. FAOSTAT: Suite of Food Security Indicators. In: *FAO*. [Cited 12 July 2023]. www.fao.org/faostat/en/#data/FS

FIGURE 7 THE CONCENTRATION AND DISTRIBUTION OF FOOD INSECURITY BY SEVERITY DIFFER GREATLY ACROSS THE REGIONS OF THE WORLD



SOURCE: FAO. 2023. FAOSTAT: Suite of Food Security Indicators. In: *FAO*. [Cited 12 July 2023]. www.fao.org/faostat/en/#data/FS

» by 1.6 percentage points from 2021 to 2022, the equivalent of 28.7 million people.

Latin America and the Caribbean showed encouraging progress in 2022, as the proportion of the population facing moderate or severe food insecurity decreased from 40.3 percent in 2021 to 37.5 percent in 2022, the equivalent of 16.5 million fewer people in one year. The improvement was driven by a decrease in South America, from 40.9 percent in 2021 to 36.4 percent in 2022. The prevalence of severe food insecurity also declined in South America, from 15.1 percent in 2021 to 12.7 percent in 2022. In Central America and the Caribbean, on the other hand, the food security situation deteriorated from 2021 to 2022. In the Caribbean, which is the subregion most affected by food insecurity, the prevalence of moderate or severe food insecurity increased from 59.5 percent to 60.6 percent, and severe food insecurity increased from 25.7 percent to 28.2 percent.

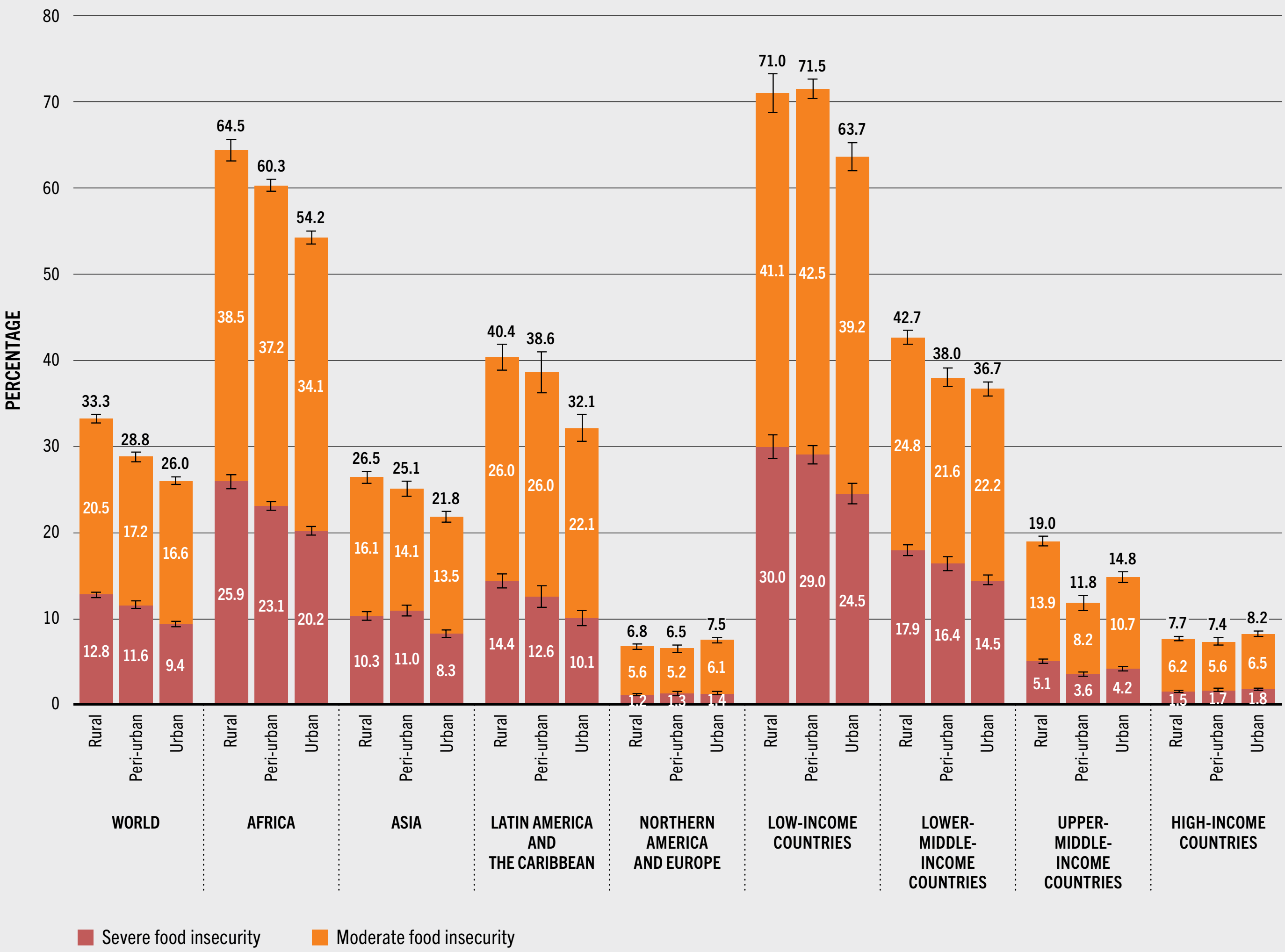
In **Oceania**, the prevalence of moderate or severe food insecurity was 13.0 percent in 2022. An estimated 3.4 percent of the population in Oceania was facing severe food insecurity in 2022, down from 4.5 percent in 2021.

In **Northern America and Europe**, the prevalence of moderate or severe food insecurity rose slightly in 2022 to 8.0 percent, while severe food insecurity remained unchanged. Moderate or severe food insecurity increased by approximately 2 percentage points in Northern Europe, reaching 6.6 percent in 2022, whereas the prevalence of moderate or severe food insecurity decreased by about 1 percentage point in Southern Europe to 7.5 percent.

It is interesting to compare how the regions have fared in the fight against hunger since the pandemic emerged in late 2019. Three years later, parts of Asia and Latin America appear to be rebounding, whereas Africa is still struggling to turn things around. Regardless, food insecurity levels in all regions are still far above pre-pandemic levels.

Figure 7 shows that, of a total of 2.4 billion people in the world facing food insecurity in 2022, nearly half (1.1 billion) were in Asia; 37 percent (868 million) were in Africa; 10.5 percent (248 million) lived in Latin America and the Caribbean; and around 4 percent (90 million) were in Northern America and Europe. The figure also illustrates the different proportions of severe food insecurity in relation to moderate or severe food insecurity across regions. Severe food insecurity represents a larger share of the combined total of moderate plus severe food insecurity in Africa, Asia, and Latin America and the Caribbean – 39.4 percent, 39.9 percent and 33.5 percent, respectively – compared with 18.8 percent in Northern America and Europe.

FIGURE 8 FOOD INSECURITY, AT BOTH LEVELS OF SEVERITY, IS HIGHER IN RURAL AREAS THAN IN URBAN AREAS IN ALL REGIONS EXCEPT NORTHERN AMERICA AND EUROPE



SOURCE: FAO. 2023. FAOSTAT: Suite of Food Security Indicators. In: *FAO*. [Cited 12 July 2023]. www.fao.org/faostat/en/#data/FS

Differences in food insecurity across rural, peri-urban and urban areas

The availability of georeferenced FIES data collected by FAO in 2022 has made it possible to present, for the first time, a comparison of food insecurity in rural, peri-urban and urban populations at the global, regional and subregional levels.[e] The Degree of Urbanization (DEGURBA) classification, a new international standard, was used to distinguish among populations living in: i) rural areas; ii) towns and semi-dense areas (peri-urban areas); and iii) cities (urban areas), based on population density and size, in a globally comparable way.[f, 17] The prevalence of food insecurity among adults within each group was then calculated.

Results show that at the global level, food security improves as the degree of urbanization increases

e See **Annex 2, Section C** for details on the methods used to obtain disaggregated estimates.

f The DEGURBA classification was developed by the Statistical Office of the European Union (EUROSTAT), the International Labour Organization (ILO), FAO, the Organisation for Economic Co-operation and Development (OECD), the United Nations Human Settlements Programme (UN-Habitat) and the World Bank and was approved at the 51st session of the UN Statistical Commission in March 2020 (see Box 2 in **Chapter 3**).[17] This differs from the Urban Rural Catchment Areas (URCA) criteria used for the analyses of subsets of countries in **Chapter 4** (see Box 3).

FIGURE 9 GLOBALLY AND IN EVERY REGION, THE PREVALENCE OF FOOD INSECURITY IS HIGHER AMONG WOMEN THAN AMONG MEN

SOURCE: FAO. 2023. FAOSTAT: Suite of Food Security Indicators. In: *FAO*. [Cited 12 July 2023]. www.fao.org/faostat/en/#data/FS

(Figure 8).[g] Moderate or severe food insecurity affected 33.3 percent of adults living in rural areas in 2022 compared with 28.8 percent in peri-urban areas and 26.0 percent in urban areas. The prevalence of severe food insecurity was 12.8 percent in rural areas, 11.6 percent among peri-urban residents, and 9.4 percent among urban residents.

At the regional level, the differences across regions are interesting. Africa clearly follows the global pattern of worsening food security when moving from urban, to peri-urban, to rural areas. In Asia and Latin America and the Caribbean, food insecurity is significantly higher in rural areas compared to urban areas, at both levels of severity, but the differences between peri-urban and rural areas are less clear. In Northern America and Europe, on the other hand, food insecurity, at both levels of severity is worse in urban areas than in rural areas.

These differences in regional patterns may be partially explained by looking at rural–urban differences in food insecurity by DEGURBA through a country income group lens (Figure 8). In LICs, rural and peri-urban populations

g See Table A1.3 in **Annex 1A** for prevalence of moderate or severe food insecurity, and severe food insecurity only, by degree of urbanization in 2022 by region and subregion.

are more food insecure compared to urban populations, whereas in LMICs, food insecurity is highest in rural areas but only marginally worse in peri-urban than in urban areas. The situation is markedly different in UMICs and HICs. Among UMICs, the prevalence of food insecurity, at both levels of severity, is highest in rural areas and lowest in peri-urban areas. In HICs, on the other hand, it is the urban population that is at higher risk of moderate or severe food insecurity, with virtually no difference for severe food insecurity.

Gender differences in food insecurity

Persistent gender inequalities are revealed by the new FIES data. Food insecurity is more prevalent among adult women than men in every region of the world. The gender gap in food insecurity at the global level widened considerably in 2020 and 2021 in the wake of the COVID-19 pandemic, as women were more affected by job and income losses and bore a larger responsibility for additional, unpaid caregiving duties.[18, 19] Women living in rural areas were even more likely to be food insecure,[20] as job and income losses were much higher for women than for men particularly in agrifood systems.[21] In 2021, the gender gap reached 3.8 percentage points, with 28.6 percent of women in the world being moderately or severely food insecure compared with 24.8 percent of men (Figure 9).

For 2022, the food insecurity gap between men and women appears to have narrowed considerably at the global level, which may partially reflect a return of women to economic activities as pandemic-related restrictions were eased, and a weakening of the disproportionate impacts of the pandemic on women's food insecurity. In 2022, 27.8 percent of adult women were moderately or severely food insecure, compared with 25.4 percent of men, and the proportion of women facing severe food insecurity was 10.6 percent compared with 9.5 percent of men. The difference in the prevalence of moderate or severe food insecurity between men and women decreased from 3.8 percentage points in 2021 to 2.4 percentage points in 2022, and the gap for severe food insecurity narrowed from 2.4 to 1.1 percentage points (Figure 9).[h]

There were encouraging improvements in the gender gap in both Asia and Latin America and the Caribbean from 2021 to 2022. The gap narrowed by more than 2 percentage points for moderate or severe food insecurity in both regions, and by about 2 and 1.3 percentage points for severe food insecurity in Asia and in Latin America and the Caribbean, respectively. In Africa and in Northern America and Europe, however, the gap increased marginally for moderate or severe food insecurity and remained about the same for severe food insecurity. ■

2.2 COST AND AFFORDABILITY OF A HEALTHY DIET

KEY MESSAGES

➔ The cost of a healthy diet rose globally by 4.3 percent in comparison to 2020, and by 6.7 percent compared to the pre-COVID-19-pandemic levels, in 2019. This increase is due to the overall rise in inflation in 2020 and 2021, driven in part by the persisting effects of the pandemic.

➔ Worldwide in 2021, the average cost of a healthy diet was 3.66 PPP dollars per person per day. The cost was higher in Latin America and the Caribbean (4.08 PPP dollars) compared to Asia (3.90 PPP dollars), Africa (3.57 PPP dollars), Northern America and Europe (3.22 PPP dollars), and Oceania (3.20 PPP dollars).

➔ In Africa, Asia, and Latin America and the Caribbean, the cost of a healthy diet increased by more than 5 percent from 2020 to 2021, negatively affecting all subregions except for Northern Africa, where the cost fell by 2.8 percent. In the same period, the cost of a healthy diet rose in Oceania (5.2 percent) and in Northern America and Europe (marginally, by 0.6 percent). The surge hit lower-middle-income countries more than high-income countries.

➔ More than 3.1 billion people in the world – or 42 percent – were unable to afford a healthy diet in 2021, representing an increase of 134 million people compared to 2019, before the pandemic. This reflects the increase in the cost of a healthy diet that, in many countries, occurred in combination with a decline in disposable income.

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h See Table A1.4 in **Annex 1A** for prevalence of moderate or severe food insecurity, and severe food insecurity only, among adult men and women in 2022 by region and subregion. See **Annex 2**, **Section C** for the methodology.

➔ While Asia had the largest number of people who were unable to afford a healthy diet (1.9 billion) in 2021, Africa reported the highest proportion of the population unable to afford it (78 percent) compared to Asia (44 percent), Latin America and the Caribbean (23 percent), Oceania (3 percent), and Northern America and Europe (1 percent).

➔ Southern Asia shows the highest number (1.4 billion) and proportion (72 percent) of the population unable to afford a healthy diet in Asia, with the prevalence almost twice the regional average. Eastern and Western Africa report the highest proportion (85 percent) in the Africa region, as well as the highest number (712 million), when considered together.

Healthy diets are essential for achieving food security goals and improving nutritional outcomes. A healthy diet is composed of a variety of nutritious and safe foods that provide dietary energy and nutrients in the amounts needed for a healthy and active life. A healthy diet is based on a wide range of unprocessed or minimally processed foods, balanced across food groups, while it restricts the consumption of highly processed foods and drink products; it includes wholegrains, legumes, nuts, an abundance and variety of fruits and vegetables, and can include moderate amounts of eggs, dairy, poultry and fish, and small amounts of red meat.[22, 23] Eating a healthy diet throughout the life cycle is critical for preventing all forms of malnutrition, including child stunting and wasting, micronutrient deficiencies and overweight or obesity. It also helps reduce the risk of non-communicable diseases (NCDs) such as cardiovascular diseases, diabetes and certain types of cancer.[24]

FAO, with support from the World Bank Data Group, systematically monitors the cost and affordability of a healthy diet (CoAHD) indicators and recently began to disseminate the updated series on the FAOSTAT database.[25] These indicators provide evidence regarding people's economic access to the lowest-cost healthy diet in a given country, using locally available foods to meet nutritional requirements. In this year's report, the CoAHD indicators are updated to 2021. Lack of updated income distribution at the country level and of detailed food prices and purchasing power parity (PPP) conversion factors makes it impossible to update these estimates for 2022. See **Annex 2, Section D** for details on the methodology and important updates.

This year, affordability indicators reflect not only price shocks but also income shocks induced by the pandemic, better capturing the global situation in 2020 and 2021. This was possible because income distributions – derived from the Poverty and Inequality Platform to estimate affordability – have now been updated to include the years 2020 and 2021 for all countries (see **Annex 2, Section D**).[i] Following the recent release of new PPPs for 2017, the World Bank adopted the latest conversion factors to present its monetary indicators in 2017 PPP terms, including income distributions.[26] Consequently, the indicators of affordability are expressed in 2017 PPP rather than 2011 PPP, as in previous years (see **Annex 2, Section D**).

The cost and affordability of a healthy diet in 2021

The revised analysis presented in this year's report – which accounts for updated income distributions in 2020 and 2021 – shows that almost 3.2 billion people worldwide could not afford a healthy diet in 2020, with a slight improvement in 2021 (a decrease of 52 million people). Food prices continued to climb throughout 2021, pushing up the average cost of a healthy diet globally. However, a rebound in economic growth in many countries, particularly in Asia, may have translated into larger fiscal space for stimulus packages, social transfers and improved labour markets.[27, 28] These efforts helped to counter the effects of high food inflation, thereby reducing the number of people unable to afford a healthy diet at the global level, largely driven by Asia.

Table 5 presents the CoAHD indicators at the global and regional levels, and by country income group, for 2019, 2020 and 2021. Estimated ranges of affordability indicators are presented in Table A3.2 for 2021, where lower and upper bounds reflect different assumptions about the share of income reserved for food. Country-level »

i In last year's report, affordability in 2020 was obtained by applying the cost of a healthy diet in 2020 to income distributions in 2019, hence accounting for price shocks induced by the pandemic, but not for income shocks.

TABLE 5 MORE THAN 3.1 BILLION PEOPLE COULD NOT AFFORD A HEALTHY DIET IN 2021, ALTHOUGH THERE WAS SOME IMPROVEMENT FROM 2020 TO 2021

	Cost of a healthy diet (PPP dollars per person per day)					Proportion of the population unable to afford a healthy diet (%)			Number of people unable to afford a healthy diet (millions)				
	2019	2020	2021	2019–2020 change (%)	2020–2021 change (%)	2019	2020	2021	2019	2020	2021	2019–2020 change (millions)	2020–2021 change (millions)
WORLD	**3.43**	**3.51**	**3.66**	**2.3**	**4.3**	**41.2**	**43.3**	**42.2**	**3 005.5**	**3 191.9**	**3 139.5**	**186.4**	**-52.4**
AFRICA	**3.31**	**3.38**	**3.57**	**2.2**	**5.6**	**77.4**	**77.9**	**77.5**	**989.4**	**1 020.7**	**1 040.5**	**31.3**	**19.8**
Northern Africa	3.60	3.57	3.47	-0.6	-2.8	54.7	54.0	51.7	131.3	131.9	128.5	0.6	-3.4
Sub-Saharan Africa	3.28	3.36	3.58	2.6	6.6	82.6	83.3	83.4	858.1	888.8	912.1	30.7	23.3
Eastern Africa	3.01	3.09	3.29	2.7	6.7	84.2	84.7	84.6	341.3	352.7	361.9	11.4	9.2
Middle Africa	3.30	3.37	3.55	2.2	5.3	82.1	82.2	81.9	145.7	150.5	154.5	4.8	4.0
Southern Africa	3.71	3.84	4.06	3.4	5.8	65.4	67.4	67.0	43.4	45.3	45.6	1.9	0.3
Western Africa	3.37	3.45	3.71	2.5	7.6	84.1	85.1	85.4	327.6	340.3	350.1	12.7	9.8
ASIA	**3.57**	**3.70**	**3.90**	**3.7**	**5.2**	**43.2**	**46.4**	**44.2**	**1 877.4**	**2 031.4**	**1 949.9**	**154.0**	**-81.5**
Central Asia	2.91	3.10	3.32	6.7	7.2	21.3	24.6	24.4	7.3	8.6	8.7	1.3	0.1
Eastern Asia	4.45	4.67	4.87	5.1	4.1	11.2	14.5	10.0	177.8	230.9	159.4	53.1	-71.5
South-eastern Asia	3.86	3.99	4.19	3.6	4.8	52.3	54.0	54.9	335.1	349.0	357.4	13.9	8.4
Southern Asia	3.66	3.82	4.08	4.2	6.9	70.2	73.8	72.2	1 340.6	1 425.9	1 408.5	85.3	-17.4
Western Asia	3.15	3.22	3.36	2.2	4.5	9.7	9.7	9.0	16.7	17.0	15.9	0.3	-1.1
LATIN AMERICA AND THE CARIBBEAN	**3.78**	**3.88**	**4.08**	**2.7**	**5.3**	**20.8**	**20.9**	**22.7**	**120.0**	**121.9**	**133.4**	**1.9**	**11.5**
Caribbean	4.06	4.20	4.41	3.3	5.0	51.6	55.2	57.0	13.7	14.8	15.4	1.1	0.6
Latin America	3.49	3.55	3.75	1.9	5.6	19.3	19.3	21.1	106.3	107.1	118.0	0.8	10.9
Central America	3.45	3.48	3.62	0.8	4.1	23.6	25.4	22.2	35.7	38.7	34.2	3.0	-4.5
South America	3.50	3.59	3.82	2.4	6.4	17.7	17.0	20.6	70.6	68.4	83.8	-2.2	15.4
OCEANIA	**2.96**	**3.04**	**3.20**	**2.8**	**5.2**	**2.6**	**2.7**	**2.9**	**0.7**	**0.7**	**0.8**	**0.0**	**0.1**
NORTHERN AMERICA AND EUROPE	**3.19**	**3.20**	**3.22**	**0.6**	**0.6**	**1.7**	**1.6**	**1.4**	**18.1**	**17.2**	**14.9**	**-0.9**	**-2.3**
COUNTRY INCOME GROUP													
Low-income countries	3.14	3.22	3.37	2.5	4.7	86.7	86.9	86.1	456.8	471.0	480.0	14.2	9.0
Lower-middle-income countries	3.55	3.65	3.88	2.9	6.2	68.3	71.0	70.2	2 180.7	2 296.8	2 299.6	116.1	2.8
Upper-middle-income countries	3.65	3.72	3.91	2.0	5.1	14.4	16.6	14.1	350.5	406.4	345.5	55.9	-60.9
High-income countries	3.29	3.36	3.43	2.1	2.1	1.5	1.5	1.3	17.4	17.6	14.3	0.2	-3.3

NOTES: The cost of a healthy diet is expressed in purchasing power parity (PPP) dollars per person per day. The share of people unable to afford a healthy diet is a weighted average (%) estimated using population data. The 2022 World Bank's income classification is used to identify country income groups. The calculation of the annual change (%) in the cost of a healthy diet is based on the cost rounded to three decimal places.
SOURCE: FAO. 2023. FAOSTAT: Cost and Affordability of a Healthy Diet (CoAHD). In: *FAO*. [Cited 12 July 2023]. www.fao.org/faostat/en/#data/CAHD

» estimates for the entire 2017–2021 series can be found in Table A3.1.

In 2021, the average cost of a healthy diet globally was 3.66 PPP dollars per person per day (Table 5). The cost was higher in Latin America and the Caribbean (4.08 PPP dollars) compared to Asia (3.90 PPP dollars), Africa (3.57 PPP dollars), Northern America and Europe (3.22 PPP dollars), and Oceania (3.20 PPP dollars).

The cost of a healthy diet has been on the rise since 2019. It increased globally by 6.7 percent between 2019 and 2021, with a notable single-year increase of 4.3 percent in 2021 (Table 5 and Figure 10A). The surge in the cost of a healthy diet reflects an overall rise in food inflation that hit every region following the outbreak of the pandemic. Soaring prices were mostly driven by lockdowns and by disruptions in the global supply chain and transportation systems, as well as labour shortages hitting especially the agriculture sector.[8]

The cost of a healthy diet increased by more than 5 percent between 2020 and 2021 in Africa, Asia, Latin America and the Caribbean, and Oceania, but only marginally in Northern America and Europe (0.6 percent). The increase in cost in Africa, Latin America and the Caribbean, and Oceania was nearly double that which occurred between 2019 and 2020, while the cost rose to a lesser extent in Asia and in Northern America and Europe (Table 5 and Figure 10A).

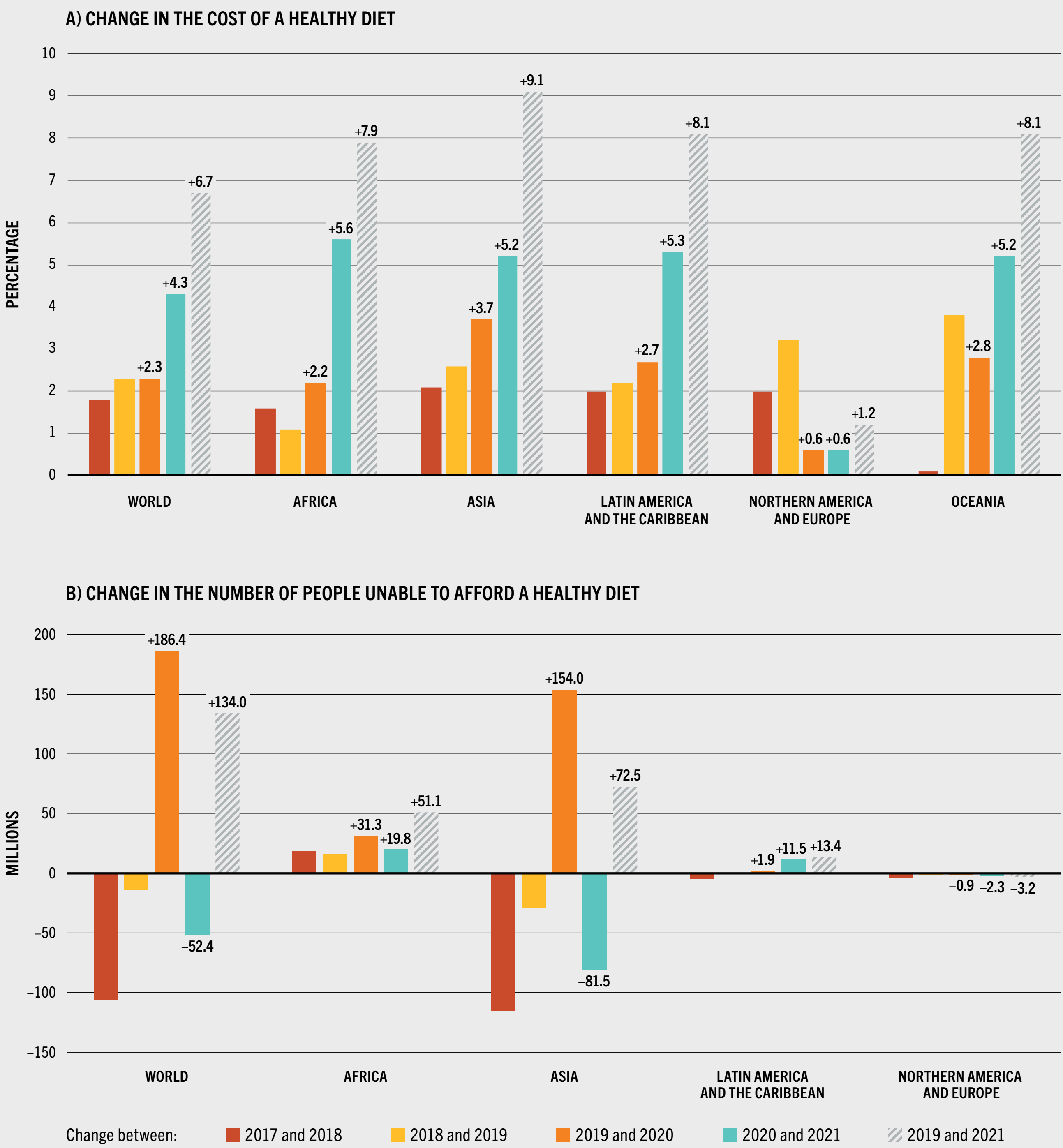
Between 2020 and 2021, soaring costs affected all subregions in Africa, Asia, and Latin America and the Caribbean, except for Northern Africa, where the cost declined by 2.8 percent. The cost of a healthy diet climbed by 7.6 percent in Western Africa, a threefold increase compared to the period between 2019 and 2020 (Table 5). Eastern Africa also experienced a 6.7 percent rise in the cost of a healthy diet, followed by Southern Africa (5.8 percent) and Middle Africa (5.3 percent). In Asia, the highest surge was seen in Central Asia and Southern Asia (7.2 percent and 6.9 percent, respectively). Eastern Asia reported the smallest increase in the cost between 2020 and 2021 (4.1 percent) and showed a slowdown in cost inflation compared to the previous period. In Latin America and the Caribbean, the cost increase ranged from 6.4 percent in South America to 4.1 percent in Central America.

The COVID-19 pandemic has exacerbated existing inequalities across all regions in the world. Low- and middle-income countries have faced greater challenges related to increases in food prices and food insecurity compared to high-income countries.[29] This is also reflected in the increased cost of a healthy diet from 2020 to 2021, which was much larger in LMICs (6.2 percent increase), UMICs (5.1 percent) and LICs (4.7 percent), compared to HICs (2.1 percent) (Table 5).

About 3.14 billion people in the world – or 42 percent – were unable to afford a healthy diet in 2021; this figure is down somewhat from 3.19 billion people – or 43 percent – in 2020 (Table 5 and Figure 10B). In many countries, the increase in the cost of a healthy diet occurred in combination with a decline in disposable income following the persisting effects of the pandemic. Lockdowns, economic downturns, and other pandemic-related disruptions in 2020 led to job losses and reduced incomes for many people, affecting low-income households the most as they spend a higher share of income on food.[30] The impact of escalating prices, coupled with a reduction in disposable income in many countries, resulted in an additional 186 million people unable to afford a healthy diet in 2020 compared to 2019.

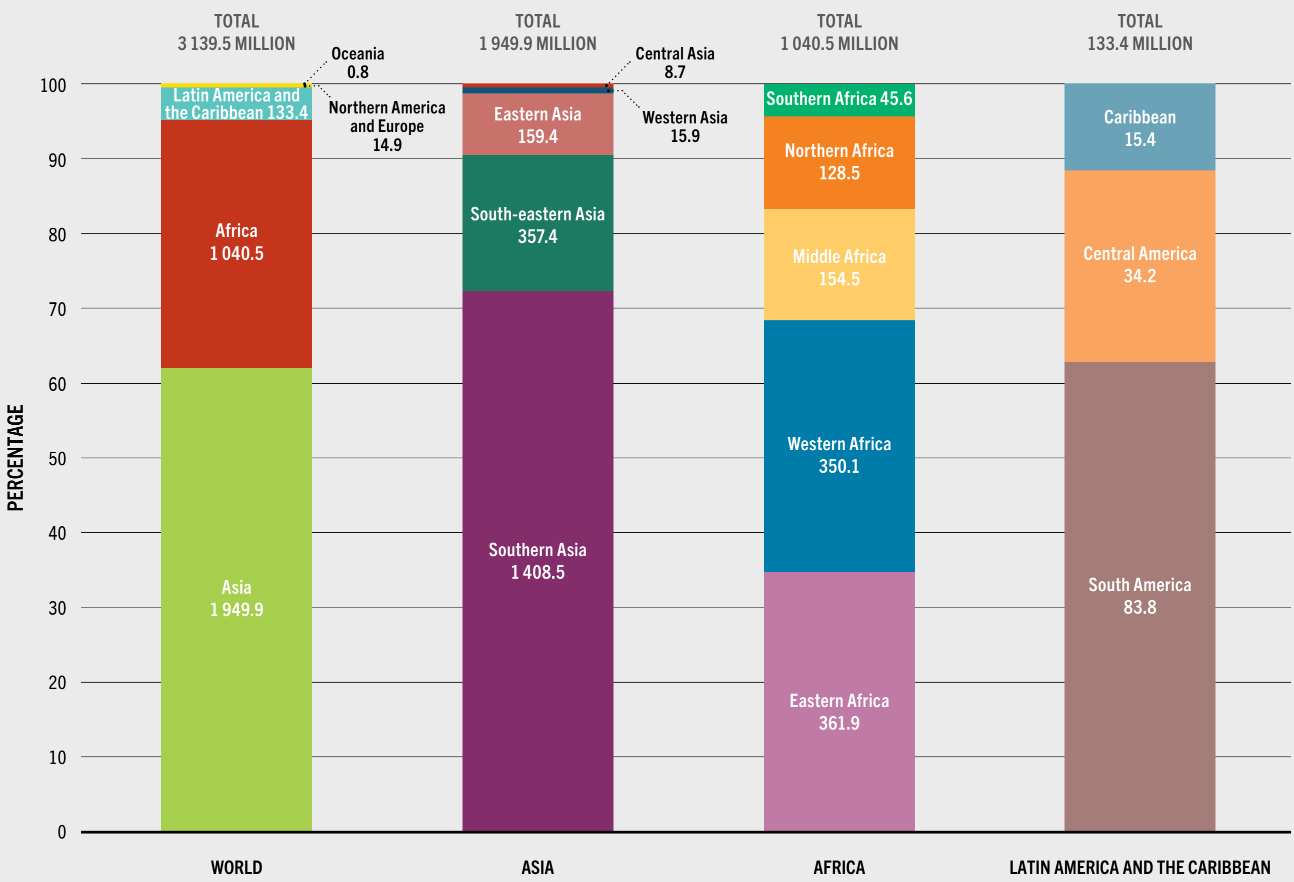
A slight turnaround occurred in 2021, when the number of people unable to afford a healthy diet declined by 52 million compared to 2020 (Table 5 and Figure 10B), but this is still 134 million more people compared to pre-pandemic levels in 2019. A rebound in global GDP growth to 6 percent in 2021, following the pandemic that plunged most countries into recession in 2020,[3] likely alleviated the burden of unaffordability, owing to several factors, including government stimulus programmes, social protection measures, and employment recovery, in some instances.[31] However, the unequal pattern of economic recovery across and within countries, coupled with increasing prices and inequalities, has made a healthy diet less affordable especially in some regions, placing an additional burden on the most vulnerable households. »

FIGURE 10 GLOBALLY IN 2021, THE COST OF A HEALTHY DIET INCREASED AND MORE PEOPLE WERE UNABLE TO AFFORD THE DIET COMPARED TO 2019 IN ALL REGIONS EXCEPT NORTHERN AMERICA AND EUROPE, DESPITE A SMALL DECLINE IN UNAFFORDABILITY FROM 2020 TO 2021



SOURCE: FAO. 2023. FAOSTAT: Cost and Affordability of a Healthy Diet (CoAHD). In: *FAO*. [Cited 12 July 2023]. www.fao.org/faostat/en/#data/CAHD

FIGURE 11 MOST OF THE PEOPLE UNABLE TO AFFORD A HEALTHY DIET IN 2021 LIVED IN SOUTHERN ASIA, AND IN EASTERN AND WESTERN AFRICA



SOURCE: FAO. 2023. FAOSTAT: Cost and Affordability of a Healthy Diet (CoAHD). In: *FAO*. [Cited 12 July 2023]. www.fao.org/faostat/en/#data/CAHD

» Compared to 2019, the number of people unable to afford a healthy diet was higher in 2021 in all regions except Northern America and Europe, where the number of people unable to afford the diet decreased by 2.3 million despite the price and income shocks induced by the pandemic (Figure 10B). In Asia, the number of people who could not afford a healthy diet increased by 154 million from 2019 to 2020, but then decreased by 81.5 million from 2020 to 2021 (Figure 10B). A notable improvement occurred from 2020 to 2021 in Eastern Asia, where a healthy diet was out of reach for fewer people (71.5 million fewer people could not afford it), and in Southern Asia (17.4 million fewer people), following sharp increases the previous year in the number of people unable to afford this diet. Eastern Asia is the only subregion in Asia reporting an overall improvement in 2021 compared to 2019, as the number of people unable to afford a healthy diet decreased by 18.4 million. In Africa, unaffordability continued to worsen: 51.1 million more people could not afford a healthy diet in 2021 compared to 2019, with the highest increase occurring from 2019 to 2020 (31 million). Sub-Saharan Africa reported the largest increase in the number of people unable to afford a healthy diet from 2019 to 2021 (54 million more people), while the situation improved in Northern Africa, where the diet was out of reach for almost 3 million fewer people (Table 5). Finally, in Latin America and the Caribbean, 13.4 million more people could not afford a healthy diet in 2021 compared to 2019, with the largest increase in South America (13.3 million people) due to a sharp jump from 2020 to 2021 (Table 5 and Figure 10B).

Of the people in the world who were unable to afford a healthy diet in 2021, 1.9 billion, or 62 percent, were found in Asia (Figure 11). In terms of proportion, however, Africa was the region with the highest proportion of the population that could not afford a healthy diet in 2021 (78 percent) compared to Asia (44 percent), Latin America and the Caribbean (23 percent), Oceania (3 percent), and Northern America and Europe (1 percent) (Table 5).

Almost 70 percent of the people in Africa who were unable to afford a healthy diet lived in Eastern and Western Africa. Considered together, the two subregions reported the highest number (712 million) and proportion (85 percent) of people who were unable to afford a healthy diet in Africa in 2021 (Table 5 and Figure 11). A high proportion was also found in Middle Africa (82 percent) in 2021, followed by Southern Africa (67 percent) and Northern Africa (52 percent), whose percentage was lower than the regional average (78 percent).

In Asia, Southern Asia showed the highest number (1.4 billion) and proportion (72 percent) of people unable to afford a healthy diet in 2021, far above the regional average of 44 percent. In South-eastern Asia, around 55 percent of people could not afford this diet, and the number has been increasing since 2019.

Finally, in Latin America and the Caribbean, 63 percent of the people unable to afford a healthy diet lived in South America, and only 12 percent lived in the Caribbean (Figure 11). The Caribbean was the subregion with the lowest absolute number of people (15 million) but the highest proportion of the population (57 percent) unable to afford a healthy diet – more than twice the regional average.

The indicators described in this section and in **Annex 2** and **Annex 3** provide a snapshot of the "average" cost and affordability situation at the global, regional and country levels. However, they do not fully capture the heterogeneous characteristics of a population that determine the ability to afford a healthy diet within a country or a region. Affordability is affected not only by the average cost of a healthy diet and people's incomes, but also by factors such as place of residence, proximity to food markets, or food production for own consumption. Due to data limitations, affordability estimates cannot control for these factors and may overestimate, in some instances, the cost of a healthy diet for specific population subgroups, and hence the number of people whose income falls below the cost threshold for a healthy diet. ■

2.3 THE STATE OF NUTRITION: PROGRESS TOWARDS GLOBAL NUTRITION TARGETS

KEY MESSAGES

➔ Worldwide in 2022 among children under five years of age, an estimated 148.1 million (22.3 percent) were stunted, 45 million (6.8 percent) were wasted and 37 million (5.6 percent) were overweight.

➔ Global stunting prevalence was 1.6 times higher and wasting prevalence 1.4 times higher in rural versus urban areas. The prevalence of overweight was only slightly higher in urban children (5.4 percent) compared to rural children (3.5 percent).

➔ There has been steady progress in reducing stunting since 2012, but the world is still not on track to achieve the 2030 target of 13.5 percent (50 percent reduction in the number of children with stunting from the baseline). In the ten years since 2012, the number of children with stunting declined by nearly 30 million.

➔ Reduction in wasting is making some progress but global prevalence is more than twice the 2030 target. Wasting among children was highest in low- and lower-middle-income countries (94 percent of the global burden).

➔ Globally, the majority of overweight children (77 percent) lived in lower-middle- and upper-middle-income countries in 2022. In terms of progress towards the 2030 target of less than 3 percent prevalence, no regions were on track and only Northern America and Europe made some progress towards the target.

➔ Globally, there has been no significant change in low birthweight over the last two decades – 16.6 percent in 2000 compared with 14.7 percent in 2020 – and no region is on track to attain the 2030 target of a 30 percent reduction since the 2012 baseline. Data gaps present a challenge to the global monitoring of low birthweight, as nearly one in three newborns in the world were not weighed at birth in 2020.

➔ Steady progress has been made on exclusive breastfeeding, with 47.7 percent of infants under six months of age exclusively breastfed worldwide in 2021, up from 37.0 percent in 2012. An estimated 75 percent of exclusively breastfed infants live in low- or lower-middle-income countries.

➔ Conflict, climate change and rising food prices, along with the persisting effects of the COVID-19 pandemic, all threaten progress towards achieving the 2030 global nutrition targets. Coordinated efforts are needed to eliminate malnutrition in all its forms.

The importance of nutrition and reporting on the Sustainable Development Goals

Nutrition is mentioned specifically in SDG 2 but it is central to the achievement of all 17 SDGs, specifically those related to health, education, gender equality and the climate.[32] This section presents an assessment of global and regional levels and trends for global nutrition targets. There are updates on five of the six nutrition targets initially endorsed by the World Health Assembly (WHA) in 2012 to be achieved by 2025, for which extended 2030 targets were subsequently proposed by the World Health Organization (WHO) and the United Nations Children's Fund (UNICEF). Four out of the six indicators were also selected to monitor progress towards SDG Target 2.2, namely stunting, wasting and overweight in children under five years of age, and anaemia in women aged 15 to 49 years. A seventh target to halt the rise in adult obesity was adopted by the WHA as part of the Global Action Plan for the Prevention and Control of NCDs in 2013. Only the indicators for stunting, wasting, overweight, exclusive breastfeeding and low birthweight will be presented in this edition of the report, as updated data were not available for anaemia in women aged 15 to 49 years and adult obesity.

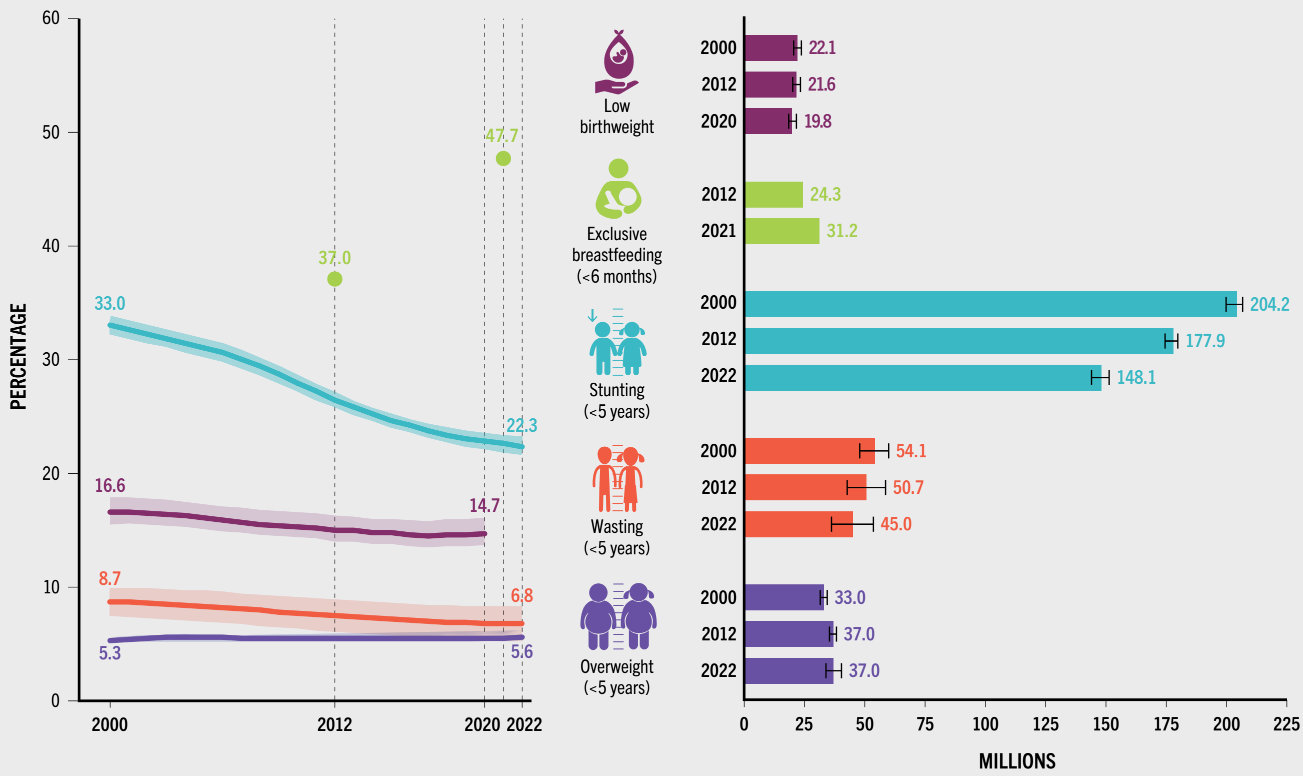
Global trends and burden of malnutrition

Conflict, climate change and the enduring secondary effects of the COVID-19 pandemic continue to affect malnutrition, birthweights and caring practices like exclusive breastfeeding. The 2022 edition of this report presented multiple pathways for the pandemic to impact child nutrition along with potential risks stemming from the war in Ukraine. Although the effects of the current crises on malnutrition are not yet fully reflected in the updates presented in this edition of the report, due either to data sparsity or to the long-term impact of some of the nutritional outcomes, negative impacts on various forms of malnutrition are expected at the global level. Any potential global consequences of the war in Ukraine on malnutrition are also yet to be measured comprehensively. The global trends in prevalence and absolute numbers for five nutrition indicators are summarized in Figure 12.

The latest estimate for **low birthweight** reveals that 14.7 percent of newborns (19.8 million) were born with low birthweight (less than 2 500 g) in 2020, a non-significant decline from 16.6 percent (22.1 million) in 2000. Infants born weighing less than 2 500 g are approximately 20 times more likely to die than those with adequate birthweight,[33] and those who survive face long-term development and health consequences, including a higher risk of stunting, a diminished intelligence quotient, and increased risk of obesity and diabetes as adults.[34]

Optimal breastfeeding practices, including **exclusive breastfeeding** for the first six months of life, are critical for child survival and the promotion of health and cognitive development.[35] Globally, the prevalence of exclusive breastfeeding among infants under six months of age rose from 37.0 percent (24.3 million) in 2012 to 47.7 percent (31.2 million) in 2021. Worldwide, over half of all

FIGURE 12 STUNTING IN CHILDREN UNDER FIVE YEARS OF AGE AND EXCLUSIVE BREASTFEEDING HAVE IMPROVED AND SOME PROGRESS HAS BEEN MADE ON WASTING, WHILE LOW BIRTHWEIGHT AND OVERWEIGHT IN CHILDREN UNDER FIVE YEARS OF AGE HAVE NOT CHANGED



NOTES: Wasting is an acute condition that can change frequently and rapidly over the course of a calendar year. The *UNICEF-WHO-World Bank: Joint child malnutrition estimates* do not currently adjust for seasonal variation that can affect wasting prevalence estimates. The global estimates of the number of children with wasting are based on national-level prevalence data which capture the cases of wasting at a given moment in time. As such, the reported estimates do not reflect the cumulative cases of wasting over the year.
SOURCES: Data for stunting, wasting and overweight are based on UNICEF, WHO & World Bank. 2023. *UNICEF-WHO-World Bank: Joint child malnutrition estimates - Levels and trends (2023 edition)*. [Cited 24 April 2023]. https://data.unicef.org/resources/jme-report-2023, www.who.int/teams/nutrition-and-food-safety/monitoring-nutritional-status-and-food-safety-and-events/joint-child-malnutrition-estimates, https://datatopics.worldbank.org/child-malnutrition; data for exclusive breastfeeding are based on UNICEF. 2022. Infant and young child feeding. In: *UNICEF*. [Cited 6 April 2023]. https://data.unicef.org/topic/nutrition/infant-and-young-child-feeding; data for low birthweight are from UNICEF & WHO. 2023. *Low birthweight joint estimates 2023 edition*. [Cited 12 July 2023]. https://data.unicef.org/topic/nutrition/low-birthweight; www.who.int/teams/nutrition-and-food-safety/monitoring-nutritional-status-and-food-safety-and-events/joint-low-birthweight-estimates. The burden estimates by indicator are based on different denominators including children under five years of age for stunting, wasting and overweight, children under six months of age for exclusive breastfeeding and live births for low birthweight. Population data are based on United Nations Population Division. 2022. *World Population Prospects 2022*. [Cited 27 April 2023]. https://population.un.org/wpp

infants under six months of age do not receive the protective benefits of exclusive breastfeeding.

Stunting, the condition of being too short for one's age, is a marker for longer-term chronic malnutrition. It is caused by a combination of nutritional and other factors that simultaneously undermine the physical and cognitive development of children and increase their risk of dying from common infections. Stunting and other forms of undernutrition early in life may also predispose children to overweight and NCDs later in life.[36] Globally, the prevalence of stunting among children under five years of age has declined steadily, from an estimated 33.0 percent (204.2 million) in 2000 to 22.3 percent (148.1 million) in 2022.

Child **wasting** is a life-threatening condition caused by insufficient nutrient intake, poor nutrient absorption and/or frequent or prolonged illness. Affected children are dangerously thin, with weakened immunity and a higher risk of mortality.[37] The prevalence of wasting among children under five years of age declined non-significantly from 8.7 percent in 2000 to 6.8 percent in 2022. The estimated number of children with wasting declined from 54.1 million in 2000 to 45.0 million in 2022, but it is important to note that these are point estimates and not representative of the cumulative number of cases of wasting over the year. The global prevalence-based estimates of children under five years of age affected by wasting from the *UNICEF-WHO-World Bank: Joint child malnutrition estimates* should be considered underestimates of the annual burden. Wasting is an acute condition that can change rapidly and is affected by seasonal changes in many contexts.[38, 39] This makes reliable national trends over time challenging to estimate and interpret.

Children who are **overweight** or obese face both immediate and potentially long-term health impacts. Immediate impacts include respiratory difficulties, increased risk of fractures, hypertension, early markers of cardiovascular disease, insulin resistance and psychological effects.[40] Affected individuals also have a higher risk of NCDs later in life. Child overweight has been on the rise in many countries, hastened by increasingly inadequate levels of physical activity and increased access to highly processed foods, which tend to be high in energy, fats, free sugars and/or salt.[23] Globally, the prevalence of overweight among children under five years of age showed a non-significant increase from 5.3 percent (33.0 million) in 2000 to 5.6 percent (37.0 million) in 2022. The personal, community and societal costs of overweight and obesity are heavy and are increasing globally.[41]

Nutrition across country income groups

The global burden of malnutrition varies substantially across country income groups and over time. These analyses examine the distribution of the burden based on the latest classification of a country's income group.

The distributions of the global burden for five nutrition indicators by country income group are presented in Figure 13. For each indicator, the distributions in 2012 and in the year for which the most recent data are available are presented to show changes over time.

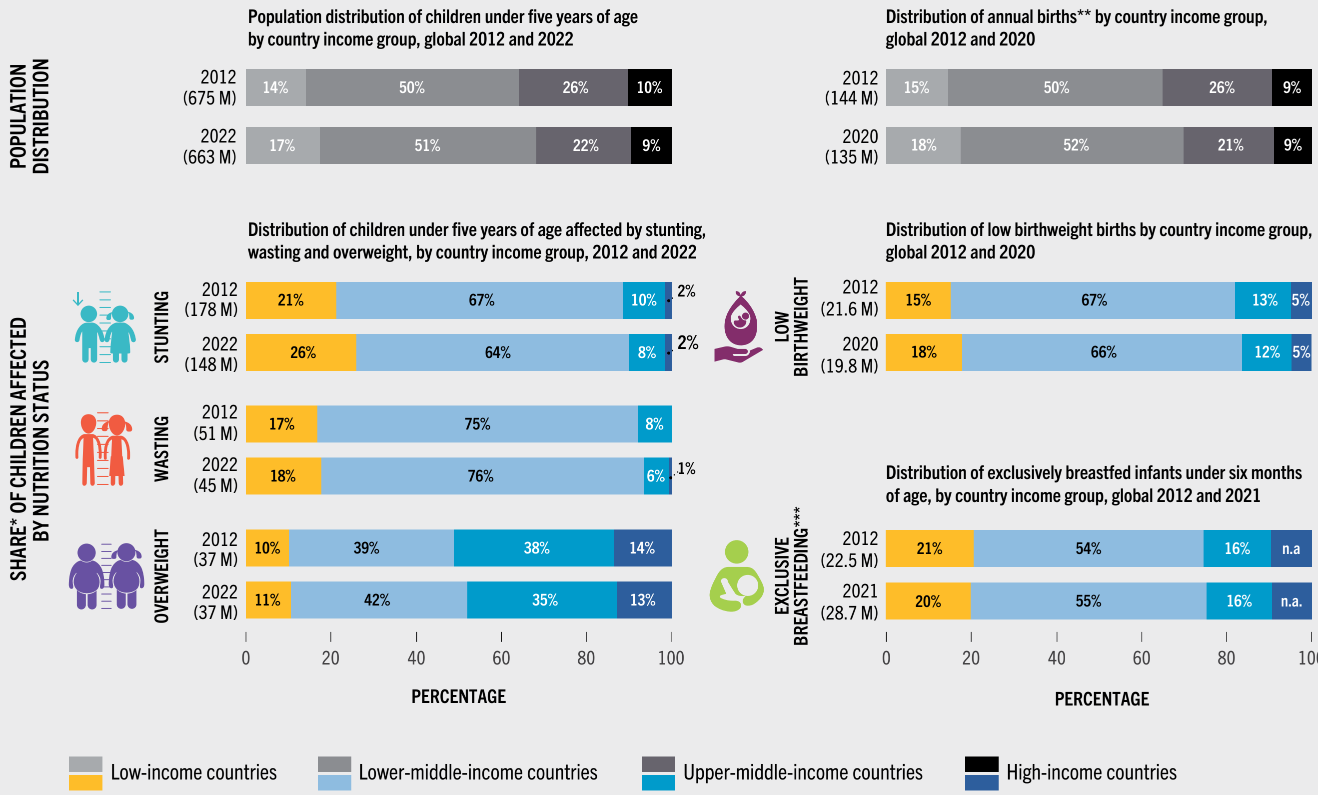
LICs and LMICs together carried the brunt of the low birthweight burden among newborns in both 2012 and 2020 – a total of 84 percent of the global burden of low birthweight in 2020 – while the two country income groups together represented only 70 percent of global annual births. Overall, the distribution of the burden across income groups remained similar between 2012 and 2020. The proportion of low birthweight in LICs increased from 15 percent to 18 percent, in parallel with the fastest global population growth.

Worldwide, the largest proportion of exclusively breastfed infants live in LICs or LMICs, and the combined estimate did not change from 2012 to 2021 (75 percent). The greatest proportion of exclusively breastfed children is found in LMICs (55 percent), while these countries represent only 52 percent of the overall target population. For HICs, there were insufficient data to examine the portion of exclusively breastfed infants; thus, the proportional contribution of HICs to the global total is presented as "estimates not available" in Figure 13.

The proportion of stunting in children under five years of age increased in LICs from 21 percent in 2012 to 26 percent in 2022, while the proportion of children under five years of age in these countries increased from 14 percent to 17 percent. For LICs and LMICs combined, the proportion of stunted children increased from 88 percent in 2012 to 90 percent in 2022, while these country income groups only represented 64 percent of all children under five years of age globally in 2012 and 68 percent in 2022.

As they do for low birthweight and stunting, LICs and LMICs also bear the greatest burden of wasting. These groups comprised a combined total of 92 percent in 2012 and 94 percent in 2022 of all wasted children under five years of age,

FIGURE 13 LOW- AND LOWER-MIDDLE-INCOME COUNTRIES BEAR THE GREATEST BURDEN OF STUNTING, WASTING AND LOW BIRTHWEIGHT, BUT ALSO HAVE THE LARGEST PROPORTION OF EXCLUSIVELY BREASTFED CHILDREN; MOST OVERWEIGHT CHILDREN LIVE IN LOWER-MIDDLE- OR UPPER-MIDDLE-INCOME COUNTRIES



NOTES: n.a. = estimates not available. * The percentages in the bar graphs refer to the proportion of the population/affected population in the four country income groups from the fiscal year 2023 World Bank income classification while the numbers in millions (depicted below each year) are aligned with global estimates. The distribution of affected population is relative to the total number affected across the four country income groups except for exclusive breastfeeding; this varies from the global totals (depicted below each year), which are aligned with global estimates used elsewhere in this report. The sums of the four country income groups are as follows: stunting 2012 = 177.4 million, 2022 = 147.7 million; wasting 2012 = 47.7 million, 2022 = 42.8 million; overweight 2012 = 36.9 million, 2022 = 36.8 million; low birthweight 2012 = 21.6 million, 2020 = 19.8 million. The percentages for distribution of children under five years of age (2022), wasting (2022), overweight (2012 and 2022) and low birthweight (2020) do not add up to 100 percent due to rounding. ** Due to space limitations, the population distribution for infants under six months of age in 2012 and 2021 is not shown, but the distributions are the same as for annual births in 2020 and only vary from 2012 births in high-income countries for which the proportion for infants under six months of age was 10 percent in 2012. *** Exclusive breastfeeding estimates are not available for high-income countries, so their contribution to the global total is presented as n.a. and the sums represent three country income groups.
SOURCES: Data for stunting, wasting and overweight are based on UNICEF, WHO & World Bank. 2023. *UNICEF-WHO-World Bank: Joint child malnutrition estimates - Levels and trends (2023 edition).* [Cited 24 April 2023]. https://data.unicef.org/resources/jme-report-2023, www.who.int/teams/nutrition-and-food-safety/monitoring-nutritional-status-and-food-safety-and-events/joint-child-malnutrition-estimates, https://datatopics.worldbank.org/child-malnutrition; data for exclusive breastfeeding are based on UNICEF. 2022. Infant and young child feeding. In: *UNICEF.* [Cited 6 April 2023]. https://data.unicef.org/topic/nutrition/infant-and-young-child-feeding; data for low birthweight are from UNICEF & WHO. 2023. *Low birthweight joint estimates 2023 edition.* [Cited 12 July 2023]. https://data.unicef.org/topic/nutrition/low-birthweight; www.who.int/teams/nutrition-and-food-safety/monitoring-nutritional-status-and-food-safety-and-events/joint-low-birthweight-estimates. Population data are based on United Nations Population Division. 2022. *World Population Prospects 2022.* [Cited 27 April 2023]. https://population.un.org/wpp

despite representing only 68 percent of the global population under five years of age in 2022.

The proportion of overweight children in LICs and LMICs combined increased from 49 percent in 2012 to 53 percent in 2022. While these changes were marginal, they illustrate the rising threats of overweight and obesity among populations of lower country income groups. The distribution across country income groups of the burden of overweight among children under five years of age changed marginally between 2012 and 2022, with a small increase in the number of overweight children residing in LMICs and a small decline in numbers of overweight children in UMICs. The majority of overweight children (77 percent) live in LMICs and UMICs.

The analysis presented indicates that LICs and LMICs are home to the majority of infants who benefit from exclusive breastfeeding. It also highlights that LICs and LMICs combined carry the greatest burden for low birthweight, stunting, wasting and overweight.

Progress towards ending all forms of malnutrition by 2030

Global progress

Global progress towards the five nutrition 2030 targets for which indicators have been updated is summarized in Figure 14. The 2020 low birthweight prevalence of 14.7 percent has not declined quickly enough to be on track for the 2030 target of a 30 percent reduction from the 2012 baseline. The available low birthweight data suffer from data quality issues, especially among countries that are most likely to have high prevalence, and nearly one in three newborns in the world were not weighed at birth in 2020. Improvements in low birthweight data quality and representativeness are needed to assess the severity and magnitude of the problem more reliably.

The proportion of exclusively breastfed infants under six months of age increased from 37.0 percent in 2012 to 47.7 percent in 2021. Although this is close to the 50 percent target for 2025, the world is not on track to achieve the 2030 target of at least 70 percent. To achieve this target, sustained investment is needed in effective interventions that promote the adoption and continuation of exclusive breastfeeding (such as adequate paid maternity leave and workplace policies to ensure nearby access to quality childcare, breastfeeding breaks and dedicated nursing spaces), along with greater protection and support for breastfeeding in emergency contexts. Enactment and enforcement of the International Code of Marketing of Breastmilk Substitutes,[42] institutionalization of the Baby-friendly Hospital Initiative,[43] and scaling up of antenatal and postnatal breastfeeding counselling will also help countries to reach their individual targets.

Stunting in children under five years of age decreased from 26.3 percent in 2012 to 22.3 percent in 2022. To be on track for the target of a 13.5 percent stunting prevalence in 2030, however, the prevalence needed to reach 18.2 percent in 2022. Strong progress has been made, but larger investments in nutrition-appropriate policies and actions across multiple systems will be required to ensure greater strides are made in reducing stunting.

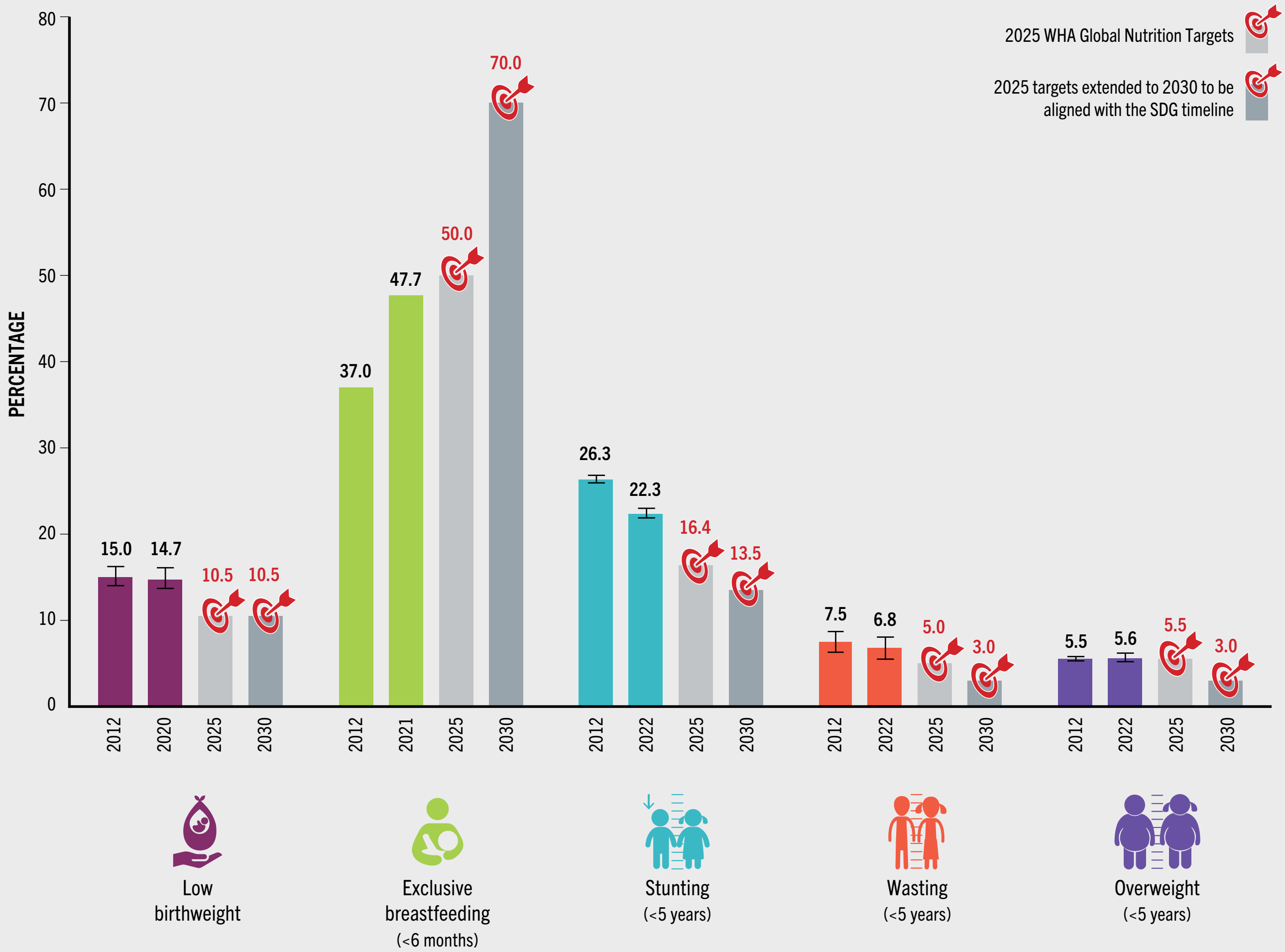
The global prevalence of wasting among children under five years of age did not change significantly from 2012 to 2022, declining from 7.5 percent to 6.8 percent. The 2022 estimate is more than double the 2030 target of less than 3 percent. These results signal that greater targeting of resources is needed towards those countries with the highest burden to increase their access to essential actions for the prevention of child wasting across multiple systems, including health, water and sanitation, education, and social policy. To ensure achievement of the global targets, scaling up of early detection, optimized treatments, and monitoring and delivery of effective services for reducing child wasting are needed, as per the Global Action Plan on Child Wasting.[44]

To achieve the 2030 target of 3 percent for child overweight, a shift is required in the direction of the global trend. The prevalence of overweight remained stagnant at 5.5 percent in 2012 and 5.6 percent in 2022. To address overweight and obesity in the youngest age groups, it is critical to invest in effective promotion and adoption of positive habits including healthy feeding patterns, avoiding easy access to foods high in sugars, salt and fats, as well as active play and other types of physical activity.[45]

Regional progress

This section presents an assessment of the progress towards the 2030 global nutrition targets at the regional and subregional levels. The regional and subregional analysis is based on the annual average rate of reduction[46] observed from trends between the baseline and the most recent year of the indicator, compared to the rate of reduction needed between 2012 and 2030 to reach the global targets. Progress is calculated as the progress achieved versus the change required to bring the indicators to the desired levels (Table 6). (The methodology is described in **Annex 2, Section F.**)

FIGURE 14 THE GLOBAL TRENDS IN STUNTING, WASTING, EXCLUSIVE BREASTFEEDING AND LOW BIRTHWEIGHT MUST BE ACCELERATED, WHILE FOR OVERWEIGHT IN CHILDREN THEY WILL HAVE TO BE REVERSED, TO ACHIEVE THE 2030 GLOBAL NUTRITION TARGETS



NOTE: WHA = World Health Assembly.
SOURCES: Data for stunting, wasting and overweight are based on UNICEF, WHO & World Bank. 2023. *UNICEF-WHO-World Bank: Joint child malnutrition estimates - Levels and trends (2023 edition)*. [Cited 24 April 2023]. https://data.unicef.org/resources/jme-report-2023, www.who.int/teams/nutrition-and-food-safety/monitoring-nutritional-status-and-food-safety-and-events/joint-child-malnutrition-estimates, https://datatopics.worldbank.org/child-malnutrition; data for exclusive breastfeeding are based on UNICEF. 2022. Infant and young child feeding. In: *UNICEF*. [Cited 6 April 2023]. https://data.unicef.org/topic/nutrition/infant-and-young-child-feeding; data for low birthweight are from UNICEF & WHO. 2023. *Low birthweight joint estimates 2023 edition*. [Cited 12 July 2023]. https://data.unicef.org/topic/nutrition/low-birthweight; www.who.int/teams/nutrition-and-food-safety/monitoring-nutritional-status-and-food-safety-and-events/joint-low-birthweight-estimates. The targets are drawn from: UNICEF & WHO. 2017. *Methodology for monitoring progress towards the global nutrition targets for 2025 – technical report*. New York, USA and Geneva, Switzerland. https://data.unicef.org/resources/methodology-for-monitoring-progress-towards-the-global-nutrition-targets-for-2025; and UNICEF & WHO. 2019. *The extension of the 2025 Maternal, Infant and Young Child nutrition targets to 2030*. New York, USA and Geneva, Switzerland. https://data.unicef.org/resources/who-unicef-discussion-paper-nutrition-targets

For low birthweight, no region is on track to reach the 2030 targets and global progress is off track (no progress or worsening). Only Africa made modest progress (off track – some progress) and the remaining regions have made no progress (off track – no progress or worsening) towards the 30 percent reduction in prevalence of low birthweight. Despite Africa being one of the two regions with the highest prevalence of low birthweight, it is the region where some progress is being achieved in three out of five subregions.

At the global level, there has been some progress (off track – some progress) towards reaching the 2030 target for exclusive breastfeeding. At the regional level, Africa, Asia, and Latin America and the Caribbean have all achieved some progress (off track – some progress). »

TABLE 6 ALL REGIONS MADE SOME PROGRESS TOWARDS THE STUNTING, WASTING AND EXCLUSIVE BREASTFEEDING 2030 TARGETS EXCEPT OCEANIA EXCLUDING AUSTRALIA AND NEW ZEALAND

	Child stunting (%)			Child overweight (%)			Child wasting (%)		Low birthweight (%)			Exclusive breastfeeding (%)		
	2012	2022	2030	2012	2022	2030	2022	2030	2012	2020	2030	2012	2021	2030
WORLD	**26.3**	**22.3**		**5.5**	**5.6**		**6.8**		**15.0**	**14.7**		**37.0**	**47.7**	
AFRICA	**34.4**	**30.0**		**5.0**	**4.9**		**5.8**		**14.5**	**13.9**		**35.4**	**44.3**	
Northern Africa	23.5	21.7		11.8	12.3		6.3		14.0	14.1		40.8	n.a.	
Sub-Saharan Africa	36.2	31.3		3.8	3.7		5.7		14.5	13.9		34.4	45.1	
Eastern Africa	38.6	30.6		3.9	3.6		5.0		14.7	14.0		48.6	59.1	
Middle Africa	37.9	37.4		4.5	4.6		5.6		12.8	12.2		28.4	44.4	
Southern Africa	23.4	22.8		12.3	11.4		3.5		16.4	16.4		n.a.	32.8	
Western Africa	34.5	30.0		2.3	2.4		6.7		14.9	14.3		22.1	35.1	
ASIA	**28.2**	**22.3**		**4.8**	**5.1**		**9.3**		**17.2**	**17.2**		**39.0**	**51.5**	
Central Asia and Southern Asia	39.3	29.4		2.9	2.9		13.7		25.4	23.5		46.5	59.4	
Central Asia	14.7	7.7		8.2	5.0		2.1		6.3	6.0		29.2	44.9	
Southern Asia	40.3	30.5		2.7	2.8		14.3		26.1	24.4		47.2	60.2	
Eastern Asia and South-eastern Asia	16.0	13.9		6.5	8.0		4.2		8.1	8.7		30.3	41.5	
Eastern Asia	7.7	4.9		6.6	8.3		1.5		5.5	5.5		28.4	35.3	
South-eastern Asia	30.4	26.4		6.4	7.4		7.8		12.8	12.5		33.4	48.3	
Western Asia	19.1	14.0		9.1	7.2		3.5		12.2	12.2		31.9	31.7	
Western Asia and Northern Africa	*21.2*	*17.9*		*10.4*	*9.8*		*4.9*		*13.1*	*13.1*		*37.2*	*n.a.*	
LATIN AMERICA AND THE CARIBBEAN	**12.7**	**11.5**		**7.4**	**8.6**		**1.4**		**9.5**	**9.6**		**34.3**	**42.6**	
Caribbean	13.0	11.3		6.5	6.6		2.9		11.4	11.7		29.4	31.4	
Central America	18.2	16.9		6.6	6.7		1.0		10.9	10.9		21.7	37.7	
South America	10.1	9.0		7.9	9.7		1.4		8.6	8.8		42.2	46.8	
OCEANIA EXCLUDING AUSTRALIA AND NEW ZEALAND	**40.9**	**44.0**		**9.3**	**13.9**		**8.3**		**17.4**	**17.9**		**56.6**	**59.5**	
Australia and New Zealand	3.4	3.4		12.4	19.3		n.a.		6.4	6.4		n.a.	n.a.	
NORTHERN AMERICA AND EUROPE*	**4.2**	**3.8**		**9.0**	**7.6**		**n.a.**		**7.4**	**7.4**		**n.a.**	**n.a.**	
Northern America	2.6	3.6		8.6	8.2		0.2		8.0	8.1		25.5	25.8	
Europe	5.1	4.0		9.2	7.3		n.a.		7.1	7.0		n.a.	n.a.	

Legend for stunting, wasting and overweight

- On track
- Off track – some progress
- Off track – no progress
- Off track – worsening
- Assessment not possible

Legend for low birthweight and exclusive breastfeeding

- On track
- Off track – some progress
- Off track – no progress or worsening
- Assessment not possible

NOTES: Details on the methodology to assess progress can be found in **Annex 2**, **Section F**; n.a. is where population coverage is under 50 percent.
* The combined regions of Northern America and Europe had a lower bound confidence interval of 3.1 percent for stunting in 2022 and were projected to have a lower bound confidence interval below 3 percent by 2030; they were therefore categorized as "on track".
SOURCES: Data for stunting, wasting and overweight are based on UNICEF, WHO & World Bank. 2023. *UNICEF-WHO-World Bank: Joint child malnutrition estimates - Levels and trends (2023 edition).* [Cited 24 April 2023]. https://data.unicef.org/resources/jme-report-2023, www.who.int/teams/nutrition-and-food-safety/monitoring-nutritional-status-and-food-safety-and-events/joint-child-malnutrition-estimates, https://datatopics.worldbank.org/child-malnutrition; data for exclusive breastfeeding are based on UNICEF. 2022. Infant and young child feeding. In: *UNICEF.* [Cited 6 April 2023]. https://data.unicef.org/topic/nutrition/infant-and-young-child-feeding; data for low birthweight are from UNICEF & WHO. 2023. *Low birthweight joint estimates 2023 edition*. [Cited 12 July 2023]. https://data.unicef.org/topic/nutrition/low-birthweight; www.who.int/teams/nutrition-and-food-safety/monitoring-nutritional-status-and-food-safety-and-events/joint-low-birthweight-estimates. The targets are drawn from: UNICEF & WHO. 2017. *Methodology for monitoring progress towards the global nutrition targets for 2025 – technical report*. New York, USA and Geneva, Switzerland. https://data.unicef.org/resources/methodology-for-monitoring-progress-towards-the-global-nutrition-targets-for-2025; and UNICEF & WHO. 2019. *The extension of the 2025 Maternal, Infant and Young Child nutrition targets to 2030*. New York, USA and Geneva, Switzerland. https://data.unicef.org/resources/who-unicef-discussion-paper-nutrition-targets

» Considerable improvements have been made in Eastern Africa and Southern Asia with exclusive breastfeeding, both of which are on track to reach their targets. Subregions that are not progressing (off track – no progress or worsening) include the Caribbean, Oceania excluding Australia and New Zealand, Northern America and Western Asia. The subregions with inadequate data (assessment not possible) include Australia and New Zealand, Europe, Northern Africa and Southern Africa.

Global estimates show some progress (off track – some progress) towards reaching the stunting reduction target. Northern America and Europe are on track. All other regions except Oceania excluding Australia and New Zealand achieved some progress (off track – some progress) on stunting reduction. The subregions considered on track for stunting include Australia and New Zealand, Central Asia, Eastern Asia, Europe and Northern America. The remaining subregions are making some progress on stunting with the exception of Middle Africa and Southern Africa.

For wasting at the global level, some progress (off track – some progress) has been achieved, with Latin America and the Caribbean on track to reach the 2030 target. Among the subregions, those on track are the Caribbean, Central America, Central Asia, Eastern Asia, Northern America and South America. Africa and Asia have made some progress (off track – some progress) to address this dangerous condition in regions with the highest prevalence.

There has been no progress in reducing overweight in children to meet the 2030 target at the global level (off track – no progress). The prevalence of overweight is worsening in Asia, Australia and New Zealand, Latin America and the Caribbean, and Oceania excluding Australia and New Zealand. The situation is comparatively better in Africa; the region is still off track (no progress), but with a non-significant reduction in overweight in children under five years of age.

Great achievements have been made in promoting exclusive breastfeeding and reducing stunting, but the results vary across regions. Malnutrition in all its forms is found across all regions and could be underestimated due to various factors, as mentioned at the beginning of this section. Achieving the 2030 global nutrition targets requires stronger and more concerted efforts to prevent global setbacks. The global trends in stunting, wasting, exclusive breastfeeding and low birthweight must be accelerated, while for overweight in children they will have to be reversed, to achieve the 2030 global nutrition targets.

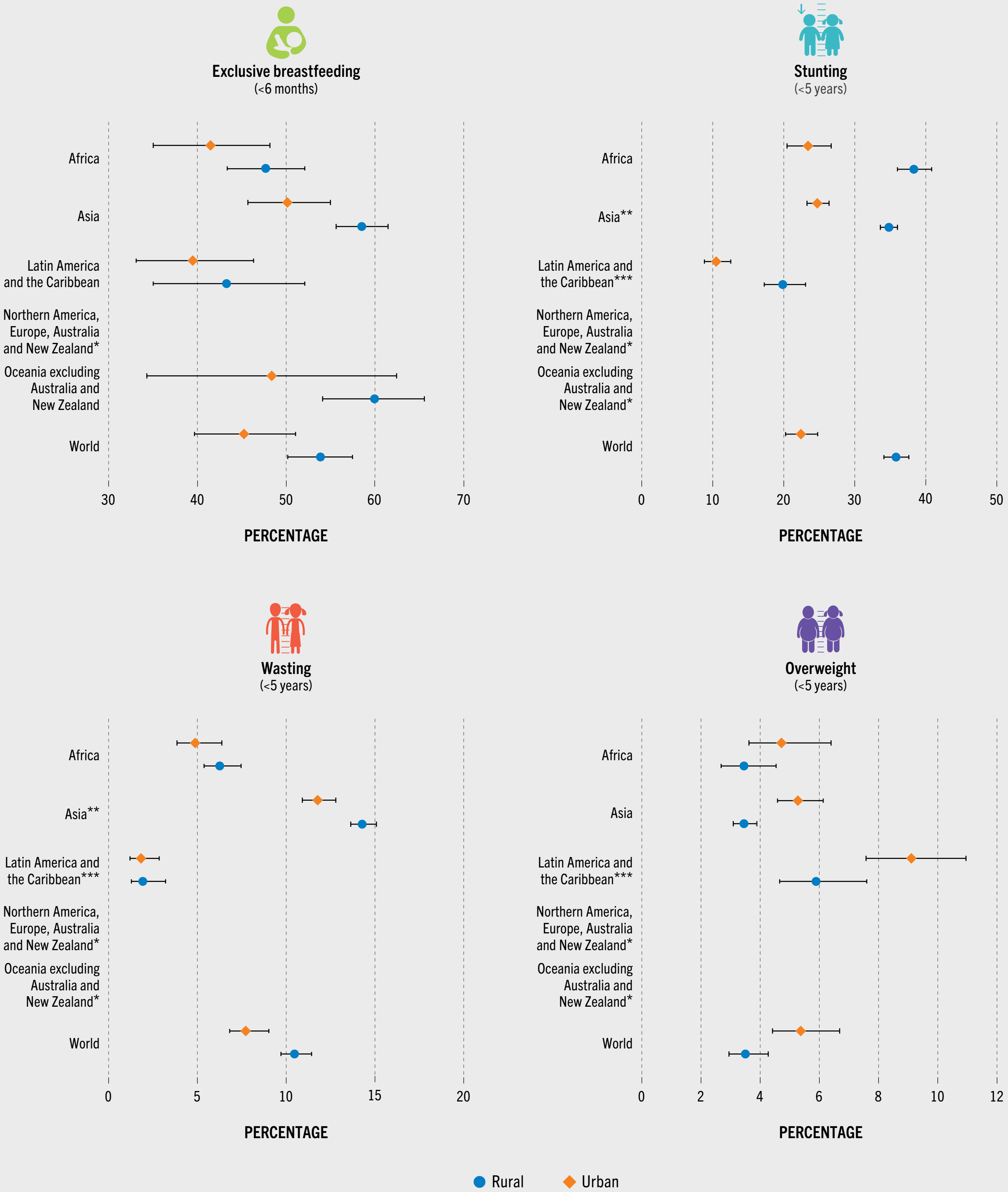
Urban–rural differences in nutrition indicators

In the past, urban children held a distinct advantage of being better nourished than rural children.[47] The higher incomes and improved food access and availability associated with urban residence allowed children to obtain more regular and diverse diets as well as access to health services, potable water and sanitation. But with continued urbanization and the rapid rise in urban poor, there is now a larger population dependent on the most easily available and inexpensive foods which are often not nutritious or hygienic, increasing the risk of malnutrition.

Rural populations often depend on agriculture for their livelihoods. At the same time, the poorest populations are typically found in agricultural regions across and within countries. Hence, when other labour opportunities arise, people often move away from poorly compensated agricultural work, which reinforces the paradox that in agricultural regions, the population and notably its children are more likely to be malnourished.[48] In fact, it has been demonstrated that proximity to agricultural food production does not translate into healthier diets for children. The 2022 report on child food poverty found a higher prevalence of severe food poverty (consuming foods from only two food groups or less per day) among children living in rural areas.[49]

Urban–rural differences in stunting and wasting arise in part from disparities in access to health care, water, sanitation and a hygienic environment.[50] Implementation of key public health interventions across the continuum of care helps to improve the health and nutritional status of children and mothers, through provision of care at first-line health facilities. Improved »

FIGURE 15 THE PREVALENCE OF STUNTING AND WASTING WAS HIGHER IN RURAL COMPARED TO URBAN AREAS, WHILE OVERWEIGHT WAS MORE COMMONLY FOUND IN URBAN AREAS



NOTES: The regional estimates for urban and rural areas presented are based on a population-weighted analysis of a subset of countries with disaggregated data available on place of residence using the latest available data from national surveys between 2015 and 2021 for exclusive breastfeeding and between 2016 and 2022 for stunting, wasting and overweight. * Regions with less than 50 percent population coverage are not considered representative and results are supressed. ** In the urban estimates for Asia, stunting and wasting are based on 49 percent population coverage. *** Latin America and the Caribbean excluding Brazil.
SOURCES: Data for stunting, wasting and overweight are based on UNICEF, WHO & World Bank. 2023. *UNICEF-WHO-World Bank: Joint child malnutrition estimates - Levels and trends (2023 edition).* [Cited 24 April 2023]. https://data.unicef.org/resources/jme-report-2023, www.who.int/teams/nutrition-and-food-safety/monitoring-nutritional-status-and-food-safety-and-events/joint-child-malnutrition-estimates, https://datatopics.worldbank.org/child-malnutrition; data for exclusive breastfeeding are based on UNICEF. 2022. Infant and young child feeding. In: *UNICEF*. [Cited 6 April 2023]. https://data.unicef.org/topic/nutrition/infant-and-young-child-feeding. Population data are based on United Nations Population Division. 2022. *World Population Prospects 2022*. [Cited 27 April 2023]. https://population.un.org/wpp. Rural/urban data are from United Nations Population Division. 2018. *World Urbanization Prospects 2018*. [Cited 27 April 2023]. https://population.un.org/wup

sanitation and hygiene practices can make significant differences in halting the cycle of infectious disease and undernutrition.

Since 2000, as urban populations have undergone the nutrition transition, nutrition-related NCDs – including obesity, diabetes and hypertension – have caused a larger proportion of death and disability compared to undernutrition.[51] Worldwide, rural populations are now undergoing the same transition, and in some areas are beginning to show higher prevalence of overweight and obesity compared to urban areas.[52] The unfinished agendas to reduce stunting, wasting and micronutrient deficiency, along with rising overweight and obesity, represent the current challenge to address multiple forms of malnutrition. Malnutrition in all its forms is related to poor diets, the rise of low-cost nutrient-poor foods and the increasing availability of highly processed foods in rural areas.[53, 54]

Figure 15 presents the prevalence of four nutrition indicators in rural and urban areas.

The definitions of rural and urban residence used in the analysis are based on national definitions recorded in national master sample frames employed to generate survey samples.[j] The criteria are commonly based on population size, range of economic activities undertaken, whether the area has been assigned an administrative function, or a combination of these characteristics. For more information on rural–urban classification, see Box 3 in **Chapter 3**.

The prevalence of exclusive breastfeeding is significantly higher in rural Asia (58.6 percent) than in urban Asia (50.2 percent). No significant differences were found in exclusive breastfeeding by area of residence in Africa, Latin America and the Caribbean, and Oceania excluding Australia and New Zealand. Globally, exclusive breastfeeding is higher in rural areas (53.9 percent) than in urban areas (45.3 percent) with the differences bordering on statistical significance but clearly indicating public health significance for the millions of children who benefit from exclusive breastfeeding.

For stunting, there are major rural–urban differences globally and in three of the five regions. In Africa, Asia, and Latin America and the Caribbean, the prevalence of stunting in rural areas is 9 to 15 percentage points higher than in urban areas. Globally, the prevalence of stunting is higher in rural areas (35.8 percent) than in urban areas (22.4 percent).

Wasting presented a similar distribution, with the global prevalence significantly higher in rural areas (10.5 percent) than in urban areas (7.7 percent). In Asia, there is a significant difference in wasting between rural (14.3 percent) and urban (11.8 percent) areas. No rural–urban differences were found in Africa or Latin America and the Caribbean.

For child overweight, there are small but significant differences by rural–urban residence that serve as an important alert. In Asia and globally, overweight prevalence was nearly two percentage points higher in urban areas (5.3 percent in Asia and 5.4 percent globally) than in rural areas (3.5 percent in both). The highest reported regional prevalence in 2022 was among children residing in urban areas of Latin America and the Caribbean (9.1 percent). Current results were not available in the most urbanized subregions, namely Australia and New Zealand, Europe and Northern America.

The results from these analyses help to identify vulnerable population groups, contributing to evidence to inform decision-making and effective action through the appropriate targeting and design of policies and programmes. Sound nutrition is fundamental to the achievement of the Sustainable Development Goals and must be central in government policy and supported by key stakeholders, including civil society and the private sector. ■

j Therefore, the rural–urban classifications are not entirely comparable across countries, as are the DEGURBA classifications used in Section 2.1 and the URCA classification used in **Chapter 3** (see Box 3).

PALESTINE
A man tends to the vegetable garden on the rooftop of his home – increasing access to food by improving household-level production.
©FAO/Marco Longari

CHAPTER 3
URBANIZATION IS TRANSFORMING AGRIFOOD SYSTEMS AND AFFECTING ACCESS TO AFFORDABLE HEALTHY DIETS ACROSS THE RURAL–URBAN CONTINUUM

KEY MESSAGES

➔ Growing urbanization is a megatrend that, combined with changes in incomes, employment and lifestyles, is driving changes throughout agrifood systems across the rural–urban continuum, from food production, food processing, food distribution and procurement, to consumer behaviour.

➔ These changes represent both challenges and opportunities to ensure everyone has access to affordable healthy diets. Challenges include the increasing availability of cheap, energy-dense and highly processed foods and the exclusion of small farmers from formalizing value chains. But there are also opportunities for increased employment along the food value chains and improvements in the variety of nutritious foods.

➔ The centrality of large cities to the transformation of agrifood systems is challenged by the fact that, due to urbanization, nowadays one-fourth of the global population live in peri-urban areas of intermediate and small cities and towns, which can serve as important nodes in strengthening rural–urban linkages and the functioning of value chains.

➔ Moreover, with the convergence of high food purchases in both peri-urban and rural areas, where almost half of the global population live, markets in these areas are a significant driver of agrifood systems transformation.

➔ Urbanization is often associated with a diversification of diets, including increased consumption of dairy, fish, meat, vegetables, fruits and legumes – foods that can contribute to a healthy diet.

➔ But there are challenges: i) the availability of vegetables and fruits, in particular, is insufficient to meet the daily requirements of a healthy diet in almost every region of the world; and ii) urbanization contributes to the spread of convenience, pre-prepared and fast foods, often energy dense and high in fats, sugars and/or salt, which are increasingly abundant and also cheaper.

➔ The increased demand for high-value crops, such as fruits and vegetables and processed products, including in rural areas, has led to significant growth in longer, more formal and complex food value chains, providing greater income opportunities for off-farm employment, especially for women and youth.

➔ Supply-side factors, including globalized technology in food production, transportation and marketing, coupled with an increase in demand for readily available foods, have contributed to a substantial expansion of supermarkets, hypermarkets, food deliveries and other convenience retailers. However, these are also associated with increased supply and spread of energy-dense and highly processed foods.

➔ As urban areas and rural areas become more interlinked, rural producers often have better access to agricultural inputs and services, allowing for improved productivity, which typically increases income levels. However, there are also risks that small-scale producers in peri-urban areas may lose their lands to urban expansion.

➔ Overall, access to affordable healthy diets and food security are better in cities than in rural areas, although this generalization is complicated by the socioeconomic disparities in diet affordability and food security that exist within urban areas and across the rural–urban continuum.

Urbanization, combined with other contextual factors such as rising incomes, employment and changing lifestyles, is driving changes throughout agrifood systems across the rural–urban continuum, including food production, food processing, food distribution and procurement, and consumer behaviour. These changes may also lead to disparities across this continuum, with both positive and negative effects on the availability and affordability of healthy diets, and in turn, on food security and nutrition outcomes.

This chapter first examines the drivers, patterns and dynamics of urbanization, through a rural–urban continuum lens. It then presents a conceptual framework to understand the pathways through which urbanization is affecting agrifood systems across the rural–urban continuum. Last, the chapter summarizes the challenges and opportunities that urbanization and the associated agrifood systems changes can pose for access to affordable healthy diets. ■

3.1 DRIVERS, PATTERNS AND DYNAMICS OF URBANIZATION

Drivers of urbanization

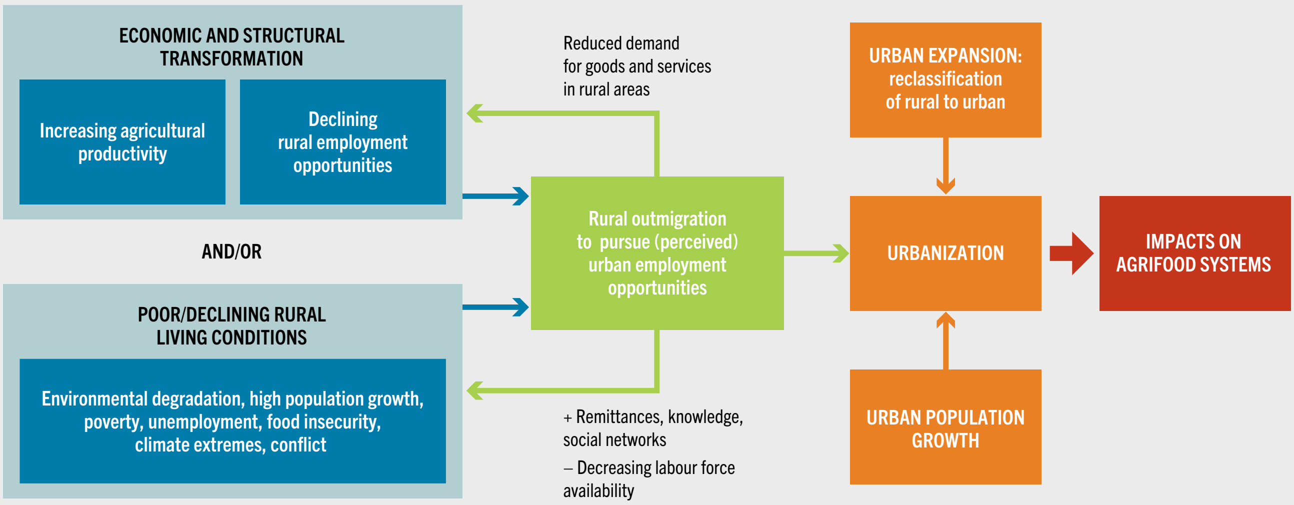
Urbanization is the result of urban population growth, urban expansion (i.e. reclassification of rural areas to peri-urban or urban) and migration from rural to urban areas, as conceptualized in Figure 16. This process is fast-changing, context specific and driven by intertwined factors, including diverse economic developments (e.g. increasing agricultural productivity), policy choices, availability of natural resources, and external stressors such as conflict, climate extremes or environmental degradation.

Many parts of the world have rapidly urbanized since the Second World War, with the urban share of the world's population rising from 30 percent in 1950 to 57 percent in 2021. It is projected to reach 68 percent by 2050.[1] In most regions, this has been largely driven by structural transformation, which entails an economic transformation from mainly agriculture to a more diversified national economy, in the process attracting rural people to urban areas.[2]

The structural transformation of economies is characterized by improvements in productivity, especially of labour, and changes in the relative importance of sectors through the reallocation of production factors such as labour and capital.[3] This entails four interrelated processes: i) a declining share of agriculture in gross domestic product (GDP) and employment, and a gradual shift of jobs from the primary agriculture sector to secondary and tertiary sector jobs, typically located in urban areas; ii) rural-to-urban migration; iii) the rise of a modern industrial and service economy; and iv) a demographic transition from high to low rates of births and deaths.[2, 4, 5, 6]

As the relationship between agriculture and the rest of the economy changes, rural transformation occurs. The latter refers to the process of inclusive and sustainable improvements in rural livelihoods following rising productivity of (smallholder) agriculture, increasing marketable surpluses, rising off-farm employment opportunities in rural areas, better access to services and infrastructure also in rural areas, and the capacity to influence policy, embedded in national processes of economic growth and structural transformation.[7] This process involves a strengthening of rural–urban linkages, which connect agriculture and other activities in the rural economy to the manufacturing and service sectors as they expand into urban centres.[3] Growth in non-farm sectors and shifts in the labour force out of farming are then expected to

FIGURE 16 DRIVERS OF URBANIZATION



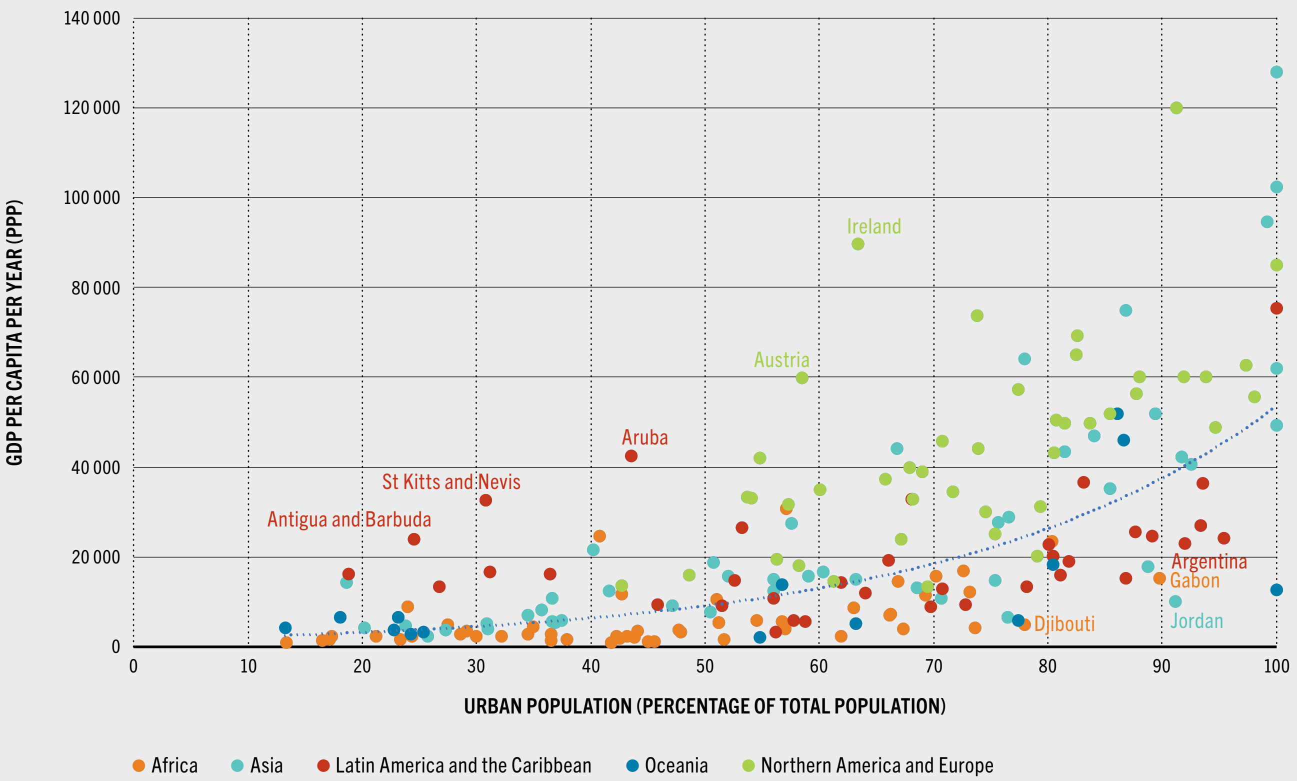
SOURCE: de Bruin, S. & Holleman, C. (forthcoming). *Urbanization is transforming agrifood systems across the rural–urban continuum creating challenges and opportunities to access affordable healthy diets*. Background paper for *The State of Food Security and Nutrition in the World 2023*. FAO Agricultural Development Economics Technical Study. Rome, FAO.

gradually contribute to land consolidation and rising farm sizes. Improvements in agricultural productivity are a necessary condition for such a process to result in reductions in rural poverty and overall improvements in living standards.

However, the theory that urbanization goes hand in hand with economic growth and structural transformation does not hold for all countries and regions. Although countries with a high share of urban population are often more prosperous than countries with a large rural population, this is not true in all cases.[8] Figure 17 shows that although a trend can be seen between GDP per capita at purchasing power parity (PPP) and level of urbanization (measured by the share of the urban population), there is no one-to-one association. For example, in 2019, 91 percent of Jordan's population was urban, but this country's GDP per capita was relatively low at almost 10 000 PPP dollars per year. Likewise, in Gabon, 90 percent of the population was living in cities in 2019, but the country's GDP per capita was around 15 000 PPP dollars per year. Small island countries and territories (Antigua and Barbuda, Saint Kitts and Nevis, and Aruba), as well as small landlocked countries, have lower levels of urbanization than expected considering their relatively high GDP per capita.

Urbanization without structural transformation and economic growth occurred in some of the poorest countries in the late twentieth century.[9] As in the cases above, the increase in share of population in cities does not necessarily indicate high economic growth. Rather urbanization is associated with other "atypical" developments. First, overall population growth leads to growth in both urban and rural areas. Without increases in agricultural productivity, rural population growth results in land subdivision, unviable farming plots and a lack of livelihood opportunities in rural areas. Rural inhabitants then migrate to cities where opportunities may be limited (because of the lack of economic growth), resulting in increases in urban poverty. Second, urban population growth stretches the capacity of urban infrastructure and social and other services to the limit. This is particularly the case for rapidly growing urban areas, where investments have not kept pace with urban expansion.

FIGURE 17 GROSS DOMESTIC PRODUCT PER CAPITA AND LEVEL OF URBANIZATION



NOTES: GDP = gross domestic product; PPP = purchasing power parity. Each dot represents a country/territory.
SOURCE: World Bank. 2023. DataBank. In: *World Bank.* [Cited 23 May 2023]. https://databank.worldbank.org

Urbanization without economic growth can be linked to poor rural living conditions – including poverty, lack of employment or underemployment, lack of infrastructure, lack of access to services and food insecurity – and/or environmental degradation.[10, 11, 12] Southern Asia and sub-Saharan Africa are two regions where structural transformation is lagging behind, as a result of the low productivity of subsistence agriculture and, above all, the rapid rates of population growth and urbanization.[3] In sub-Saharan Africa, there is less poverty reduction alongside urbanization than is historically observed in other regions.[13] Through the late 1990s, sub-Saharan Africa had the highest rate of urbanization in the world; however, this took place in the midst of lagging performances in agriculture and the broader economy.[k] In the late 1990s, per capita income growth in this subregion began to increase significantly, outpacing many countries around the world; still however, aspects of the economic transformation show significant divergences from urbanization driven by structural transformation elsewhere.[15] For example, rural populations continue to grow as most African countries are urbanizing and farm labour is not necessarily moving to

k In sub-Saharan Africa, the urban population share rose by a factor of 3.2, from 11 percent in 1950 to 36 percent in 2010. In comparison, Asia's urban population share during this period increased only 2.5 times (from 18 percent to 44 percent), and Latin America's 1.9 times (from 41 percent to 79 percent).[14]

off-farm sectors of the economy.[15] Moreover, urban-based households, many of whom are medium-scale investor farmers, control a sizeable share of national agricultural land and continue to invest there.

Another factor that may contribute to urbanization is climate change and environmental degradation, which can affect rural-to-urban migration movements.[16, 17] Generally, in low-income rural regions, the lower the per capita income, the larger the share of the labour force employed in agriculture, forestry and fisheries.[18] This means that more people in these regions depend on natural resources for their livelihoods, and are therefore more vulnerable to climate change and environmental degradation.[19] If the agriculture, forestry, fisheries and land-use sectors are weakened from the effects of climate change and biodiversity loss, these populations may be compelled to migrate to urban areas in search of work.[20] With the growing magnitude of climate change impacts, future rural-to-urban migration may be increasingly affected.

However, migration may be neither possible nor desirable for all affected populations. Some of the poorest and most vulnerable groups (including women, children and the elderly) can become trapped in rural areas, their mobility constrained by insufficient resources or social norms. Evidence also indicates that others may choose to remain in high-risk areas due to a strong attachment to their ancestral land and livelihoods.[21] While migration to cities presents risks and opportunities, those who remain in rural areas, whether willingly or unwillingly, are disproportionately vulnerable to climate change impacts, which will have adverse implications for their future livelihoods and food security.

Where there are recurrent climate shocks, patterns of movement can become cyclical, pre-emptive and permanent because of perceived future risk. For example, evidence from Bangladesh suggests that around 22 percent of rural households affected by tidal-surge floods, and 16 percent of those affected by riverbank erosion, have migrated to urban areas.[22] Evidence from sub-Saharan Africa shows that, between 1960 and 2000, nearly 50 percent of net migration[l] (estimated at 5 million people) was due to changes in temperature and rainfall, which affected agricultural production and brought about a reduction in farm incomes and rural wages, thus spurring rural-to-urban movements.[23]

Sending one or more family members into cities to work in sectors other than agriculture, especially for poor rural households, is often important in order to reduce the risks of hunger and extreme poverty, and to cope with possible adverse shocks the household might face. For example, evidence from the Sidama District in southern Ethiopia shows that households whose members were anxious about a decrease in quality and quantity of food were more likely to decide that an adult should migrate in search of employment to support better lives for themselves and the family.[24] Additional evidence from the same country confirmed these results: for households without a migrant member, the inability to feed the family compared to neighbouring households with migrant members increased by four times the propensity to send out a migrant for work.[25]

There is also an increasing occurrence of forced displacement from rural areas to urban areas, often as a result of disasters and/or conflict. Displaced populations are increasingly concentrating in cities, with 61 percent of the 26 million refugees,[26] and two out of three internally displaced persons, residing in urban areas in 2019.[27]

Patterns and dynamics of urbanization

With urban expansion and improving road and communication infrastructure across ever larger parts of rural areas, the distinction between rural and urban areas is increasingly blurred. A large share of the new urban dwellers are expected to live in peri-urban areas, as well as in small cities and interconnected towns. Increasingly, rural and urban areas are less separate spaces in their own right, but rather two ends of a spectrum, connected via numerous linkages across a rural–urban continuum (Box 2), which are important for agrifood systems. »

l The difference between immigration to and emigration from the area during the year.

BOX 2 UNTANGLING THE RURAL–URBAN CONTINUUM

Global populations are regularly categorized as living either in urban centres *or* in rural areas. This distinction is often attributed to data limitations but also to the practicality of the categorization, for example in national ministries which are usually divided by rural and urban mandates.[28, 29] This approach also tends to focus on the rural–urban divide, with the conclusion that rural areas typically lag behind their urban counterparts.[30, 31] However, this divide is challenged both in science and in policy, due to the increasing interconnectedness between various types of population agglomerations.

There is no commonly agreed upon definition of the term "urban" across countries, and thus comparability of "urban areas" across countries and regions is not always straightforward.[32] This limitation carries over directly to globally reported urban population statistics by the United Nations Department of Economic and Social Affairs, which classifies areas as urban according to the criteria used by each country or territory.[33] Criteria may be based on political/administrative aspects, structural and/or functional characteristics related to population density and size or the functions that cities have for their inhabitants.[34]

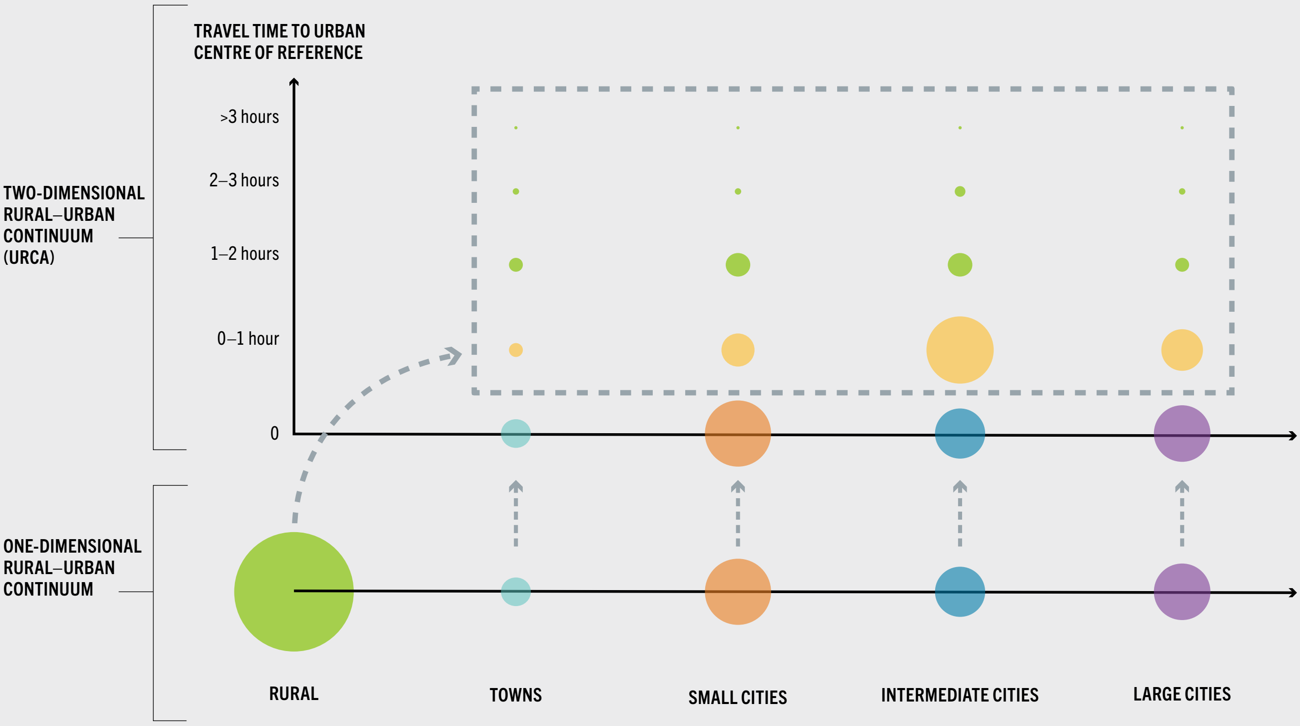
Recently, important advances were made in developing a methodology for delineating urban and rural areas for international and regional statistical comparisons.[35] The UN Statistical Commission endorsed the Degree of Urbanization (DEGURBA) in March 2020 – a methodology developed by a consortium of the European Union and international agencies (Organization for Economic Co-operation and Development [OECD], World Bank, FAO, United Nations Human Settlements Programme [UN-Habitat] and International Labour Organization [ILO]). This methodology classifies the entire territory of a country across a rural–urban continuum,[36] by degree of urbanization. The classification system consists of three classes – cities, towns and semi-dense areas, and rural areas – and seven subclasses for the rural and semi-dense areas, based on population size and density, using the same thresholds across the globe, and thus ensuring global comparability.[37] The outcome is an open-access geospatial dataset. This official classification system is used for the first time in **Chapter 2**, to look at differences in SDG Indicator 2.1.2 (prevalence of moderate or severe food insecurity in the population based on the Food Insecurity Experience Scale [FIES]) among rural, peri-urban and urban populations around the world.

To explore how urbanization shapes agrifood systems, a more granular lens of the rural–urban continuum is useful. For this reason another publically available global geospatial dataset – Urban Rural Catchment Areas (URCA) – is used for the country case study analysis in **Chapter 4**. This newly available global geospatial dataset provides a global mapping of the rural–urban continuum,[28, 38] based on the Global Human Settlement Layer.[39] Like the DEGURBA classification, it places urban centres on a gradient based on population size and density, whereby city size is a proxy for the breadth of services and opportunities provided by an urban centre. But it also adds a second dimension: rural locations are assigned a gradient of their own, using the shortest travel time to urban centres of various sizes as a proxy for the cost of accessing goods, services and employment opportunities (Figure A). Thus, the URCA dataset disaggregates rural areas into multiple categories; distinguishing, for example, between locations that are less than 1 hour from an urban centre (in yellow) and those that are farther away.

The URCA methodology for defining urban–rural catchment areas provides a spatial and functional representation of the connection between rural areas and urban centres, giving new insights into the degree of connectivity between rural and urban areas and the diversity of patterns in rural–urban linkages around the world. Spatial representation refers to the geographical and locational distribution of the population (i.e. what area it occurs in and how spread out it is). Functional representation entails how these areas relate to each other in terms of activities and purpose (i.e. access of rural locations to urban services and opportunities, captured by the size of the closest urban centre and the associated travel time from the rural location). This categorization, when combined with household survey data, allows for a more detailed analysis regarding consumption and production across the rural–urban continuum (see **Chapter 4**).

BOX 2 (Continued)

FIGURE A RURAL–URBAN CONTINUUM BASED ON THE URBAN RURAL CATCHMENT AREAS (URCA) DATASET



NOTES: The figure is a stylized representation of the URCA-defined rural–urban continuum which has a two-dimensional gradient and the more common one-dimensional conceptualization of a rural–urban continuum. The size of the bubble roughly expresses population sizes based on the URCA dataset of global population distribution across the rural–urban continuum in 2015 (see Figure 19B). See **Annex 4** for full definition and description.
SOURCE: Adapted from FAO. 2021. Global Urban Rural Catchment Areas (URCA) Grid – 2021. In: *FAO*. [Cited 12 June 2023]. https://data.apps.fao.org/?share=g-3c88219e20d55c7ce70c8b3b0459001a

» Figure 18 conceptualizes two divergent patterns of urbanization and their major impacts (see Box 3 for definitions of city sizes), which ultimately determine the availability and affordability of healthy diets.[3] The degree of connectivity between rural and urban areas shapes agrifood systems, and thus the availability of affordable healthy diets, and the livelihoods of urban and rural primary producers, processors and traders.[3]

Rural agricultural livelihoods often depend on their connection to peri-urban and urban food spaces, while cities depend on surrounding peri-urban and rural areas for food and ecosystem services. For example, in many parts of Africa, agriculture often flourishes in close proximity to urban centres through more intensive production of high-value crops such as fruits and vegetables, which are highly perishable. In this case, farmers can take advantage of this proximity to markets for both inputs and post-harvest products and services.[3, 40]

Whether urban growth takes place in large or intermediate and small cities or towns will affect rural populations' access to services, markets and

BOX 3 DEFINITIONS OF URBAN, PERI-URBAN AND RURAL AREAS IN URBAN–RURAL CATCHMENT AREAS (URCAs)

The definition of city size and type differs widely among countries. Numerous designations are given indicating size and function, such as primary, secondary or tertiary cities, indicating the role of a city within a national context.

There is also no standard definition of peri-urban, and the term is applied to a diverse mix of informal and formal settlements around urban areas.[41, 42] In general, however, peri-urban refers to the geographical edge of a city – the "urban fringe" outside the formal city limits. It is often described as the landscape interface or transition zone between urban and rural areas.

For the purposes of the discussion and analysis in **Chapters 3**, **4** and **5** of this report, the terminology utilizes URCA definitions to define urban, peri-urban and rural areas.

Based on combined URCA urban area subcategories, urban areas are defined according to the following population sizes:

- Large cities: >1 million people.
- Intermediate cities: 0.25–1 million people.
- Small cities: 50–250 thousand people.
- Towns: 20–50 thousand people.

Furthermore, based on URCA subcategories, peri-urban and rural areas are defined as follows:

- Peri-urban areas consist of three URCA subcategories: <1 hour to a large city; <1 hour to an intermediate city; <1 hour to a small city.
- Rural areas also consist of three URCA subcategories: <1 hour to a town; 1–2 hours to a city or town; >2 hours to a city or town.

See **Annex 4** for further details on the URCA methodology.

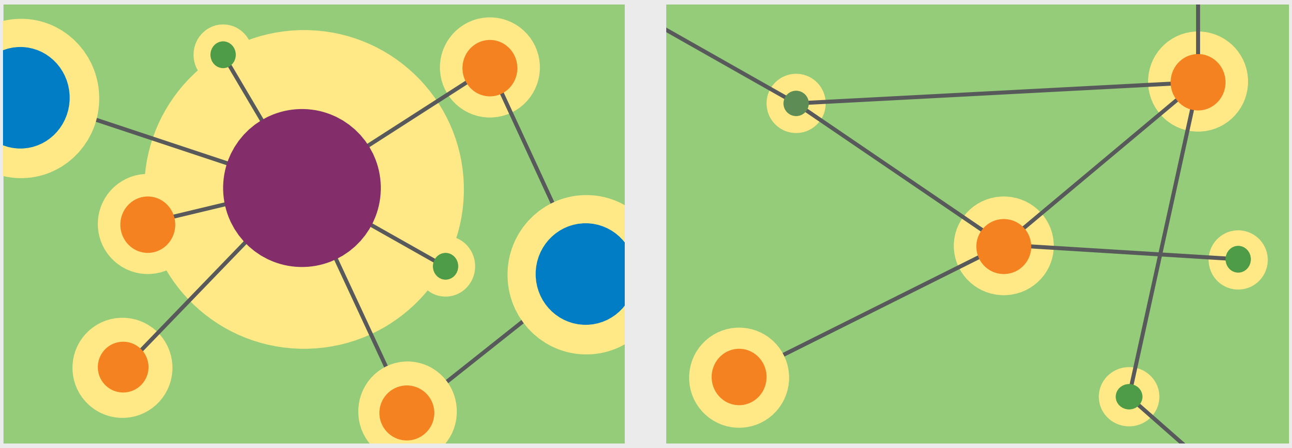
inputs (Figure 18). This is because intermediate and small cities, also referred to as "secondary cities",[m] play a pivotal role in providing input and output market opportunities for rural populations not residing close to the large cities. Infrastructure and facilities in intermediate and small cities are important for connecting different urban centres with each other and with rural areas, thereby facilitating access to more dispersed patterns of pre-harvest and post-harvest facilities such as collection hubs, (cold) storage facilities, and distribution and processing centres.[45, 46]

Several studies find that the growth of intermediate and small cities may matter even more than the growth of large cities in reducing poverty nationally.[47, 48, 49] Population growth in large cities seems to have little effect on poverty reduction, and even increases poverty in some cases, while decreasing levels of urban food security.[50] For these reasons, several local, national and international policies have explicitly promoted the growth of such intermediate and small cities.[51]

As rural and urban areas represent two ends of a spectrum, a rural–urban continuum framework is therefore critical to understand the links between urbanization and agrifood systems changes and how these changes are affecting the availability and affordability of healthy diets, and in turn, food security and nutrition. With this in mind, the global Urban Rural Catchment Areas (URCA) dataset suggests that the breadth of services and opportunities available, as well as their accessibility to rural locations, are often a function of the size of nearby urban centres and the associated travel time from rural locations (see Box 2 and **Annex 4** for a full description of the data and the definition of URCA categories).

m Secondary cities are geographically defined urban jurisdictions or centres performing vital governance, logistical and production functions at a subnational or submetropolitan regional level within a system of cities in a country. Secondary cities range in size from 100 000 to 1 000 000 people or more in some of the more populated countries, and they are centres of subnational government, logistics, employment and services.[43, 44]

FIGURE 18 PATTERNS OF URBANIZATION



- Centralized markets and demand
- More centralized economic growth
- Higher levels of economic inequality
- Increased risk of slums and urban poverty

- Decentralized markets and demand
- Scattered centres of economic growth
- More dispersed non-farm employment
- More inclusive growth

Large city · Intermediate city · Small city · Town · Sphere of influence · Connectivity

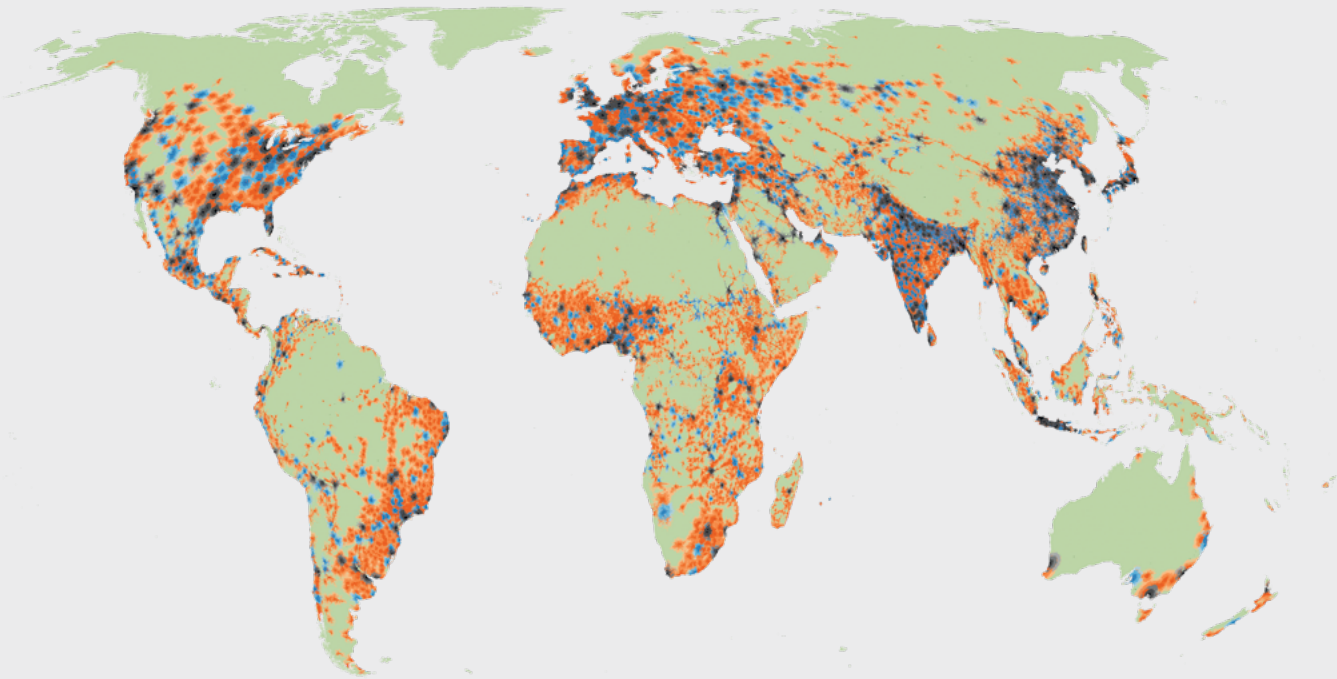
SOURCE: Adapted from de Bruin, S., Dengerink, J. & van Vliet, J. 2021. Urbanisation as driver of food system transformation and opportunities for rural livelihoods. *Food Security*, 13: 781–798. https://doi.org/10.1007/s12571-021-01182-8

Figure 19A shows a global mapping of the URCA categories around the world and Figure 19B shows the global population distribution of URCA categories by country income group and regional group. The URCA mapping reveals disparities in access to services, with around 3.4 billion people living in peri-urban and rural locations (Figure 19) (see Box 3 for specific URCAs). Around one-fourth of the global population live in peri-urban areas (less than 1 hour to an urban centre) of intermediate and small cities and towns, which challenges the centrality of large cities to development, as well as to the transformation of agrifood systems (Figure 19B). Intermediate and small cities appear to provide catchment areas for proportionately more people gravitating around them compared to larger cities, emphasizing their importance (as conceptualized in Figure 18). Similarly, in low-income countries, 64 percent of the population live either in small cities and towns or within their catchment areas (i.e. locations that gravitate around a specific urban centre in terms of access to markets, services and employment opportunities). All told, almost half of the global population (47 percent) live in peri-urban areas (less than 1 hour to large, intermediate and small cities or towns)[n] and rural areas (1 to 2 hours or more to an urban centre). Given the increasing connectivity of peri-urban and rural areas and the convergence »

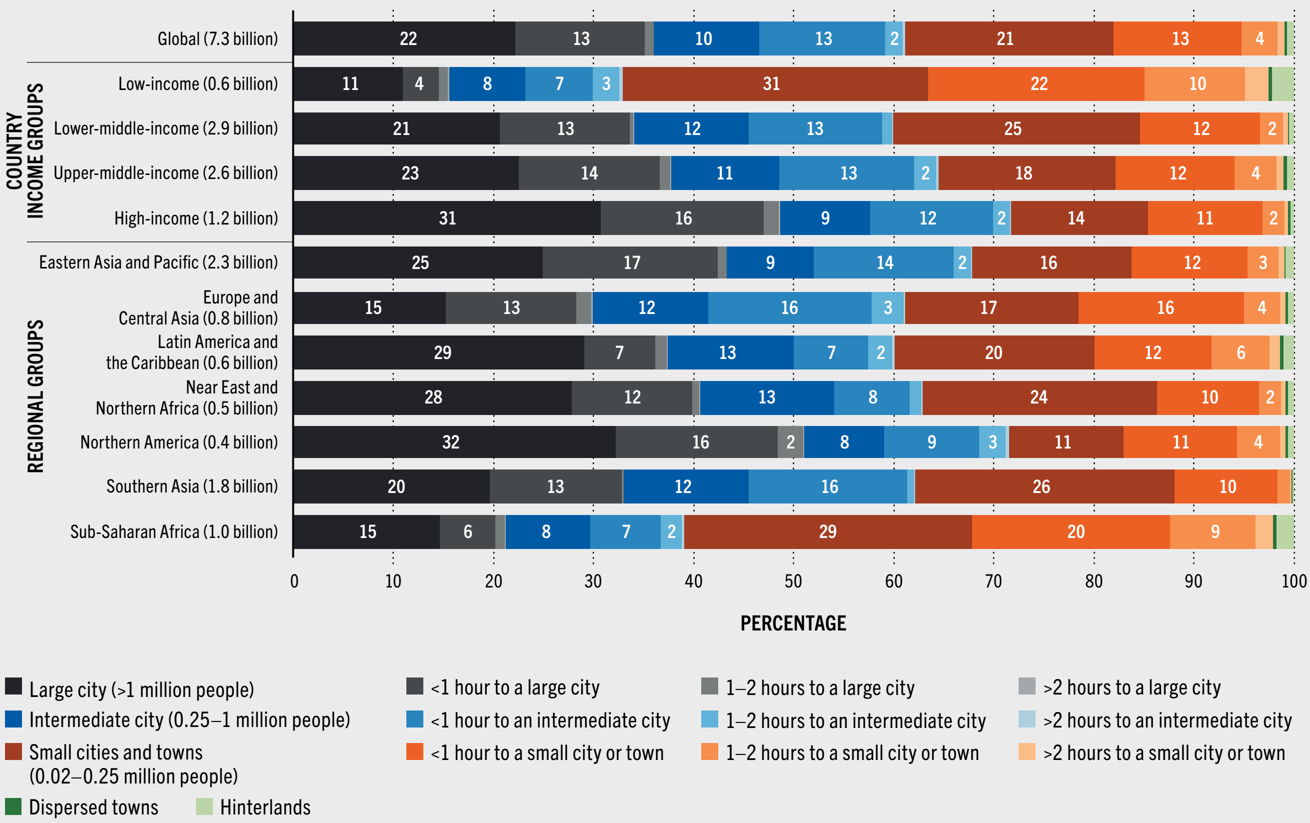
n Note for the purposes of the selected country analyses in **Chapter 4**, small cities and towns are split into two separate categories and peri-urban areas are defined as less than 1 hour travel to a city of any size (i.e. towns are excluded). This facilitates representation of the analysis of the selected countries in Africa studied in **Chapter 4**.

FIGURE 19 GLOBAL MAPPING AND DISTRIBUTION OF POPULATION BY RURAL–URBAN CONTINUUM (URCA) IN 2015

A) GLOBAL MAP OF RURAL–URBAN CONTINUUM (URCA) IN 2015



B) GLOBAL POPULATION DISTRIBUTION ACROSS THE RURAL–URBAN CONTINUUM (URCA) IN 2015, BY COUNTRY INCOME GROUP AND REGIONAL GROUP



SOURCE: Adapted from Cattaneo, A., Nelson, A. & McMenomy, T. 2021. Global mapping of urban–rural catchment areas reveals unequal access to services. *PNAS (Proceedings of the National Academy of Sciences of the United States of America)*, 118(2): e2011990118. https://doi.org/10.1073/pnas.2011990118

» of high food purchases in both (see **Section 3.2**), it is clear that peri-urban and rural markets are significant drivers of agrifood systems transformation. ■

3.2 URBANIZATION AFFECTS AGRIFOOD SYSTEMS, CREATING CHALLENGES AND OPPORTUNITIES TO ENSURE ACCESS TO AFFORDABLE HEALTHY DIETS

Urbanization contributes to the transformation of agrifood systems by reshaping spatial patterns of food demand and affecting consumer preferences, changing how, where and what food is produced, supplied and consumed. These changes are affecting agrifood systems in ways that are creating both challenges and opportunities to ensure everyone has access to affordable healthy diets.

With urbanization and rising incomes, households often eat greater and more diverse quantities of food, including dairy, fish, meat, legumes, fresh fruits and vegetables, as well as more processed foods.[52, 53, 54, 55] This, together with population growth, implies substantial increases in the production and supply of some types of foods (i.e. meat, dairy, fresh fruits and vegetables, wheat and wheat products, as well as highly processed foods) to satisfy increased demand. This, in turn, as urban populations grow, translates into vast increases in the total amount of food that agrifood systems have to produce, process and distribute over time. There may also be slower growth or even declines in demand for other food products sold such as traditional grains, maize, roots and tubers.

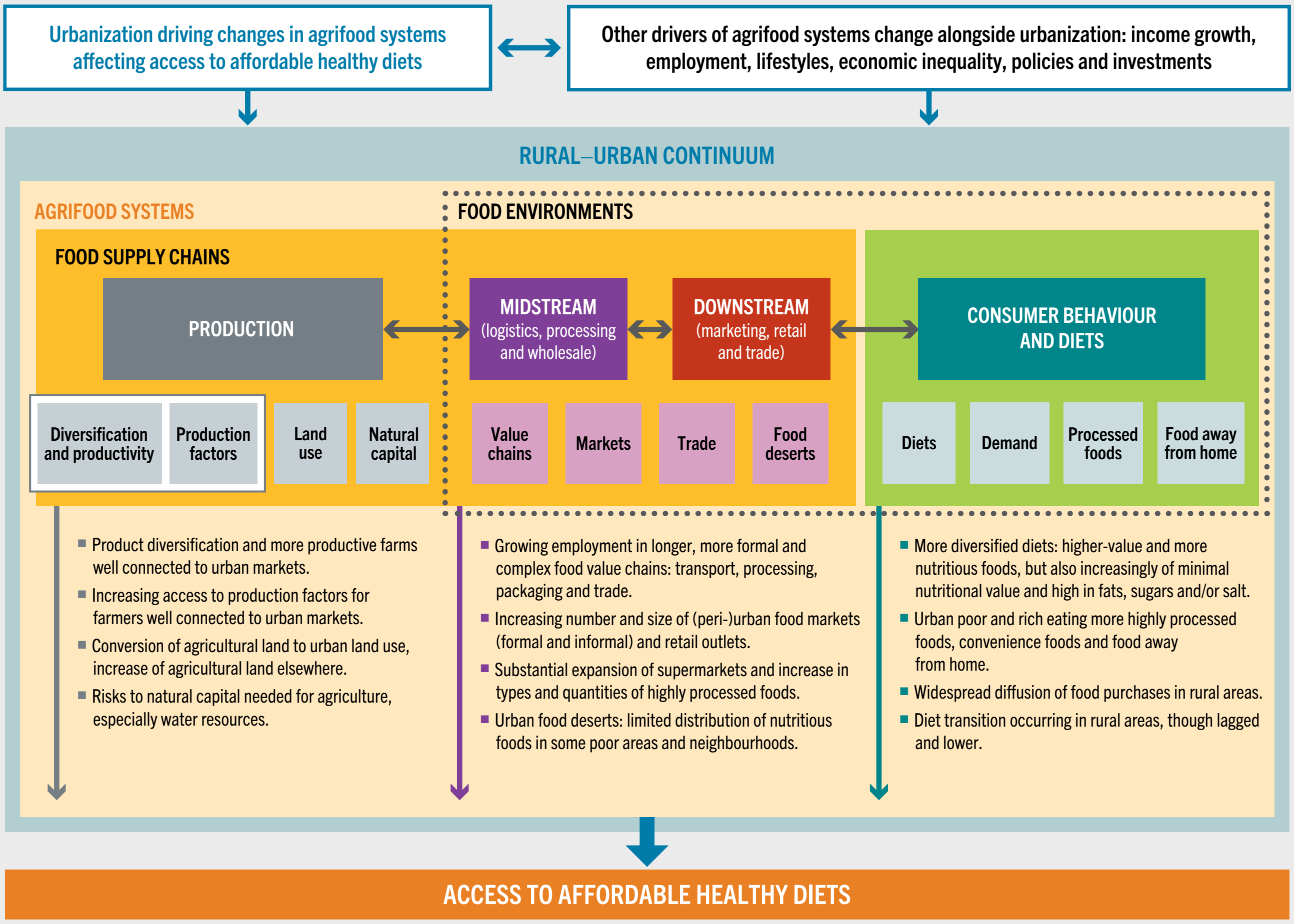
Adjustments in the quantity and quality of food demand and supply bring about changes in markets and retail trade; midstream food supply chains (changes in post-harvest systems for logistics, processing, wholesale and distribution); rural input markets; agricultural technology; and the size distribution of farms.[14, 56] Thus, agrifood systems are transformed, from traditional and mostly rural systems based on local market linkages and farming employment, to systems with greater connectivity between rural areas, and between rural, peri-urban and urban areas. This entails more complex rural–urban market linkages across a spatial and functional rural–urban continuum, and more diverse employment opportunities along the food value chain, including processing, marketing and trade. It also entails more dependence on income and food pricing (affordability) for dietary choices, as there is a greater dependence on purchased foods.

Of specific concern against this backdrop are the changes in the supply and demand of nutritious foods that constitute a healthy diet; their cost relative to foods of high energy density and minimal nutritional value, which are often high in fats, sugars and/or salt; and their cost relative to people's income (i.e. their affordability).

Figure 20 presents a conceptual framework for understanding the different pathways through which urbanization is driving changes in agrifood systems across the rural–urban continuum, and is, in turn, affecting access to affordable healthy diets. The orange text throughout this section refers to specific elements in Figure 20 for emphasis and to ease cross-referencing with the figure. The framework was developed based on a systematic review and meta-analysis of evidence from scientific studies[o] and informed by new analysis presented in **Chapter 4** on changes in food demand and supply across the rural–urban continuum. Figure 20 recognizes that urbanization is not an agrifood systems driver in isolation but that it changes agrifood systems in interaction with other drivers including income growth, employment, lifestyles, economic inequality, policies and investments.

o The design of this review is based on the design as suggested in the Preferred Reporting Items for Systematic Reviews and Meta-analysis (PRISMA) guidelines, but is adapted making use of FAO's Data Lab, which automatizes searches of scientific articles and identifies the most relevant ones through an artificial intelligence method that learns from users' selections and extends the assessment to other articles. A description of the tool and approach is available in **Annex 4.**

FIGURE 20 THE PATHWAYS THROUGH WHICH URBANIZATION AFFECTS AGRIFOOD SYSTEMS AND ACCESS TO AFFORDABLE HEALTHY DIETS



SOURCE: de Bruin, S. & Holleman, C. (forthcoming). *Urbanization is transforming agrifood systems across the rural–urban continuum creating challenges and opportunities to access affordable healthy diets.* Background paper for *The State of Food Security and Nutrition in the World 2023*. FAO Agricultural Development Economics Technical Study. Rome, FAO.

This conceptual framework stipulates that in addition to rural areas, food can also be produced in urban and peri-urban areas. In many countries, the components of agrifood systems are more interconnected. There are also both short and long food supply chains, and there can be a dislocation of midstream processing away from urban areas as part of very long supply chains. For these reasons, the conceptual framework does not visualize the rural–urban continuum alongside the agrifood systems continuum; it is a broader continuum in which agrifood systems can be placed.

Figure 20 depicts the ways in which urbanization is affecting three major components of agrifood systems: i) consumer behaviour and diets; ii) midstream (e.g. logistics, processing and wholesale) and downstream (e.g. markets, retail and trade) food supply chains; and iii) food production. The figure presents these three components in the standard order for conceptualizing agrifood systems and food supply chains. However, the following sections start at the other end with consumer behaviour and diets, as this is one of the most important pathways through which urbanization is driving changes in agrifood systems. Changes across agrifood systems also impact food environments which here refer to physical, economic, sociocultural and policy conditions that shape access, affordability, safety and food preferences.[57, 58, 59, 60]

Moreover, as illustrated in Figure 20 and expanded on below, food environments reflect a complex interplay among supply-side drivers including food pricing, product placement and promotion, and demand-side drivers including consumer preferences and purchasing power. Together this complex interplay of supply and demand considerations is key to understand how urbanization is driving changes in agrifood systems across the rural–urban continuum, affecting access to affordable healthy diets.

Consumer behaviour and diets

One of the most important pathways through which urbanization is driving changes in agrifood systems is through a shift in **consumer behaviour and diets** (Figure 20). Higher average incomes, combined with changing lifestyles and employment, are driving a dietary transition. While this is occurring in countries and regions at different speeds and with variations, it is happening around the world. This transition is characterized by changes in the types and quantities of food consumed, with diets shifting beyond traditional grains into dairy, fish, meat, vegetables and fruits, but also into consumption of more processed foods[p] and convenience foods or food away from home. These changing preferences are reinforced by the greater diversity of both food products and places to buy food in urban food environments, ranging from supermarkets to informal markets, food street vendors and restaurants.[61] The increased availability of these options often results in increased food consumption and **dietary diversity**. Dietary preferences are also shaped by marketing and other supply factors, with a reinforcing compounding effect on the food produced, supplied and consumed.

However, urbanization has also contributed to the spread and **consumption of processed and highly processed foods**, which are increasingly cheap, readily available and marketed, with private sector small and medium enterprises (SMEs) and larger companies often setting the nutrition landscape. Cost comparisons of individual food items and/or food groups from existing studies indicate that the cost of nutritious foods – such as fruits, vegetables and animal source foods – is typically higher than the cost of energy-dense foods high in fats, sugars and/or salt, and of staple foods, oils and sugars.[62, 63, 64, 65] The relative prices of nutritious foods and foods of high energy density and minimal nutritional value have also been shown to differ systematically across income levels and regions.[62, 66, 67]

With urbanization, purchases from supermarkets, fastfood takeaway outlets, home deliveries and e-suppliers and other convenience retailers are increasing.[68, 69, 70] In Latin America and the Caribbean, for example, there has been a profound shift in the last 20 years towards foods of high energy density and minimal nutritional value, including sugar-sweetened beverages. While this phenomenon occurs predominately in urban and peri-urban areas, it is spreading to rural areas and Indigenous Peoples' lands. There has also been a shift towards increased consumption of food away from home and snacking, which corresponds to high levels of overweight and obesity among all ages, along with high burdens of stunting in some countries.[69] Such challenges are not unique to the Latin America and the Caribbean region, and many settings now face multiple, simultaneous burdens of different forms of malnutrition.[71, 72]

Another reason for the spread of processed foods is convenience. Urbanization is associated with changes in the lifestyles and employment

p Food processing can facilitate the promotion of high-quality diets, as it can make food more available as well as safer. However, highly processed foods can contain very high densities of salt, free sugars and saturated or trans fats, and these products, when consumed in high amounts, can undermine diet quality. Free sugars are all sugars added to foods or drinks by the manufacturer, cook or consumer, as well as sugars naturally present in honey, syrups, fruit juices and fruit juice concentrates. For further information, see **Annex 5, Section C** ("Explanatory note on processed foods and food processing classification systems").

profiles of both women and men, as well as increasing commuting times, resulting in greater demand for convenience, pre-prepared and fast foods. Women, who often bear responsibility for food preparation, are increasingly working outside the home, and thus may have less time to shop, process and prepare food. At the same time, men are increasingly working far from home in other cities. These trends are driving the purchase of pre-prepared or ready-to-eat cereals such as rice and wheat,[73, 74] along with more processed foods and food away from home prepared by restaurants, canteens, retailers, etc.[18] The food processing sector and fastfood segment have grown quickly as a result. For example, eating patterns of Tanzanian migrants change when they move from rural to urban areas, away from traditional staple foods such as cassava and maize, and towards convenience, ready-to-eat or pre-prepared foods such as rice, bread and food away from home.[75] Increasingly, this trend is also occurring in rural areas as a time-saving measure for off-farm labourers and women working outside the home, facilitated by increased rural incomes, increased supply of these foods from urban and other rural areas, and reduced transportation costs because of better roads.

The diet transition is also occurring in rural areas, though lagged and to a lesser extent compared to urban and peri-urban areas. New studies in the last two years,[52, 53, 76] including the new analysis presented in **Chapter 4**, underscore the extent of the diet transition across the rural–urban continuum and the absence of stark differences between urban and rural areas within countries analysed.

There is also a diffusion of food purchases in rural areas, more so than is commonly understood. The diet in these areas has shifted from mainly home-produced foods to increasingly market-purchased products. The rural poor are heavily engaged in purchasing food from markets and are, in general, net food buyers. In Eastern and Southern Africa, research shows rural households buy 44 percent (in value terms) of the food they consume.[77] A study of Bangladesh, Indonesia, Nepal and Viet Nam shows rural households buy an even higher proportion of their food – 73 percent (in value terms).[78] Moreover, new research presented in **Chapter 4** also shows that food purchases form the majority (average 56 percent) of the foods consumed (in value terms) by rural households in 11 countries in sub-Saharan Africa. This is true even for those households living 1 to 2 hours from a small city or town (average 56 percent), and those living more than 2 hours from a city or town (average 52 percent).

Studies show that while consumption of processed foods (of all types) is higher in urban areas, in terms of the proportion of expenditure on food, rural consumption of processed foods is not much lower.[54, 79] In Eastern and Southern Africa, for example, 29 percent of total food outlays are spent on such food, and of these 17 percent are spent on purchased milled grains classified as minimally processed items, 48 percent on non-grain minimally processed foods and 35 percent on highly processed foods.[77, 80] Recent evidence from three African countries shows that the shares of processed foods of all types are surprisingly high among the poor and even the ultra-poor, in both rural and urban areas.[52, 53, 54] However, there are different patterns of consumption of various types of processed foods across the rural–urban continuum, with highly processed food and food away from home shares showing a strong correlation with total food-budget shares and urban areas in the 11 sub-Saharan Africa countries analysed (see **Chapter 4**).[54, 79]

Midstream and downstream food supply chains

Another pathway through which urbanization is affecting agrifood systems is changes in midstream and downstream food supply chains (Figure 20). These changes are often the result of increased investments in infrastructure such as roads, warehouses and cold storage facilities. The midstream consists of the post-farm gate activities related to the logistics, processing and wholesale of food. This includes cleaning, sorting, packaging, transportation, storage and wholesaling of agricultural and food products. Downstream food supply chains involve those segments more directly related to consumer purchases, that is retail markets and sales, and trade.

Food supply chains

Urbanization can contribute to longer, more formal and more complex food supply chains, following rising consumer demand and increased regulation of agrifood systems.[81, 82] As cities grow and diets of urban dwellers change, urban populations increasingly must look beyond local production for their food supply. Only around 30 percent of urban residents worldwide are estimated to fulfil their demand for specific crops locally (approximately 100 km radius).[83, 84] The majority of urban food demand, about 80 percent, is supplied regionally (within a 500 km radius).[85]

Although some of the foods consumed in urban areas must travel far to reach their destination, most are produced within national borders and traded domestically (for example, this share is 90–95 percent in Asia).[80] Exceptions are the entire Near East and North Africa region, some countries in sub-Saharan Africa, as well as the Small Island Developing States. According to the latest World Trade Organization report, there are 32 net food-importing developing countries.[86] For these countries, food imports can be substantial. For example, according to the OECD–FAO Agricultural Outlook, roughly 70 percent of all food commodities consumed in the Near East and North Africa are imported.[87] For most other countries, imports are a low share of food supply, and mainly consist of a few products, such that domestic supply chains really drive food supply.[55] This is consistent across regions and most food groups (except oils and fats), and is particularly the case for fruits, vegetables and animal source foods, which are important food groups for healthy diets.

Domestic food supply chains are usually long and criss-cross a country from supply zones to cities and rural areas.[88] Short rural local supply chains, or traditional food supply chains based around subsistence agriculture, only account for approximately 10 percent of the food economy in Africa and Southern Asia, and 5 percent in South-eastern Asia and Latin America.[76, 88, 89] On the other hand, long supply chains connecting rural producers to urban consumers through a web of labour-intensive agrifood SMEs are more prevalent, accounting for approximately 70 percent of the food economy in Africa and Southern Asia, and 50 percent in South-eastern Asia and Latin America.[88, 89] Modern food supply chains based around supermarkets and large processors tend to be long as well, stretching from rural areas to urban areas, but they also include international elements. Such long supply chains account for approximately 20 percent of agrifood systems in Africa and Southern Asia, and 45 percent in South-eastern Asia and Latin America.

Midstream food supply chains

Midstream food supply chains have become major supply chain growth engines as a result of the overall rise in urban food demand and more specifically the higher demand for high-value and processed products.[90] These supply chains have grown quickly over several decades and now constitute a significant share of the total value added and costs in food value chains. In low- and lower-middle-income countries, midstream food supply chains form 30 to 40 percent of the value added in food value chains.[80] Additionally, due to the embeddedness in local economies, the midstream segments can provide locally adapted services and market linkages to farmers contributing to enhancing food supply and rural economies.[91]

The past several decades have witnessed a rapid proliferation of SMEs, which now play an important role in the transformation of agrifood value chains in Africa, Asia and Latin America.[91, 92] The spread of SMEs is most rapid during the transitional stage of this transformation, when agrifood value chains develop and grow longer as urbanization progresses, but remains fragmented (see Table 7 for more detail on the transformation of agrifood value chains). The absence of appropriate policies has been a factor hindering the proliferation of "formal" SMEs, particularly in the processing sector.[91]

In sub-Saharan Africa, SMEs operating in the midstream food value chains procure 95 percent of the total supply for small farms and have become the largest investors in agricultural produce markets in the region.[93] The productivity of this midstream is, therefore, as important as farm yields for food security in poor countries. The post-farm gate segments of the supply chain – the midstream (processing

TABLE 7 THE THREE STAGES OF TRANSFORMATION OF AGRIFOOD VALUE CHAINS

	Traditional agrifood value chains	Transitional agrifood value chains	Modern agrifood value chains
Main enterprise type in:			
Retail	Home enterprise	Small and medium enterprises (SMEs), wet markets	Supermarkets
Food service	None (home cooking)	Street vendors, independent restaurants	Fastfood chains, supermarkets and hypermarkets, independent restaurants
Processing	None (home processing)	SMEs such as small mills	Large processors and food manufacturers
Wholesale	Brokers based in rural villages	Wholesalers based in urban markets	Off-market distribution companies
Logistics	Own logistics by brokers	SMEs in third-party logistics (3PL)	Large 3PL companies and freight forwarders
Supply chain length	Short, local	Long, rural–urban	Long, rural–urban, international
Exchange arrangements	No contracts, no standards	No contracts, public standards, some vertical integration	Emerging contracts, private standards, vertical integration
Technology	Labour intensive	Labour intensive	Capital intensive
Foreign direct investment	None	Emerging	Significant

SOURCE: Adapted from Barrett, C.B., Reardon, T., Swinnen, J. & Zilberman, D. 2022. Agri-food Value Chain Revolutions in Low- and Middle-Income Countries. *Journal of Economic Literature*, 60 (4): 1316–1377. https://doi.org/10.1257/jel.20201539

and wholesale/transport) and downstream (retail and food stalls) segments – together comprise 40 to 70 percent of food costs for urban Africans.[94] Rural areas nearer to cities tend to experience a more rapid transformation of food value chains, including the development of the midstream.[80] However, in some low-income and urbanizing countries, the midstream segments of agrifood systems are still at an early stage of transformation. For example, in many countries in sub-Saharan Africa, most cities still have only a narrow range of packaged and processed foods, with the greatest diversity of products available in the capital or large cities.[95, 96, 97]

Importantly, **growing midstream and downstream activities provide important off-farm employment opportunities**, which can provide steady and liveable incomes, increasing the affordability of healthy diets. For example, in sub-Saharan Africa, employment in off-farm agrifood systems is currently growing more rapidly than employment in farming itself[45] – a clear manifestation of agrifood systems transformation. Employment in off-farm activities, most often in SMEs, includes post-farm gate jobs in food processing, wholesale, logistics, retail, and food service, as well as non-agrifood systems jobs. Studies show that SME employment in agrifood systems in processing, wholesale, transport and retail can be especially important to the employment of women and youth.[36, 98] While estimates of the number of employed people in food supply chains are scarce, a number of studies have estimated employment in agrifood systems as a whole for specific regions and subpopulations. For example, one study estimates that in Africa, Asia and Latin America, youth employment rates in agrifood systems are 61 percent, 39 percent and 48 percent, respectively.[99] Another study in Western Africa estimates that agrifood systems account for 66 percent of total employment and that processing

BOX 4 FOOD DESERTS AND SWAMPS

Urbanization and changing agrifood systems have given rise to two new types of food environments: food deserts and food swamps. Food deserts are geographic areas where residents' access to diverse, fresh or nutritious foods is limited or even non-existent, due to the absence or low density of "food entry points" within a practical travelling distance. Food swamps are areas where there is an overabundance of foods of high energy density and minimal nutritional value. They offer few options for affordable, nutritious foods.

Although both concepts have been criticized for their narrow and inappropriate meaning in certain contexts,[110] urbanization can affect the accessibility of both healthy and unhealthy diets, especially in expanding informal neighbourhoods. While a new and growing phenomenon in urban slums of low- and middle-income countries, this problem was already well established in poorer neighbourhoods in high-income countries.

For example, the rapid growth of Windhoek, the capital of Namibia, has gone hand in hand with the rapid growth of informal peri-urban and urban settlements. These settlements can be defined as food deserts due to the lack of nutritious foods for most inhabitants.[111] In the Mexican city of Mazatlán, in contrast, low- and middle-income neighbourhoods, with a very high density of very small, informal businesses selling energy-dense snacks, quick meals and sugary drinks, can be considered food swamps.[112] In Rio de Janeiro, Brazil, a study found that food deserts and swamps were simultaneously more prevalent in the lowest-income neighbourhoods, which had high levels of deprivation and segregation.[113]

and food vending/services are disproportionately female, with women comprising over 80 percent of workers in those sectors.[45] In the fisheries and aquaculture sector, women represent 50 percent of those employed in the entire aquatic value chain (including pre- and post-harvest).[100]

Furthermore, several studies highlight that especially in low- and middle-income countries, where agrifood systems employ the largest number of workers, agrifood systems transformation offers the promise of new jobs both downstream and midstream, particularly for large, young populations.[101, 102, 103] A new study estimates that total employment in agrifood systems was 1.23 billion people worldwide in 2019.[104, 105] Total agrifood systems employment in Africa is estimated at 62 percent, compared with 40 percent in Asia and 23 percent in the Americas. While the study does not disaggregate employment by the different components of agrifood systems, it does separate out employment related to food supply trade and transportation. Of the 1.23 billion people employed in agrifood systems, 375 million are in jobs related to food supply, trade and transportation. The inclusion of trade and transportation jobs has the biggest impact in Africa, where the share of non-agricultural jobs in agrifood systems is between 5 percent and 14 percent. Across all other regions, the share ranges from 8 percent in Europe to 14 percent in Africa.[104, 105]

Changing urban food markets: the rise of supermarkets and highly processed foods

Urbanization results in an **increase in the number and size of urban food markets**. Both formal and informal food market outlets have been expanding with city growth, owing to the demand and purchasing power of urban residents as well as to public and private investments in these markets. A study in Eastern and Southern Africa estimates the growth of urban markets in the two regions at between 600 percent and 800 percent over the last four decades.[90] A study of South-eastern Asia places growth at roughly 1 000 percent in the same period.[106] Urbanization and changing agrifood systems have also given rise to both food deserts and swamps, which are characterized by markets that provide poor access to or limited availability of diverse and nutritious foods (Box 4). »

DEMOCRATIC REPUBLIC OF THE CONGO
A woman harvesting potato leaves.
©FAO/Olivier Asselin

» The formal food sector is characterized by more formalized supermarkets and chains; they are regulated and taxed by governments at various scales, and – unlike informal markets – are able to afford financial and technical services. In contrast, the informal food sector can be broadly defined as all food-related economic activities that take place in independent, small and/or unregistered enterprises. Mostly, there is limited coverage by formal authorities for monetary, regulatory and institutional arrangements such as taxation.

Supply-side factors, coupled with an increase in demand for readily available foods, have contributed to **a substantial expansion of supermarkets and hypermarkets**.[107, 108, 109] These supply factors include policy liberalization and privatization in the 1980s and 1990s leading to competitive domestic investments, public infrastructure investments that reduced transaction costs for supply chain development (e.g. procurement systems), and globalized distribution of modern technology related to food production, transportation and marketing, mass media, and the flow of capital and services. Supermarkets have been able to attain economies of scale in procurement, and economies of scale and scope in marketing, which has allowed them to increase over time their share of retail compared to small shops and wet markets (marketplaces selling fresh foods such as meat, fish, produce and other consumption-oriented perishable goods in a non-supermarket setting), especially in Asia and Latin America.[108, 109]

Increasingly, supermarkets and hypermarkets represent the major force contributing to the diet transition in any country or region. Their establishment has been facilitated by the increase in large urban food markets, which both bring together potential consumers and attract foreign investments.[114] These markets are often part of multinational chains or, in countries such as South Africa and China, domestic chains that function like global chains.

The relationship between urbanization and the growth of supermarkets differs widely by region and city size. In Latin America and the Caribbean, urbanization occurred in the 1980s, before the rise of supermarkets, and the process was actually more profoundly linked to privatization and liberalization of agrifood systems.[69] In Asia on the other hand, supermarket development was closely correlated with urbanization. Ultimately, the shift towards more supermarkets has been driven by a range of factors including rising incomes, changing lifestyles, marketing and increasing awareness of food safety and quality.[115, 116, 117]

While supermarkets can be linked to increased access to nutritious foods,[118] and modern food technology has provided benefits in terms of reducing waste, enhancing sanitation and reducing adverse effects of seasonality,[109] they have also been associated **with increased supply of energy-dense and highly processed foods**.[81, 119, 120, 121, 122, 123] The substantial expansion in the types, varieties and quantities of highly processed foods sold worldwide can be associated with the expansion of supermarkets and hypermarkets, the industrialization of agrifood systems, technological change, and globalization including market growth and the political activities of transnational food corporations. While there are wide variations between regions and countries, sales of highly processed foods are highest in Oceania and the Pacific, Northern America, Europe and Latin America, but are also growing rapidly in Asia, the Near East and Africa.[119]

Despite the greater penetration of formal markets such as supermarkets and hypermarkets, open and wet markets, as well as informal kiosks and street vendors, are still important for local urban food cultures in many countries around the world, particularly in Asia and Africa.[117] Here, the low average annual income per person is seen as an important limitation for supermarkets to expand.[124]

Poor urban dwellers especially buy most of their food at informal markets or street shops. For example, supermarkets account for only 3 percent and 0.4 percent of all food expenditure of slum dwellers in Nairobi and Kampala, respectively.[125] In Zambia, the share of supermarkets is lower in small cities than in larger cities.[126] Despite a greater penetration of formal markets, informal food retailers – such as street and market traders and small-scale shops – remain abundant across the African

TABLE 8 THE AVAILABILITY OF FOOD GROUPS TO MEET A HEALTHY DIET BASKET, BY REGION (PER CAPITA PER DAY), 2020

	Africa	Asia	Latin America and the Caribbean	Northern America	Europe	World
	(%)					
Staple foods	188	108	68	44	73	111
Animal source foods (except oils)	–33	40	143	331	258	71
Pulses, nuts and seeds	–38	–37	–42	–43	–67	–41
Vegetables	–55	25	–63	–20	–27	–4
Fruits	–40	–31	–2	–13	–24	–29
Fats and oils	–21	–3	67	100	82	12

NOTES: Yellow highlights emphasize where amounts of food available are insufficient to meet a Healthy Diet Basket (HDB). Food availability is based on FAO Food Balance Sheets data and healthy diet requirements by food group are those of the HDB used in the cost and affordability of a healthy diet in **Chapter 2**.
SOURCE: Dolislager, M.J., Holleman, C., Liverpool-Tasie, L.S.O. & Reardon, T. (forthcoming). *Evidence and analysis of food demand and supply across the rural–urban continuum for selected countries in Africa.* Background paper for *The State of Food Security and Nutrition in the World 2023.* FAO Agricultural Development Economics Technical Study. Rome, FAO.

continent as well as in many Asian countries.[117] In Latin America and the Caribbean, street markets and wholesale markets are also still relevant, especially for fresh foods.[127, 128, 129] In places where supermarkets are expanding, this process affects prices, quality and safety standards, often restricting access to sales channels for small producers.[130, 131]

Food production

Urbanization, in particular, by increasing the connectivity of rural and urban areas, also affects agrifood systems through changes in agricultural production (Figure 20). As consumer behaviour and diets change, this influences agricultural production and diversification, with shifts in intensity and type of production factors (i.e. labour, land and other natural resources). Furthermore, as already highlighted, this has a reinforcing compounding effect – as food supply changes in turn influence consumer behaviour and choices, which further affect food production.

Food production, production factors and agricultural services

Urbanization is often associated with a diversification of diets, including dairy, fish, meat, vegetables, fruits and legumes – foods that help constitute a healthy diet, as already highlighted above. However, the availability of vegetables and fruits, in particular,[q] is insufficient to meet the daily dietary requirements in almost every region of the world (Table 8). Particularly concerning is the insufficient availability of all food groups apart from staple foods in Africa. There are, however, notable differences across countries and within regions. For example, the supply of vegetables is more than adequate in Asia.[55]

Urbanization affects agricultural production in different ways across the rural–urban continuum. In rural and peri-urban regions that are well connected to expanding urban markets or storage and processing facilities, small- and large-scale farmers are increasingly commercial and relatively well served by agribusinesses providing inputs and farm output marketing services.[133] Farmers located close to urban markets often receive higher returns on their agricultural products and benefit most from growing markets for diversified high-value products.[134, 135]

As urban areas become better connected to rural areas, rural producers may also have better access to agricultural inputs and services, allowing for improved productivity that typically increases income levels,[136]

q This finding is aligned with an analysis in the 2020 edition of this report,[62] which showed that the availability of fruits and vegetables for human consumption was below 400 g per capita per day, which is the recommended amount in FAO and World Health Organization guiding principles of a healthy diet.[132] Further research is needed to determine the reasons behind these results.

which is key to increase access to nutritious foods. For instance, in Meru, United Republic of Tanzania, urbanization has stimulated the demand for milk, providing a reliable source of income for smallholders in a region facing a scarcity of (fertile) land.[137] Improved access to inputs and the support of stable institutions were important conditions that facilitated this intensification, resulting in higher incomes.

The effects of urbanization can spread to agricultural zones quite far from towns and cities, depending on the connectivity between rural and urban areas, which is shaped by the proximity to cities and by existing transport routes.[138] This can be seen in the rural regions around Delhi, India. Vegetables and dairy products are becoming increasingly important components of consumption not only in high-income urban households, but also in low- and middle-income urban households. As a result of these changes in urban consumption, the rural areas around Delhi, which used to be cultivated with cereals, are now increasingly being diversified to vegetable production and livestock keeping, and productivity is rising.[139] The far-reaching influence of urbanization is also seen in fisheries, where it has impacted fishers' ability to meet the rising cost of living in fishing communities.[140]

At the same time, millions of smallholders in less accessible or detached hinterlands remain cut off from the opportunities that growing urban food markets can bring.[141] In more isolated rural areas, agricultural growth is limited due to low productivity and high transportation costs.[138] Farmers with limited access to urban markets have few opportunities to profit from urban development. For example, in sub-Saharan Africa, the adoption of high-input technology and crop productivity is found to be negatively correlated with travel time to urban centres.[142]

Another important direct impact of urban expansion is land-use change. In some countries, farmers receive high compensation for selling their land,[143] whereas in others, dispossession of agricultural land is not compensated, resulting in a loss of livelihoods and issues around land rights. As farms in peri-urban areas make voluntary or involuntary room for urban expansion and associated infrastructure, they often move farther away from cities and convert more remote natural areas (mostly forests and scrublands) into new farmland, negatively affecting habitat quality and biodiversity, and causing environmental degradation and deforestation.[144, 145, 146, 147] In some cases, farmers are driven to use less productive lands in more remote villages, or are restricted to unauthorized public spaces.[148, 149] What is more, converted lands are less fertile than arable lands around cities, leading to a loss in agricultural productivity that is higher than the absolute loss of land.[150] Meeting food production and demand for an urbanizing population when land availability and quality are reduced requires agricultural intensification; this implies intensive use of energy, land and water, which if not managed to mitigate against climate change, can lead to an increase in greenhouse gas emissions.[151, 152, 153, 154]

With urbanization continuing, the resultant loss of cropland is expected to be 3 percent in the whole of Asia and Africa by 2030. The production loss, however, is 6 and 9 percent (respectively), because (as stated above) agricultural land around cities is often more fertile – an important reason why cities historically developed where they did. Additionally, farmers close to cities are often more productive due to higher input use and knowledge levels.[150] Therefore, the productivity loss is higher than the absolute loss of land. In most countries, production is relocated, although this is not possible everywhere – in Egypt, for instance, the amount of arable and fertile land is limited.[155]

Urbanization can also affect farm size in various ways. Impacts depend on land tenure security, non-farm opportunities, and the magnitude and impact of land purchases by urban buyers.[133, 138] In low-income countries, farm sizes have decreased from an average of 2.1 hectares in 1960 to 1.3 hectares in 2010, due to rural population growth (and subsequent outmigration as part of urbanization).[156] In general, farm sizes decrease until off-farm opportunities, often in cities, expand sufficiently to absorb new workers. Asia has now passed this turning point so its average farm sizes can rise, while in Africa average farm sizes are expected to continue to fall in many countries[138] – although in some areas they are rising. In sub-Saharan Africa, the growing acquisition of farmland by urban buyers has increased average farm sizes compared to other African countries.[15]

How urbanization affects access to affordable healthy diets, food security and nutrition

Urbanization can have both positive and negative impacts on access to affordable healthy diets and on food security and nutrition across the rural–urban continuum. Linkages between urbanization and access to affordable healthy diets are not unequivocal: observations depend highly on local or national context-specific dynamics, including investments in agrifood systems as well as in rural and urban infrastructure, training and education, and economic policies. There are however some important overarching challenges and opportunities concerning urbanization across the rural–urban continuum. Figure 21 summarizes the most important of these, drawing from the previous sections on how urbanization is affecting agrifood systems, as well as further empirical evidence and studies. Although the challenges outnumber the opportunities, this is not per se the case for the magnitude of the impacts on access to affordable healthy diets.

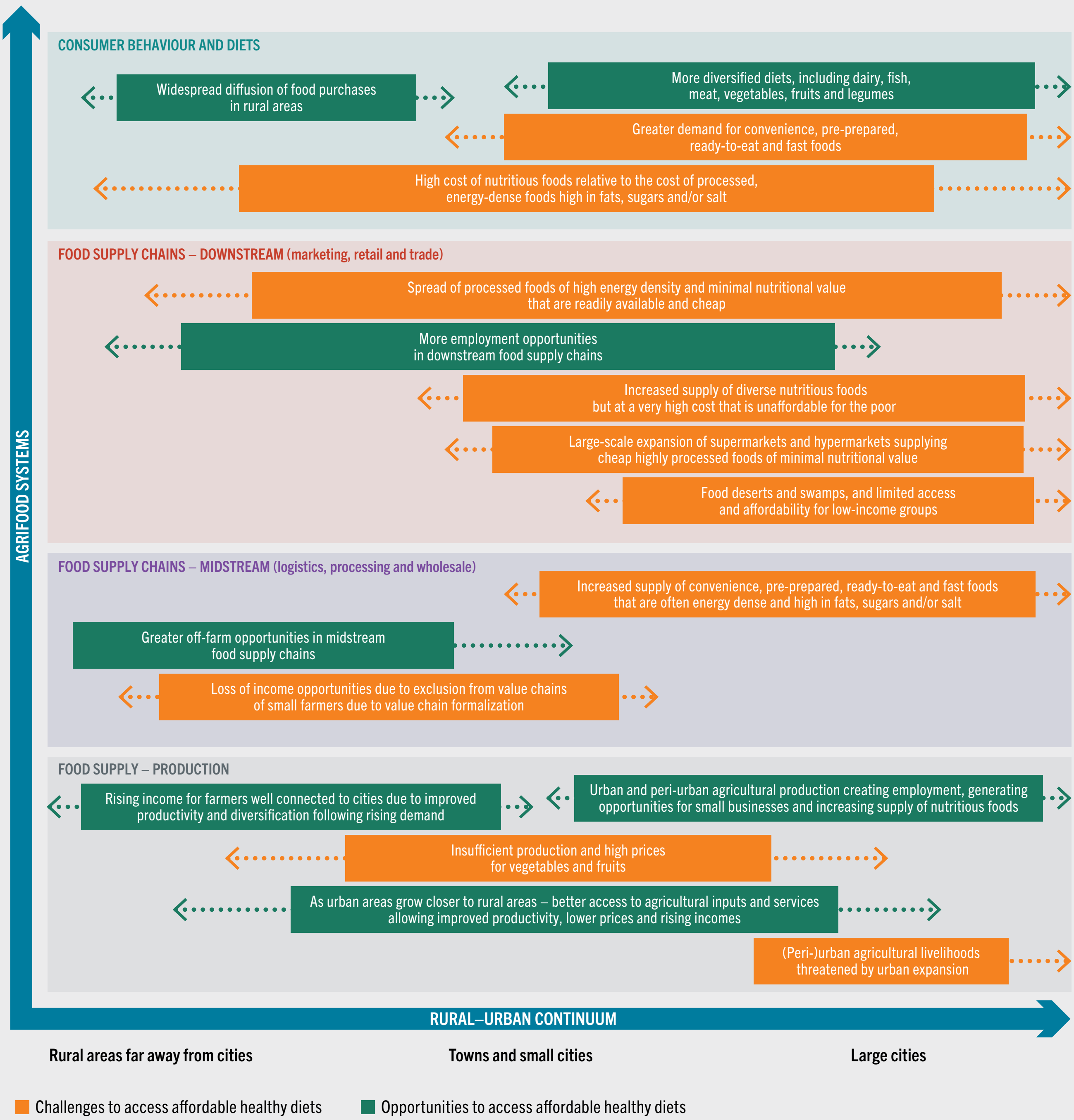
In recent years, many studies have focused on urbanization and agrifood systems transformation; nevertheless there is limited common understanding of how the nexus of these two processes affects both access to affordable healthy diets and food security and nutrition, and even fewer studies have applied a rural–urban continuum lens. Data to support such a disaggregated rural–urban continuum analysis are extremely limited; the analysis requires household survey data with geospatial locational data, and for most countries in the world such data are not readily available. **Chapter 4** explores this question through a new analysis on variations in food demand, economic access to healthy diets, and food security and nutrition across the rural–urban continuum, using selected country case studies as far as data availability allowed.

What we do know is that empirical evidence reveals socioeconomic disparities in access to affordable healthy diets throughout the rural–urban continuum as a result of a number of structural challenges.[62, 157] These include economic challenges related to the high cost of nutritious foods (Figure 21), which varies within countries and can be even higher in poor neighbourhoods. For urban populations living in poverty, the most easily available and affordable diets tend to be unhealthy.[158] Access to nutritious foods is often limited, as these types of foods are more expensive, or in some cases unavailable, in more urbanized areas. Poorer households are inclined to prioritize meeting dietary energy requirements over nutritional quality, spending their resources on more affordable foods, which tend to be of high energy density and minimal nutritional value.[158, 159] Other structural barriers are found in agrifood supply systems and markets, impeding physical access to healthy diets (resulting in food deserts and swamps in urban areas, for example).

For other income groups of urban dwellers, an important challenge to access to affordable healthy diets is that urban centres have more supermarkets and especially fastfood chains, including multinational outlets, offering a ready and abundant supply of highly processed foods, as well as energy-dense snacks, sweets, and sugar-sweetened beverages (Figure 21). These developments have negatively affected obesity levels and health conditions of urban dwellers.[160, 161] It is important to note that while supermarkets have an advantage in selling highly processed foods because of economies of scale, a growing number of small shops are also selling these products.[54, 69] The rapidly increasing share of highly processed foods of high energy density and minimal nutritional value, especially in urban consumption patterns, is linked to the rise in obesity and non-communicable diseases.[54] In many countries, obesity levels have risen alongside urbanization. New evidence for Africa suggests that consumption of highly processed foods and high-calorie snacks and beverages is spreading across the full spectrum of the rural–urban continuum, even among the rural poor – a trend of great concern (see **Section 4.1**).

Recent empirical studies show that the risk of food insecurity can even be higher in urban areas than in rural areas, due to the intra-urban inequalities present in many rapidly urbanized »

FIGURE 21 CHALLENGES AND OPPORTUNITIES IN ACCESSING AFFORDABLE HEALTHY DIETS ACROSS THE RURAL–URBAN CONTINUUM



SOURCE: de Bruin, S. & Holleman, C. (forthcoming). *Urbanization is transforming agrifood systems across the rural–urban continuum creating challenges and opportunities to access affordable healthy diets*. Background paper for *The State of Food Security and Nutrition in the World 2023*. FAO Agricultural Development Economics Technical Study. Rome, FAO.

» countries.[162] Indeed, new analysis from country cases studies in sub-Saharan Africa (see **Section 4.2**) shows that the prevalence of moderate or severe food insecurity based on the Food Insecurity Experience Scale in urban and peri-urban areas is similar to (e.g. Côte d'Ivoire, Senegal) or sometimes even higher than (e.g. Niger, Nigeria) that in rural areas. Access to food – nutritious foods in particular – across the rural–urban continuum is complex, with multiple determinants. It cannot be assumed that this access is always better for populations in urban areas. In fact, several studies show that the so-called "urban advantage" does not benefit the poorest, who – on the contrary – face disproportionate barriers to accessing and consuming a healthy diet and have an increased risk of food insecurity and malnutrition.[157]

Furthermore, when migration decisions reflect the push factors in rural areas (e.g. conflict or lack of access to land) rather than the pull of better opportunities in urban areas, food security and nutrition outcomes can be compromised (Figure 21).[10] Challenges around accessing food and the risk of food insecurity among rural–urban migrants are intensified during crises.[163, 164, 165] Rural–urban migrants who often inhabit informal settlements lack social protection coverage and their neighbourhoods often fall outside the remit of urban planning. The COVID-19 pandemic is an example of a situation in which low-income and informal rural–urban migrants experienced food insecurity in cities.

Food insecurity in urban areas is strongly driven by income limitations; low-income households need to allocate a high proportion of their total expenditure to food and are extremely vulnerable to external shocks including unemployment, health problems and food price inflation.[157] Food insecurity can be further compounded by poor health, as low-income urban households tend to have poor sanitation and a low standard of other essential housing infrastructure and goods.[166, 167, 168] Urban poverty poses diverse challenges that prevent access to healthy diets (e.g. unplanned built environments), and challenging social network structures often prevent low-income households from finding strategies to cope with food insecurity. Social protection and food assistance programmes designed to facilitate food access – such as monetary or in-kind transfer schemes, community kitchens and food banks – are often insufficient by themselves to fully resolve food insecurity problems, because they do not address barriers such as lack of cooking facilities or food storage, and competing health or housing expenses.

On the other hand, in rural areas, urbanization can provide opportunities for on- and off-farm employment (Figure 21), thus increasing purchasing power and options to access healthy diets. Especially in rural communities where agriculture completely dominates the economy, the growth of small cities and towns can play an important role in providing access to inputs, markets and non-farm activities, thus reducing poverty and improving food security.[169] However, there are also risks of losing or decreasing opportunities to sustain livelihoods due to formalization processes. For example, fees for stalls in formal markets are often relatively expensive, which decreases the accessibility of these markets for many small-scale farmers and traders. Nearly all smallholder farmers, most traders in food markets and many micro- and small-scale food processors and food retailers are not part of the formal food economy in sub-Saharan Africa,[170] and improvements in formal markets will not benefit these actors. Thus there is a risk that smallholders, small-scale food processors and food retailers be excluded from formalizing value chains. Understanding how to best sustain informal value chains is critical; however, this knowledge is often lacking.[171]

The rural-to-urban outmigration of young people, often men, also poses both challenges and opportunities in terms of improving access to affordable healthy diets (Figure 21). In some contexts, rural outmigration can result in substantial remittances that increase the accessibility of healthy diets and improve food security in rural areas.[172, 173] Households that receive remittances can be better off in terms of total income, assets, calorie supply and micronutrient supply.[174] Rural-to-urban migration can also contribute to resilience in the communities of origin and further the transfer of knowledge and other resources besides financial remittances.[175] However, there are instances where remittances are too low (or even absent) to replace the lost workers with hired labour.[176] In such cases, the lost labour and associated reduction in income or agricultural produce can result in decreased access to healthy diets, or in longer working hours for the left-behind women in subsistence farming to maintain household food security.

In terms of malnutrition, studies generally show that rural populations face a higher burden of child undernutrition than urban populations,[177, 178] not only but especially in sub-Saharan Africa, a subregion where many households still live in remote rural areas. Studies suggests there are no fundamental differences in the characteristics that determine child nutrition outcomes in urban and rural areas. Instead, differences are explained by the better urban environment, greater choices and increased opportunities related to socioeconomic characteristics, from maternal and spousal education, wealth, and employment, to social and family networks, as well as access to health care and other services.

Urbanization typically entails improved access to non-food markets and services that are important for nutrition, including schools, health clinics and non-farm labour markets that improve income stability.[177, 178, 179] Furthermore, proximity to towns can also weaken the relationship between agricultural shocks and child nutrition.[180, 181] More recently, studies find that "market access" can be an important determinant of dietary diversity and hence child nutrition outcomes.[182, 183, 184] There is relatively little research, however, on the degree to which rural populations have access to urban markets and services and the associated differences in nutrition seen across rural and urban populations, or across gradients of rural remoteness.[185] One such study, which examined the linkages between child nutrition and urbanization and proximity to large urban centres in sub-Saharan Africa,[185] found that rural populations are characterized by worse nutrition outcomes than urban populations, but it also produced the somewhat unexpected result that the nutrition outcomes of more remote rural populations are not substantially worse than those of less remote rural populations. This finding is also aligned with new analysis (presented in **Section 4.2**) of child stunting and wasting, which looks at rural catchment areas of varying travel times to the nearest town or city in three sub-Saharan African countries. Furthermore, and broadly in keeping with previous analyses of rural–urban inequality in nutrition, it appears that the majority of this nutritional disadvantage is explained by differences in wealth, education, health and non-road infrastructure services across rural and urban areas.[185]

In conclusion, access to affordable healthy diets is generally better and food security and nutrition levels are higher in cities than in rural areas because of the better availability of food, higher average purchasing power in urban areas, and better access to health care, education and other services that are essential for health and nutrition. However, this does not always hold true given the transformations underway in agrifood systems, the stark inequalities that exist within urban populations, and the increasingly spatial and functional connectivity between cities, towns and rural catchment areas.[185, 186] New evidence from 11 countries in sub-Saharan Africa presented in **Section 4.2** suggests that the "urban advantage" in accessing affordable healthy diets, food security and nutrition may not be as great as expected. Thus, it will be increasingly important to analyse these across the rural–urban continuum, and to understand the patterns of urbanization and connectivity across the rural–urban continuum in order to identify the challenges and opportunities for ensuring access to affordable healthy diets, to improve food security and nutrition for all. ■

DEMOCRATIC REPUBLIC OF THE CONGO
A man transports sacks of cabbages to market by bicycle.
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CHAPTER 4
THE INTERPLAY OF FOOD SUPPLY AND DEMAND AND THE COST AND AFFORDABILITY OF HEALTHY DIETS ACROSS THE RURAL–URBAN CONTINUUM

As highlighted in **Chapter 3,** a thorough understanding of how urbanization is driving changes in agrifood systems that affect the availability and affordability of healthy diets is only possible through a rural–urban continuum lens. As seen in **Chapter 3** and illustrated in Figure 20, food environments reflect a complex interplay among supply-side drivers including food pricing, product placement and promotion, and demand-side drivers including consumer preferences and purchasing power.

Together this complex interplay of supply and demand in agrifood systems is key to understanding how urbanization is affecting access to affordable healthy diets across the rural–urban continuum. A more nuanced georeferenced mapping of the spatial and functional connectivity across the rural–urban continuum, using the newly available FAO Urban Rural Catchment Areas (URCA) global dataset (see **Chapter 3** and Box 2), thus becomes a key tool to arrive at such a thorough understanding.

This chapter contributes new evidence on how urbanization is changing food supply and demand across the rural–urban continuum, drawing from analysis utilizing the URCA data combined with georeferenced household survey data (**Section 4.1**). This is followed by additional analysis for selected countries that explores differences in the cost and affordability of a healthy diet (CoAHD), food insecurity, and different forms of malnutrition across the URCA-defined rural–urban continuum (**Section 4.2**). ■

4.1 UNDERSTANDING FOOD SUPPLY AND DEMAND ACROSS THE RURAL–URBAN CONTINUUM

KEY MESSAGES

➔ New evidence for 11 Western, Eastern and Southern African countries shows that while high shares of food purchases among households living in urban centres are expected (78–97 percent), shares are surprisingly high across the rural–urban continuum. This is the case even for rural households living 1 to 2 hours (56 percent) and more than 2 hours (52 percent) from an urban centre.

➔ Own production is not the main source of food in rural areas in the 11 African countries. In fact, the average share of own production represents only 37 percent and 33 percent of total household food consumption in high- and low-food-budget countries respectively, dispelling the notion that rural populations in Africa rely primarily on subsistence farming.

➔ Given that rural households in the 11 African countries do not produce the majority of the food value they consume, the affordability of healthy diets is equally critical across the rural–urban continuum.

➔ While the diffusion of processed foods, including highly processed foods, is already advanced in Asia and Latin America, it is spreading quickly in Africa as well. In the 11 countries in Africa, rural households are consuming processed foods, including highly processed foods, across the rural–urban continuum, even in remote rural areas.

➔ Highly processed foods are a small proportion of total purchases and their consumption is higher in urban areas; however, results show the penetration of highly processed foods in rural areas, even those living 1 to 2 hours or more from a city or town.

➔ Moving across the continuum from urban to rural areas in these countries, there is an increasing household food consumption value share of staple foods and pulses, seeds and nuts, and a decreasing value share of animal source foods and food away from home. In contrast, shares of vegetables, fruits, and fats and oils are uniform across the rural–urban continuum.

➔ While animal source food consumption value shares are strongly driven by income across the rural–urban continuum, in contrast, shares of fruits and vegetables are driven more by access and availability.

As highlighted in **Chapter 3**, urbanization, combined with rising incomes, increases in the opportunity cost of time related to work, lifestyle changes and demographic shifts, is changing food demand. These factors together with many supply-side considerations, including food pricing, marketing and promotion, among others, in turn are changing agrifood systems, so there is a reinforcing compounding effect on the food produced, supplied and consumed.

Most notably, rapid urbanization is leading to rising and changing food demand, and shifts in patterns of food supply[1, 2] – especially in sub-Saharan Africa and Southern Asia, the two regions exhibiting the highest urbanization rates. Projections of overall food expenditure estimate an approximate 2.5-fold increase in sub-Saharan Africa and a 1.7-fold increase in Southern Asia by 2050.[1, 3, 4]

An understanding of the changes occurring in food supply and demand based on empirical evidence is crucial for policymakers. This knowledge is needed to design appropriate food, agricultural and nutrition policies, as well as related sector policies such as health, city and regional planning, and education. Only through all of these policies can agrifood systems be leveraged to deliver healthy diets that are affordable to everyone across the rural–urban continuum.

While there is a substantial amount of literature that discusses the effect of urbanization on food demand,[5] sound empirical evidence that looks at the full spectrum of the rural–urban continuum is still scarce and limited. To date, the majority of existing research is based on the descriptive comparison of food demand between rural and urban areas. While this research is important, this simple comparison does not reflect the reality of changing settlement patterns and demographic shifts within a rural–urban continuum.

New research suggests that the differences between urban and rural food demand may not be as acute as previously thought (see **Chapter 3**). However, this research does not provide an understanding of the magnitude of the differences in food demand across the full spectrum of the rural–urban continuum, nor an understanding of the location-related factors (i.e. where households live in relation to various points across the rural–urban continuum), and other household (e.g. socioeconomic) or food environment factors that may be driving these differences.

To help bridge this gap, this section presents an analysis of food demand, defined as household food consumption (at market value) across the rural–urban continuum in selected countries, applying the newly available geospatial URCA dataset. The URCA classification provides a more granular lens to explore the interplay of food supply and demand across the rural–urban continuum than the Degree of Urbanization (DEGURBA) classification used in **Chapter 2**, which is an official methodology for delineating urban and rural areas for international and regional statistical comparisons.

TABLE 9 URBAN–RURAL CATCHMENT AREAS (URCAs) USED IN CHAPTER 4

Ten URCAs applied in the analyses of Chapter 4	Further aggregation into three categories
Large city (>1 million people)	Urban
Intermediate city (0.25–1 million people)	
Small city (50–250 thousand people)	
Town (20–50 thousand people)	
<1 hour to a large city	Peri-urban
<1 hour to an intermediate city	
<1 hour to a small city	
<1 hour to a town	Rural
1–2 hours to a city or town	
>2 hours to a city or town	

SOURCE: Dolislager, M.J, Holleman, C., Liverpool-Tasie, L.S.O. & Reardon, T. (forthcoming). *Evidence and analysis of food demand and supply across the rural–urban continuum in selected countries in Africa.* Background paper for *The State of Food Security and Nutrition in the World 2023.* FAO Agricultural Development Economics Technical Study. Rome, FAO.

The URCA methodology defines urban centres across a rural–urban gradient based on population size and density, whereby the city size is a proxy for the breadth of services and opportunities provided by an urban centre. Uniquely, the URCA dataset also classifies rural locations using the shortest travel time to an urban centre, as a proxy for the cost of accessing goods, services and employment opportunities (see **Chapter 3** and Box 2). There are 30 urban–rural catchment areas (URCAs) categories in total; however, for the purpose of the analysis in this chapter, these are further aggregated into ten categories (Table 9). To facilitate the presentation and discussion of the more complex data, some of the analysis is further aggregated into three categories for urban, peri-urban and rural areas (see Table 9).

The URCA global geospatial dataset is mapped against latitudinal and longitudinal data of households from the most recent World Bank Living Standards Measurement Study (LSMS), making it possible to work with different categories of catchment areas across the rural–urban continuum – as defined in Box 3 in **Chapter 3.**

The availability of georeferenced household survey data was a major limiting factor for selection of countries for this food demand analysis, as there are currently only a handful of LSMS datasets that have latitude and longitude information which is publicly available.[r] All of these datasets are for Africa; hence the analysis in this section is limited to country case studies in that region. However, as an analysis of food demand across the URCA-defined rural–urban continuum, it is the first of its kind and provides insights on the importance of using a rural–urban continuum lens when analysing other regions. Given that Africa has the highest share of the total population unable to afford a healthy diet (77.5 percent in 2021) (see **Chapter 2**) and is lagging behind in food security and nutrition, focusing on countries of this continent is with merit in itself, especially as it has one of the highest rates of urbanization in the world. The analysis presented below also serves to highlight the need for further analysis covering other regions, which will depend on an increased availability of georeferenced survey data.

To evaluate household food consumption behaviour, georeferenced data from nationally representative LSMS surveys covering the period 2018/19 are used for Benin, Burkina Faso, Côte d'Ivoire, Ethiopia, Guinea-Bissau, Mali, the Niger,

r Most LSMS surveys collect latitude and longitude information for each household. However, almost all countries do not make these data publicly available for reasons of privacy.

TABLE 10 FOOD BUDGETS, INCOME LEVELS AND HOUSEHOLD FOOD CONSUMPTION SHARES FOR HIGH- AND LOW-FOOD-BUDGET COUNTRIES ANALYSED

	Food budget	Income	Food consumption shares
	Total household food consumption	Total household expenditure	Household food consumption as a percentage of total household expenditure
	(PPP dollars per capita per day)		(%)
High-food-budget countries	**2.34**	**4.04**	**58**
Senegal	2.57	6.10	42
Ethiopia	2.44	3.85	63
Côte d'Ivoire	2.29	5.04	45
Mali	2.29	4.54	50
Nigeria	2.26	3.81	59
Low-food-budget countries	**1.62**	**3.29**	**49**
Guinea-Bissau	2.06	4.38	47
Benin	2.00	4.41	45
Togo	1.69	4.12	41
Burkina Faso	1.57	3.70	42
Malawi	1.52	2.39	64
Niger	1.46	2.78	52

NOTES: All surveys are 2018/19, except Malawi (2019/20). PPP = purchasing power parity.
SOURCE: Dolislager, M.J, Holleman, C., Liverpool-Tasie, L.S.O. & Reardon, T. (forthcoming). *Evidence and analysis of food demand and supply across the rural–urban continuum in selected countries in Africa.* Background paper for *The State of Food Security and Nutrition in the World 2023*. FAO Agricultural Development Economics Technical Study. Rome, FAO.

Nigeria, Senegal and Togo, and 2019/20 for Malawi.[s] The LSMS surveys capture household food consumption using a seven-day recall. For the food demand analysis, reported foods are aggregated into categories based on food source, food processing level and food group. Food sources are defined using four categories, the first three of which are assumed for at-home consumption, specifically food from own production, food purchased, and food received as a gift or as in-kind payment for labour. The value of food consumption from own food production and food received as a gift or in-kind is valued at the market price that households would have had to pay if they had purchased the same quantity from the market.[27] The fourth category comprises all foods consumed away from home (e.g. from street vendors and in restaurants).

The classification of food items by level of food processing was adapted from the NOVA food classification system,[6, 7] focusing only on those foods classified as low processed ("processed" in the NOVA classification) and highly processed. See **Annex 5** for a full description of the datasets and definitions applied, including descriptions of food groups and details about food processing.

In the food demand analysis that follows, the 11 countries were classified into two groups according to their food budget, that is the market value of the average total household food consumption per capita per day: high-food-budget countries (average 2.3 PPP dollars per capita per day) and low-food-budget countries (average 1.6 PPP dollars per capita per day) (Table 10). Countries were first ranked based on average food budget and then split into high- and low-food-budget countries. Countries were split into the two groups with no reference to

s These are the only countries that have publicly available LSMS survey data identifying households by latitude and longitude and an exhaustive food consumption module, elements which are necessary to carry out the demand analysis by URCA. Other spatial identifiers were explored, but they proved to be inaccurate in identifying households by URCA, so these were not applied. The fact that 9 out of the 11 countries are located in Western Africa prevented a more balanced subregional approach.

a benchmark, but they depict a cross-section of African countries from the perspective of different levels of development in terms of average total household food consumption, which also roughly correlates with average total household expenditure, a proxy for household income (Table 10). They fell roughly into above and below 2 PPP dollars per capita per day food budget.[t, u]

Moreover, there is an assumption that the differences in food budgets will lead to different patterns of consumption. This is based on a well-established economic law, referred to as Bennett's law,[v, 8] which stipulates that diets become more diversified with higher levels of food consumption, income and employment. Thus, the differences in food consumption point to larger food budgets providing "room" for additions beyond staple foods with increasing expenditure on non-staple products (as Bennett's law predicts) as well as on industrially (rather than home) processed food products that reduce the opportunity cost of time for women and men engaged in employment (see **Chapter 3**). Usually higher food budgets are correlated with both of these consumption changes, and the two sets of countries allow this correlation to be tested. This is of particular relevance when seeking to understand how urbanization is driving changes in agrifood systems and how this is likely to affect food demand and access to healthy diets, as we shall see next.

The two country food-budget groups add a further dimension to the analysis that relates to an ongoing debate about what happens in countries of high and low per capita food consumption: Are the latter just traditional, or are they also changing? One expects to find more diversified diets and processed foods in urban areas, as well as in places where there are higher levels of food consumption per capita, but, as we shall see below, looking at food demand across the rural–urban continuum and comparing high- and low-food-budget countries, this may not be the case as a rule. If the patterns of food demand are the same – between either urban, peri-urban and rural areas or low- and high-food-budget countries – this in itself is an important finding. Indeed, the insights and messages are stronger if one sees they are happening both across the rural–urban continuum and in high- and low-food-budget contexts.

For the 11 African countries analysed, Figure 22 shows the country population distribution across ten categories (i.e. URCAs) of the rural–urban continuum (see Table 9 for specific category grouping). While there are country exceptions in each group, in general, high-food-budget countries tend to have a larger share of the population living in large and intermediate cities and their surrounding peri-urban areas (41.5 percent) compared to low-food-budget countries (34.2 percent).

Furthermore, high-food-budget countries are in most cases characterized by dense metropolitan urbanization patterns, while low-food-budget countries tend to have more dispersed urbanization patterns around small cities and towns. Figure 23 provides a mapping that represents two contrasting patterns of urbanization: dense metropolitan (e.g. Nigeria) and small city and town dispersed (e.g. Burkina Faso). The maps provide a useful visual for "unpacking" the ten URCA categories (see **Annex 6** for maps of other countries analysed).

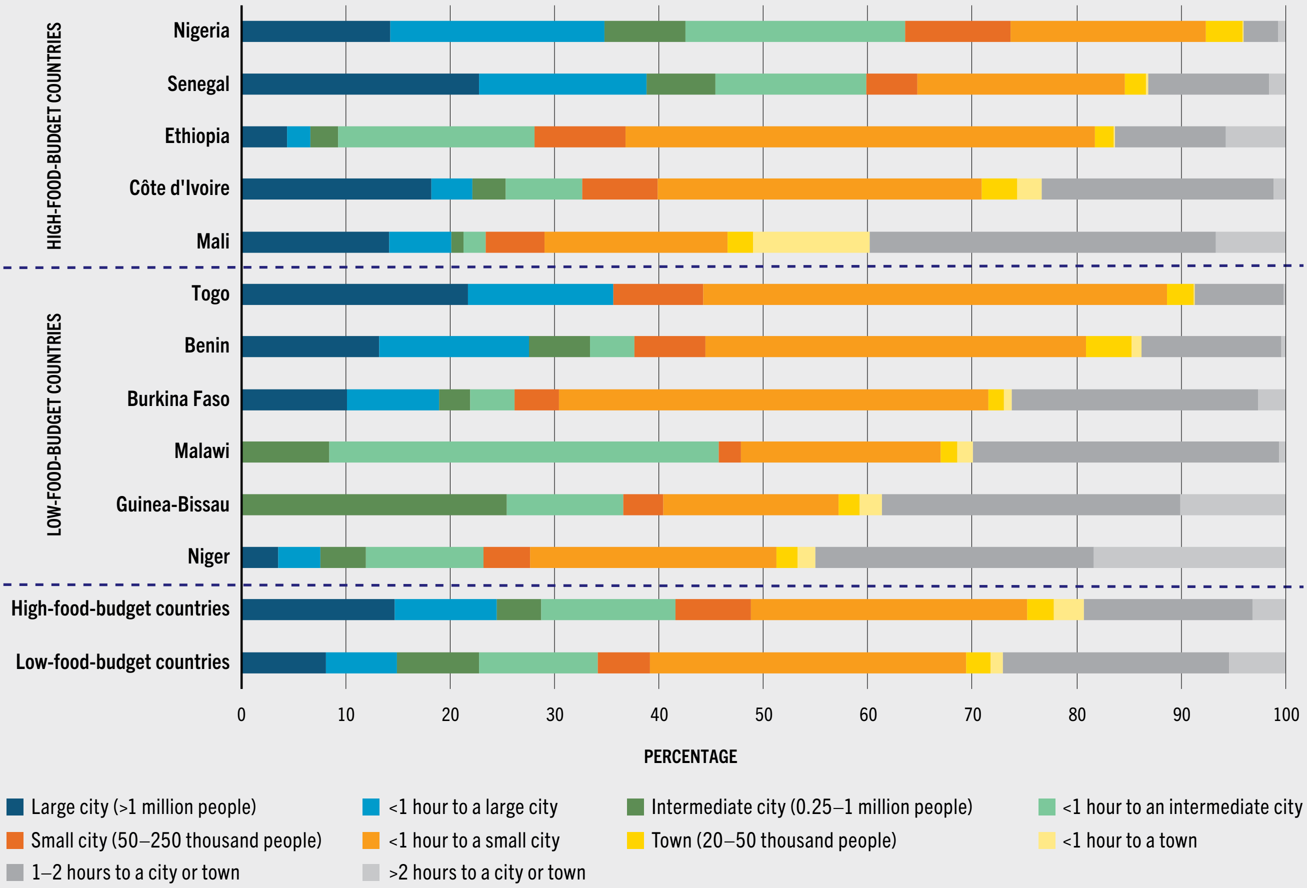
As highlighted in **Chapter 3**, the spatial patterns and degree of connectivity of rural–urban linkages determine the impacts of urbanization on agrifood systems. The analysis presented below attempts to find empirical evidence of a "location effect"; that is to say, to test if

t Ranking and classifying countries by income is not as relevant for a food demand analysis, because some countries have high incomes linked to the non-farm sector, and these incomes are spent on non-food items. It is also not useful to rank and classify countries by the share of food in total expenditure, for a similar reason: higher income usually leads to lower food share (Engel's law), but the food share can vary for non-income reasons, and thus it does not matter.

u The country "split" occurs at a food budget of roughly USD 2 per capita per day. Coincidentally, it may be noticed that this split point is not far from the new World Bank extreme poverty line of USD 2.15 per capita per day; however, the two are in no way related, as poverty lines are income based. The list of countries analysed for this report is based only on LSMS availability, and represents neither a random sample nor the totality of countries in Africa.

v In agricultural economics and development economics, Bennett's law is well established, based on the observation that as incomes rise, people eat relatively fewer staples and relatively more non-staples including some nutrient-dense foods (e.g. meats, fruits and vegetables).[8] Bennett's law is related to Engel's law, which considers the relationship between rising household incomes and total food spending. Engel's law, also well established, is related to the observation that as family income increases, the percentage spent on food decreases; that spent on clothing, rent, heat and light remains the same; while that spent on education, health and recreation increases.

FIGURE 22 DISTRIBUTION OF POPULATION ACROSS TEN URCA CATEGORIES OF THE RURAL–URBAN CONTINUUM, FOR SELECTED COUNTRIES, 2020

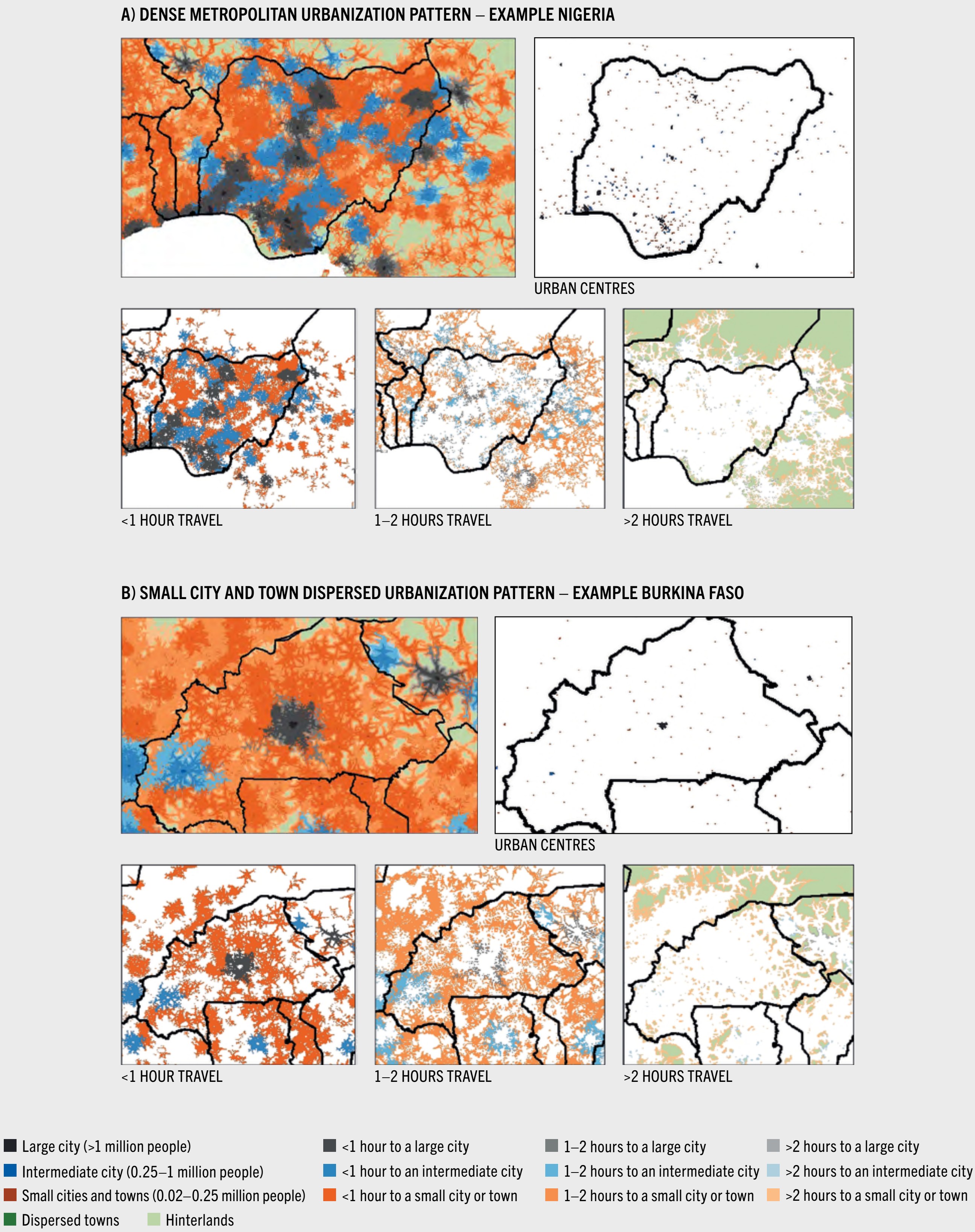


NOTES: Countries are listed based on the ranking of the percentage of their rural population within each food-budget group. See Table 10 for the definition and list of high- and low-food-budget countries.
SOURCE: FAO estimates based on 2020 GHS-POP dataset and FAO URCA dataset.

the different URCAs across the rural–urban continuum are contributing determinants of food demand. An important limitation of this analysis, however, is that it does not completely isolate the location effect from other drivers such as food environment considerations including, *inter alia*, the role of industry product placement and promotion.

In the sections that follow, we explore three different aspects of food consumption, examining patterns and their drivers across the rural–urban continuum for high- and low-food-budget countries. First, food consumption patterns are analysed in terms of how households acquire food, meaning whether the food they consume is purchased, own-produced, acquired as gifts or in-kind barter, or purchased as prepared meals eaten away from home. The extent of consumption of purchased foods sheds light on the importance and reach of food supply chains, moving out from urban areas across the continuum to more remote rural areas. The conventional view is that households living in or just outside urban areas purchase most of their food, whereas households in rural areas largely produce their own food. »

FIGURE 23 TWO CONTRASTING PATTERNS OF URBANIZATION: DENSE METROPOLITAN URBANIZATION (NIGERIA) AND SMALL CITY AND TOWN DISPERSED URBANIZATION (BURKINA FASO)



SOURCE: Dolislager, M.J, Holleman, C., Liverpool-Tasie, L.S.O. & Reardon, T. (forthcoming). *Evidence and analysis of food demand and supply across the rural–urban continuum in selected countries in Africa.* Background paper for *The State of Food Security and Nutrition in the World 2023.* FAO Agricultural Development Economics Technical Study. Rome, FAO.

» Especially in the context of sub-Saharan Africa, there is a persistent view that households living in rural areas are subsistent farmers who produce their own food, with the exception of the landless poor who are reliant on farm labour and who purchase or barter to meet some of their food consumption needs.

Second, food consumption patterns are analysed in terms of the share of total household food consumption that is low processed and highly processed. This analysis can shed some light on the magnitude and reach of the midstream food value chains and the associated employment that this sector generates (see **Chapter 3**) related to both low processed and highly processed foods.[w] In addition, low processed foods can provide many advantages to households through enhanced shelf-life, food safety, convenience, and in some cases nutritional enhancement (e.g. fortification). On the other hand, many highly processed foods are energy dense and high in fats, sugars and/or salt, and research suggests that they may contribute to overweight and obesity as well as some non-communicable diseases (NCDs) (see **Chapter 3**). As already highlighted, it is expected that the consumption of both low processed and highly processed foods is higher with higher levels of food consumption and especially where income and employment are higher.

Third, household food consumption patterns are analysed examining the market value of the foods consumed by food group, which provides insights into the spread of the consumption of diverse diets among households across the rural–urban continuum. Urbanization is generally associated with a change in consumption behaviour, with urban households usually eating a more diversified diet including more expensive foods such as animal source foods and fruits (see **Chapter 3**). However, some studies suggest that it is higher income, rather than urbanization per se, that is causing these diet shifts.

w Note a comprehensive overview of processed foods is not provided, as NOVA Group 1 (unprocessed and minimally processed) is not analysed.

Food purchases are a major contributor to household food consumption across the rural–urban continuum, even among the rural poor

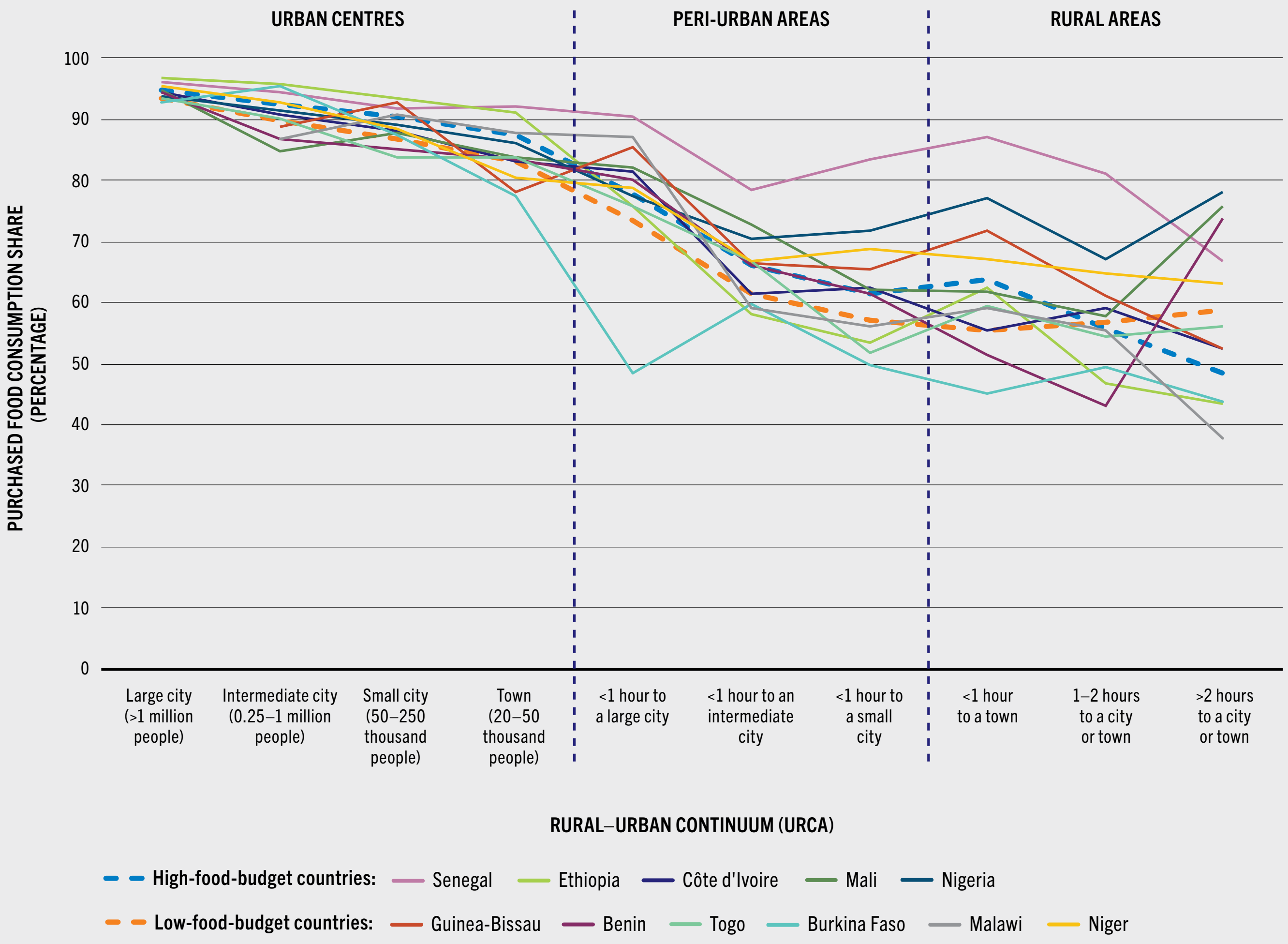
Across the 11 high- and low-food-budget African countries, food purchases form the majority of total household food consumption in value terms, including food for home consumption and food consumed away from home (Figure 24). While high shares of food purchases relative to total food consumption among households living in urban areas are to be expected (78–97 percent), shares are surprisingly high across the rural–urban continuum, even for rural households living 1 to 2 hours from a small city or town (56 percent on average) and for those living more than 2 hours from any urban centre (52 percent on average). The finding that in most of the countries analysed the "majority" of household food consumption in rural households is coming from purchases (56 percent on average in the 11 countries analysed) is a major deviation from the traditional image of rural subsistence households (Box 5).

Indeed, the diffusion of high levels of food purchases across the rural–urban continuum (Figure 24) confirms that food markets and supply chains are important to rural areas in both high- and low-food-budget countries. Furthermore, the average food purchase share for populations living in rural areas is only slightly lower in high-food-budget countries (52 percent) than in low-food-budget countries (57 percent), indicating a convergence across different patterns of urbanization and income levels.

As expected, food purchase shares decline moving from urban to rural areas across the continuum. The decline is slightly steeper for low-food-budget countries moving from urban to peri-urban areas (32 percent decline, versus 27 percent in high-food-budget countries), whereas moving from peri-urban to rural areas the drop is significantly higher in high-food-budget countries (18 percent on average) than in low-food-budget countries (6 percent).

While this pattern over the rural–urban continuum applies on average, there are variations between countries depending on the density of

FIGURE 24 WHILE HIGH FOOD PURCHASES AMONG HOUSEHOLDS LIVING IN URBAN AREAS ARE EXPECTED, THEY ARE SURPRISINGLY HIGH ACROSS THE RURAL–URBAN CONTINUUM, EVEN FOR RURAL HOUSEHOLDS



NOTES: The figure shows household food purchases as a percentage share of total household food consumption (at market value) across the rural–urban continuum (URCA) by country and high- and low-food-budget country group. Although URCA is a categorical variable, it is conceptualized as a spatial continuum, thus the use of a line graph, which also facilitates the presentation of the results. All surveys are 2018/19, except Malawi (2019/20). See **Annex 5** for the full definition of variables. See Table 10 for the definition and list of high- and low-food-budget countries.
SOURCE: Dolislager, M.J, Holleman, C., Liverpool-Tasie, L.S.O. & Reardon, T. (forthcoming). *Evidence and analysis of food demand and supply across the rural–urban continuum in selected countries in Africa*. Background paper for T*he State of Food Security and Nutrition in the World 2023*. FAO Agricultural Development Economics Technical Study. Rome, FAO.

urbanization patterns. For example, there is a notable increase in purchases in areas less than 1 hour from a town in Ethiopia, Guinea-Bissau, Nigeria and Togo (Figure 24).

Another striking finding is that for four countries, there is an uptick in food purchases in the most remote rural areas (more than 2 hours travel to a city of any size): Mali and Nigeria (high-food-budget countries), and Benin and

Togo (low-food-budget countries). The uptick in purchases in these areas can be explained in several ways. First, farmers in remote areas tend to be poorer, meaning households often need purchases to "smooth consumption" or compensate for poor harvests. Second, in furthest outlying rural areas (more than 2 hours travel to a city or town), local non-farm employment is scarce, as are services, and therefore households focus more on migration to bring in money, which can be used to buy food. This pattern is more marked in poorer countries, reflected in the larger uptick in Benin and Mali, the two low-food-budget countries.

The traditional view of a rural–urban divide formed a few decades ago, when most rural areas in Africa were much poorer and less connected to urban areas. However, more recently, the urbanization occurring in many African countries is dispersed, with growing networks of interconnected small cities and towns and increased connectivity with rural areas. This translates directly to expansive growth in off-farm employment opportunities, interconnected food markets and food supply chains; lifestyles thus change, which in turn affects how households acquire food and what foods they eat (see **Chapter 3**).

Looking to other regions, studies show there is substantial evidence of high levels of food purchases in rural areas, for example in Asia, including studies from Bangladesh, Indonesia, Nepal and Viet Nam.[9, 10] These studies find similar patterns of food purchases in rural areas, but the convergence between urban and rural food purchase patterns is more advanced than in Africa.

When household income levels are considered, the notion that rural households in sub-Saharan Africa rely primarily on subsistence farming for food still does not hold. The findings show that food purchases represent 50 percent or more of total household food consumption (including own production valued at market prices) across all income groups in rural areas of most of the countries, which is by no means low. The main exception is Ethiopia, which drags down the average share of food purchases for high-food-budget countries (Figure 24). Ethiopia is an outlier case among the high-food-budget countries, as its pattern of urbanization "straddles" the divide between "dense metropolitan" and "small city and town dispersed" (see Figure A6.1 in **Annex 6**), with poorer outlier rural areas not well connected due to very poor or limited road infrastructure.[11]

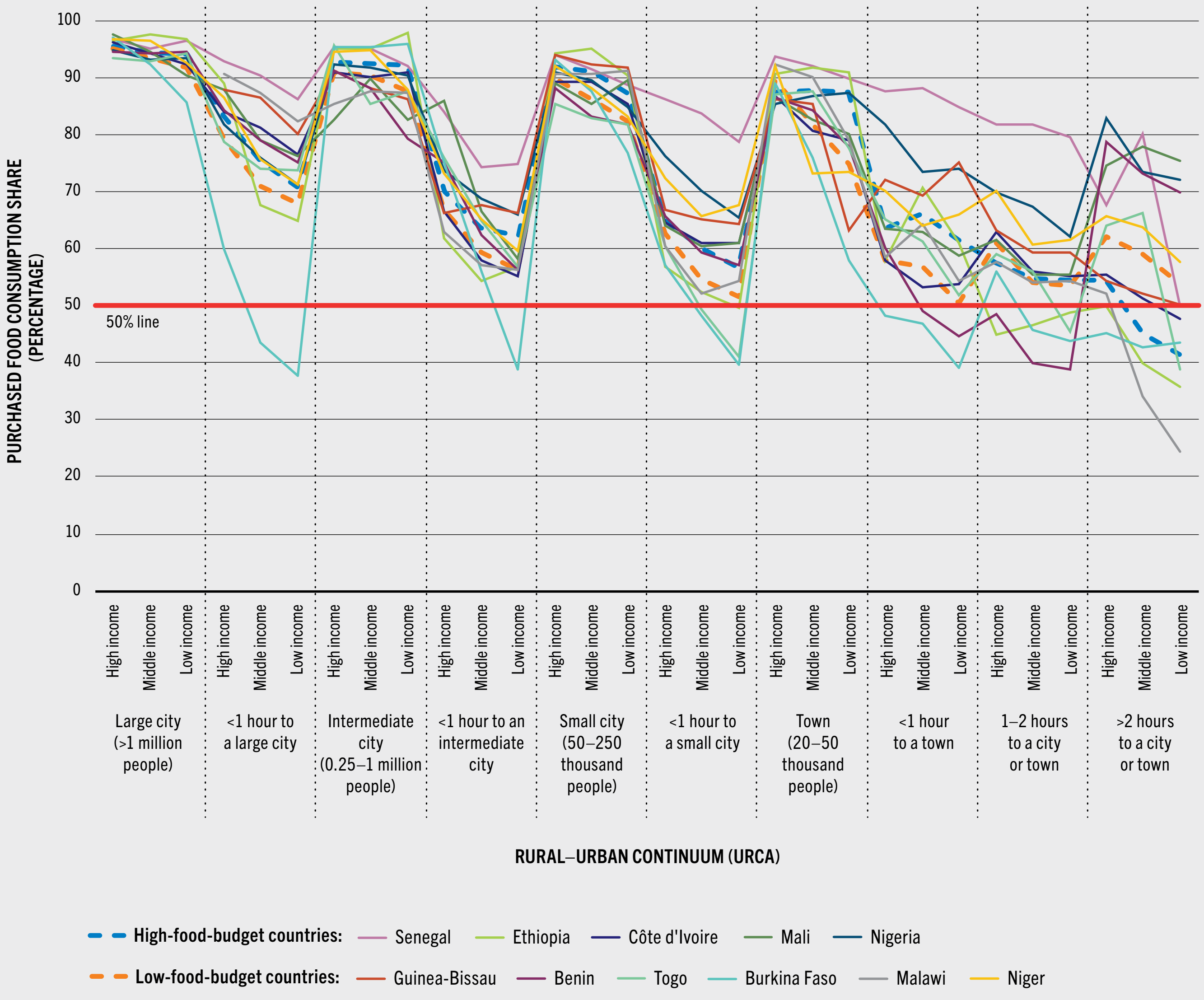
Food purchase shares of low- and middle-income households are lower overall than the shares of high-income households across the rural–urban continuum (Figure 25). The differences are small in urban areas, but become much bigger in peri-urban areas less than 1 hour from either a large city or an intermediate city. This suggests that while these households still rely on food purchases, own food production is also important (Box 5). The pattern holds for both high- and low-food-budget countries, although food purchase shares are slightly lower for the latter.

In urban and rural areas, the dispersion of food purchase shares across household income groups is smaller than in peri-urban areas, indicating that household income is less of a factor driving food purchase shares for urban and rural households. The only exception is poor households in more remote rural areas (more than 2 hours travel to a city or town), whose food purchase shares are 31 percent and 15 percent less than high-income households in the same areas of high- and low-food-budget countries, respectively.

The descriptive analysis presented up until this point is backed up by an econometric analysis that looks into the determinants of food purchase shares for the high- and low-food-budget countries. Determinants include location across the rural–urban continuum, household income, non-farm employment, food prices,[x] age, education, marital status and gender of the head of the household, household size, and size of cultivated land, ownership of assets and animal stocks. Table A7.1 in **Annex 7** presents the full econometric results. Here we highlight some of the key findings from this analysis. »

x While the focus is on non-price determinants, price variables are added as control variables to show the location effect across the rural–urban continuum. As expected, the marginal effect of own prices is statistically significant.

FIGURE 25 THERE IS A MARKED DROP IN PURCHASED FOOD CONSUMPTION SHARES FOR LOW- AND MIDDLE-INCOME HOUSEHOLDS LIVING IN PERI-URBAN AREAS, WITH LEVELS SIMILAR TO RURAL HOUSEHOLDS IN BOTH HIGH- AND LOW-FOOD-BUDGET COUNTRIES



NOTES: The figure shows household food purchases as a percentage share of total household food consumption (at market value) across the rural–urban continuum (URCA) by household income group, country, and high- and low-food-budget country group. Income levels are calculated using terciles of total household expenditure per adult equivalent as proxy. Although URCA is a categorical variable, it is conceptualized as a spatial continuum, thus the use of a line graph, which also facilitates the presentation of the results. All surveys are 2018/19, except Malawi (2019/20). See **Annex 5** for the full definition of variables. See Table 10 for the definition and list of high- and low-food-budget countries.
SOURCE: Dolislager, M.J, Holleman, C., Liverpool-Tasie, L.S.O. & Reardon, T. (forthcoming). *Evidence and analysis of food demand and supply across the rural–urban continuum in selected countries in Africa*. Background paper for *The State of Food Security and Nutrition in the World 2023*. FAO Agricultural Development Economics Technical Study. Rome, FAO.

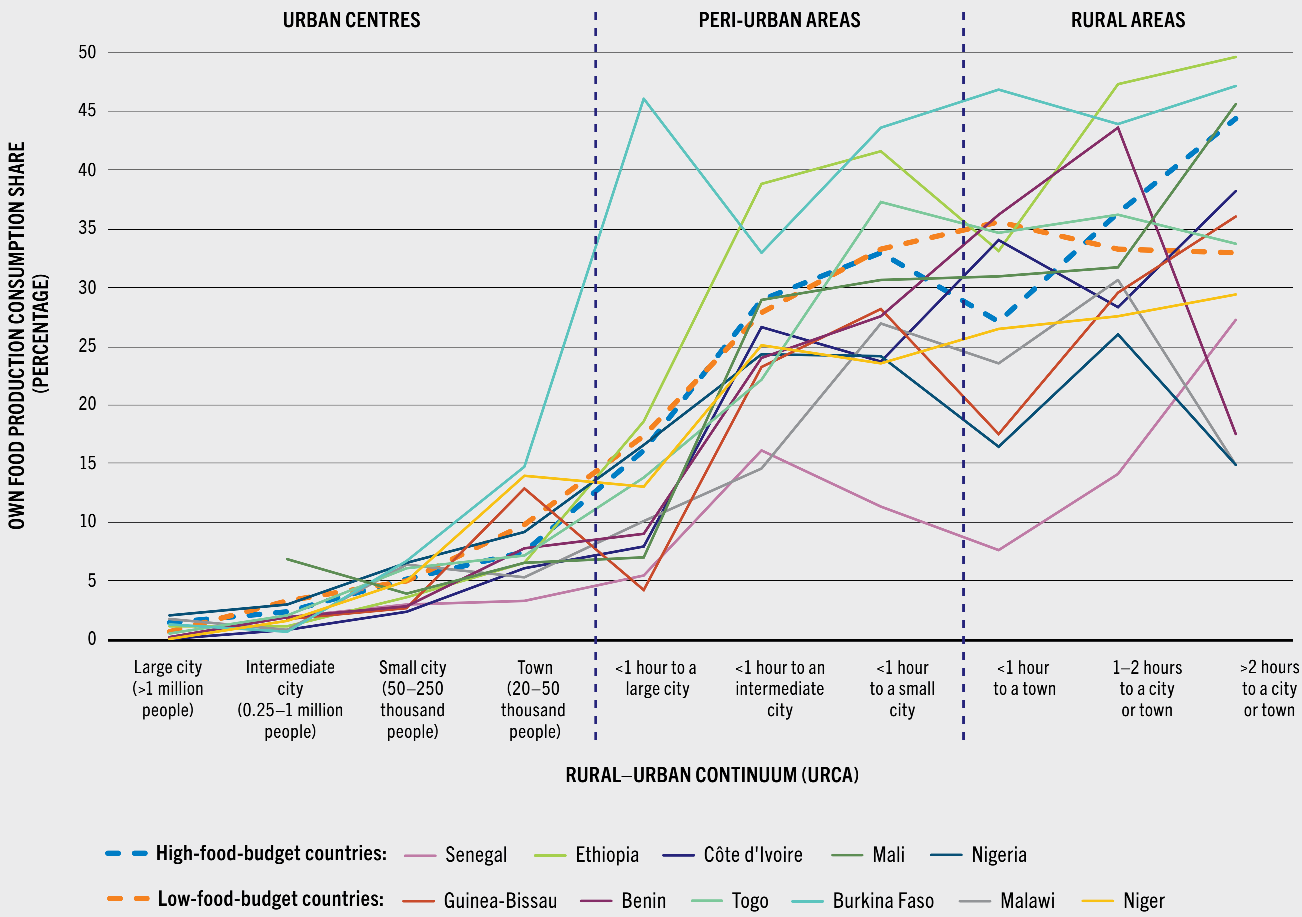
BOX 5 THE MYTH OF RURAL SUBSISTENCE FARMING IN AFRICA

Especially in the context of sub-Saharan Africa, there is a persistent view that households living in rural areas are subsistence farmers who produce their own food, yet the analysis in this report indicates that this does not hold true. Using market prices, the value of food consumption from own production is estimated here, that is the value that households would pay if they acquired the same quantity of that food from the market. Findings show that, moving from urban to rural areas across the continuum, food consumption shares of own production grow, with a sharp increase starting in areas less than 1 hour from a large city (Figure A1).

And yet, own production never becomes the main source for food – not even in rural areas. In rural areas, the average share of own production represents only 37 percent and 33 percent of total consumption in high- and low-food-budget countries, respectively. The shares range from 8 percent to 50 percent in high-food-budget countries, and from 18 percent to 47 percent in low-food-budget countries (Figure A1).

FIGURE A ALL HOUSEHOLDS ACROSS THE RURAL–URBAN CONTINUUM HAVE FOOD CONSUMPTION SHARES FROM OWN FOOD PRODUCTION THAT ARE LESS THAN 50 PERCENT

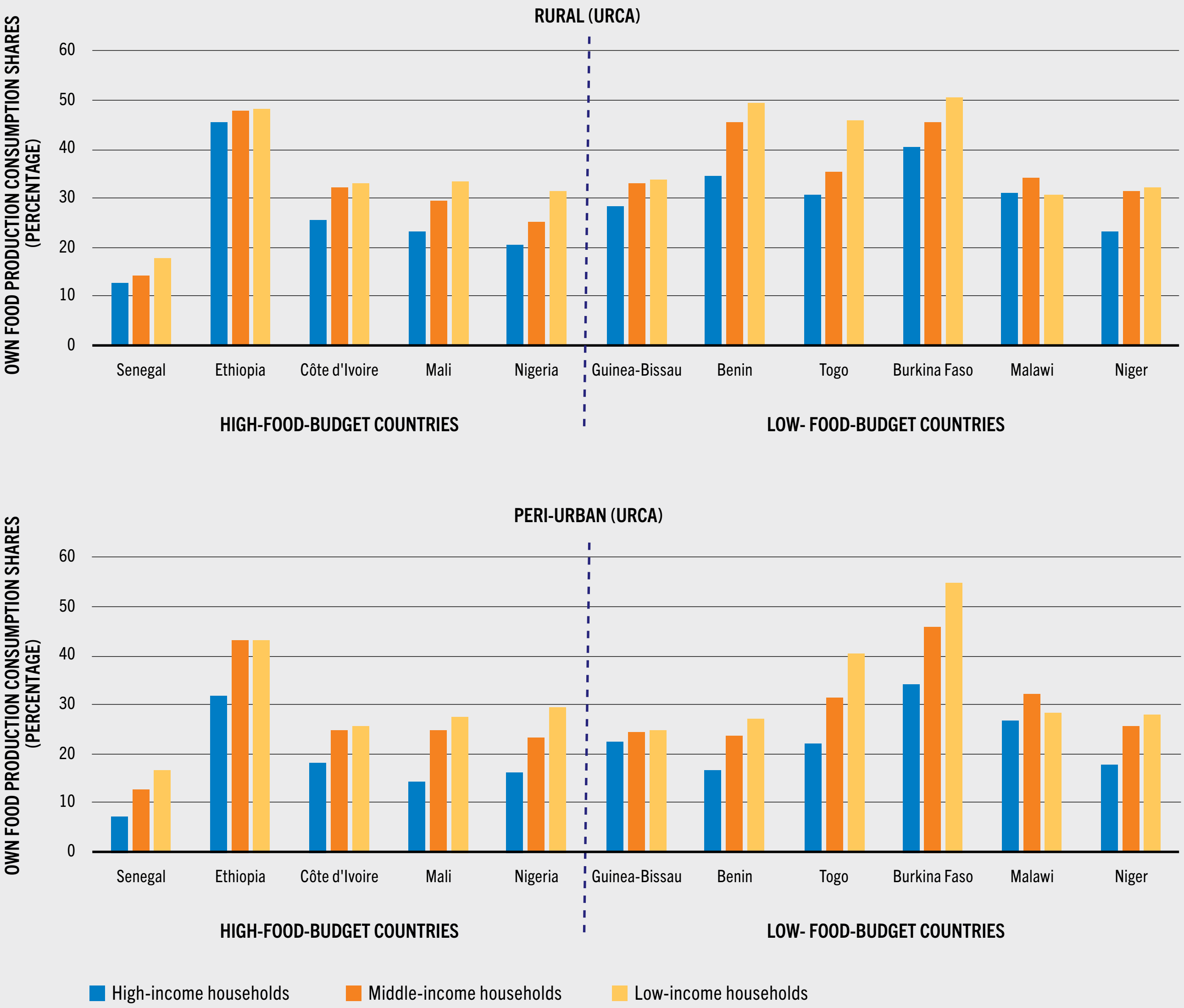
A1) MARKET VALUE DERIVED HOUSEHOLD FOOD CONSUMPTION SHARES FROM OWN FOOD PRODUCTION – ACROSS THE RURAL–URBAN CONTINUUM IN SELECTED COUNTRIES IN AFRICA



BOX 5 (Continued)

These surprising findings hold true even among poor rural households (Figure A2), who obtain on average 40 percent and 36 percent of food consumption from own production in high- and low-food-budget countries, respectively. Furthermore, these shares of own production are not much higher than the shares found for peri-urban households (i.e. an average of 34 percent in both high- and low-food-budget countries). Given that rural households do not produce the majority of the food value they consume, their capacity to afford a healthy diet is a key factor to consider regarding their consumption of nutritious foods.

A2) MARKET VALUE DERIVED HOUSEHOLD FOOD CONSUMPTION SHARES FROM OWN FOOD PRODUCTION – FOR HOUSEHOLDS LIVING OUTSIDE URBAN AREAS, BY HOUSEHOLD INCOME LEVEL IN SELECTED COUNTRIES IN AFRICA



NOTES: The figures show household consumption from own production as a percentage share of total household food consumption (at market value) across the rural–urban continuum (URCA) (Figure A1) and by rural and peri-urban area and household income group (Figure A2). Although URCA is a categorical variable, it is conceptualized as a spatial continuum, thus the use of a line graph in Figure A1, which also facilitates the presentation of the results. All surveys are for 2018/19, except Malawi (2019/20). See **Annex 5** for the full definition of variables. See Table 10 for the definition and list of high- and low-food-budget countries.
SOURCE: Dolislager, M.J, Holleman, C., Liverpool-Tasie, L.S.O. & Reardon, T. (forthcoming). *Evidence and analysis of food demand and supply across the rural–urban continuum in selected countries in Africa*. Background paper for *The State of Food Security and Nutrition in the World 2023*. FAO Agricultural Development Economics Technical Study. Rome, FAO.

» For both country food-budget groups, there is statistical confidence about the location effect across the rural–urban continuum; that is, the farther from a large city, the lower the share of purchases in total household food consumption. As observed in the descriptive analysis, this pattern is fairly smooth and continuous.

Holding all other factors constant, the effect of income on the food purchase share is positive in both sets of countries (excluding Ethiopia, which shows a negative effect), with a somewhat higher effect in low-food-budget countries – according to the supplementary econometric analysis. This can be interpreted as meaning that households "start purchasing" at lower income levels in high-food-budget countries; that is, the transition of diets in the form of purchasing has spread more into lower-income households in that group of countries. This coincides with the findings of other studies.[12]

In both country food-budget groups, furthermore, more non-farm employment (and hence non-farm income) leads to a higher food purchase share. This was found reliably in all country cases and when controlling for gender (except Guinea-Bissau). Male rural non-farm employment shows a somewhat stronger effect in low-food-budget countries (for the reason noted above). The effect is present but less supported for female employment in both high- and low-food-budget countries.

Another important result is that education of the head of the household, particularly secondary schooling, even when controlling for income, is correlated with a higher household food purchase share. The result is particularly strong in high-food-budget countries. This may reflect a variety of factors such as greater opportunity cost of time (for home production) in the types of jobs held by the more educated. In addition, when accounting for gender, there is a positive effect for female-headed households in high-food-budget countries, excluding Malawi. This could again be linked to opportunity cost of time for women in these households to do both their own farming and home processing of food, versus buying food to free up time for home chores and management.

Furthermore, results show that the larger the household size the lower the household food purchases, in both high- and low-food-budget countries. This is presumably because having their own labour allows households to substitute purchased food with their own production, for example in processing and farming. This is reinforced with the expected negative effect on food purchases of ownership of farmland and animal stocks.

There is a diffusion of processed foods and food away from home across the rural–urban continuum, but it is higher in urban areas

In all regions, there has been diffusion of purchased processed foods, as well as food away from home (e.g. prepared food from vendors or in restaurants), in urban and rural areas. Over centuries, small- and large-scale processing of staple foods (e.g. polished rice, wheat and maize flour, edible oils) have introduced essential time- and energy-saving innovations, presenting opportunities for nutritional enhancement such as food fortification. Food processing has continued to grow, expanding to prepared foods, both at small scale (often unpackaged and unbranded) and at very large scale (packaged and branded). While the diffusion of processed foods, including highly processed foods, is already advanced in Asia[9] and Latin America,[13] it is spreading quickly in Africa as well.[14]

Increasing numbers of women are working outside the home in both urban and rural areas, while men and women are increasingly commuting to work in urban areas and going to off-farm jobs in rural areas. These factors may prompt a rise in purchases of prepared food from food service enterprises, due to reduced time availability for home processing (e.g. hand-pounding grains) and food preparation. The dynamics of supply and demand for processed foods, however, are complex. There has been a surge on the supply side, with small and medium enterprises and large private companies alike making massive aggregate investments in all types of processed foods (from minimally to highly processed) in response to demand.[14] At the same time, aggressive marketing and relatively low pricing – and even interference in policies to curb consumption of highly processed foods and sugar-sweetened beverages – are driving up consumption.

There is a critical role for minimally and low processed foods as part of a healthy diet; in addition, they are a major and growing source of employment across the rural–urban continuum (see **Chapter 3**). On the other hand, there is growing evidence of the role of highly processed foods in the development of overweight, obesity and related NCDs (see **Chapter 3**). Many countries now seek to curb consumption through targeted interventions (e.g. bans in schools) and population-based policies (e.g. taxation and front-of-pack labelling) (see **Chapter 5**). Recent studies in Africa show that the expansion of food supply chains in the processing sector (processing, wholesale, transport and retail) provides a major source of employment across the rural–urban continuum, especially for women and youth.[12] Latest estimates indicate that 20 percent of rural employment and 25 percent of urban employment are in agrifood systems jobs such as wholesale and processing.[12] Unfortunately, few of these studies provide sufficient disaggregation of product portfolios to assess the balance of potential benefits and harms to healthy diet goals.

Examining the household consumption of both low processed and highly processed foods and food away from home provides insights into food demand across the rural–urban continuum. The demand for processed foods of all types in Africa is expected to continue to rise over the next decades with urbanization, the continued rise in rural non-farm employment and the concomitant effects on cost savings of food preparation and thus demand for convenience foods. Increased commuting to work is also raising the opportunity cost of time for both men and women, with meals and snacks purchased at roadside stalls, restaurants and market kiosks. Evidence shows that this process has already been seen in other developing regions.[15, 16]

In the analysis that follows, all food items were classified by level of food processing based on the four main groups in the NOVA food classification system. Unprocessed and minimally processed foods (group 1) were then excluded from the analyses in this section. Groups 2 and 3 were combined as one group, referred to as "low processed", and group 4 was maintained as highly processed. See **Annex 5** for an explanation and full description and sources of the processing categories applied. In addition to these two categories, food away from home was made a separate, single category, because there is insufficient information to identify the extent of processing for all items involved and it is therefore not possible to accurately categorize such food.

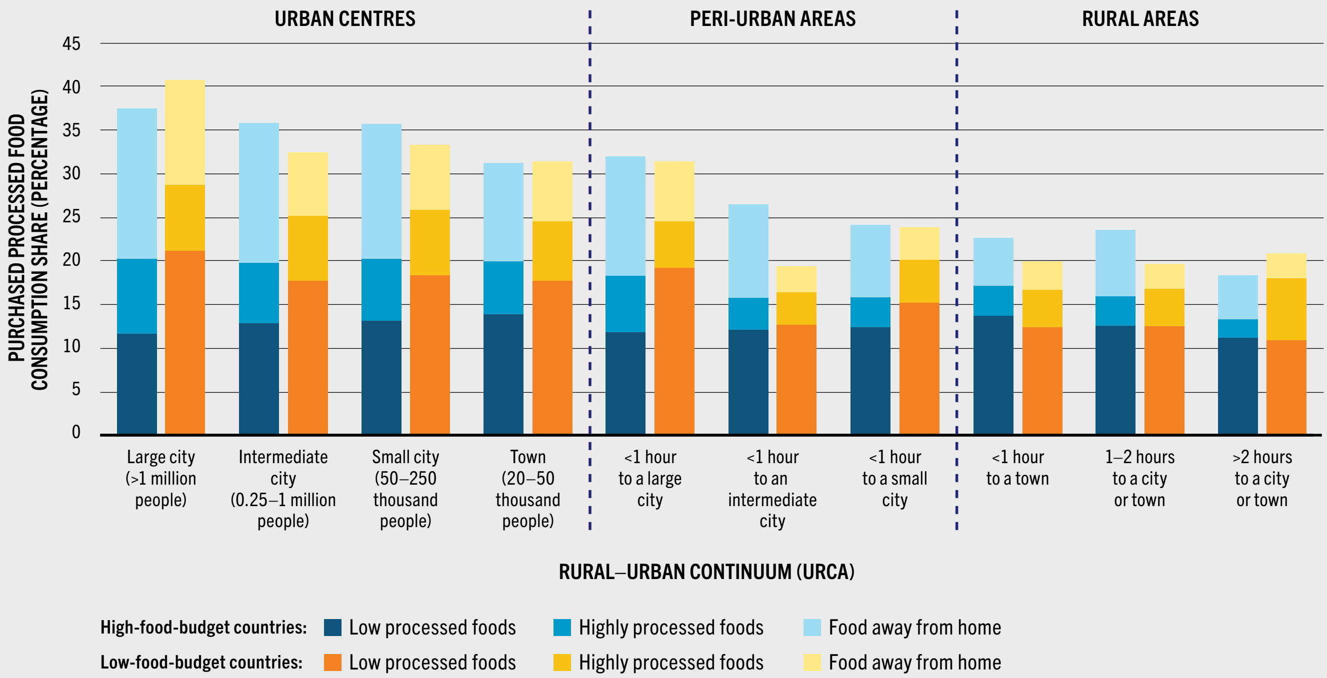
The diffusion of processed foods across the continuum is similar and quite extensive for both high- and low-food-budget countries (Figure 26A). The exception to this is in areas less than 1 hour from intermediate cities of low-food-budget countries, where the share is much lower if compared to the same catchment areas of high-food-budget countries. On average, the share of total processed foods and food away from home is 29 percent in high-food-budget countries, and 25 percent in low-food-budget countries. Even households living in rural areas 1 to 2 hours or more from a city or town are consuming processed foods and food away from home.

While the consumption of processed foods and food away from home is higher in cities and towns, in terms of consumed value shares, it only declines gradually moving into peri-urban areas; however, there is a more abrupt drop in peri-urban areas of intermediate cities in low-food-budget countries (Figure 26A). Evidence of a smooth and gradual diminishing share along the continuum dispels the notion of a sharp rural–urban divide in the consumption of processed foods.

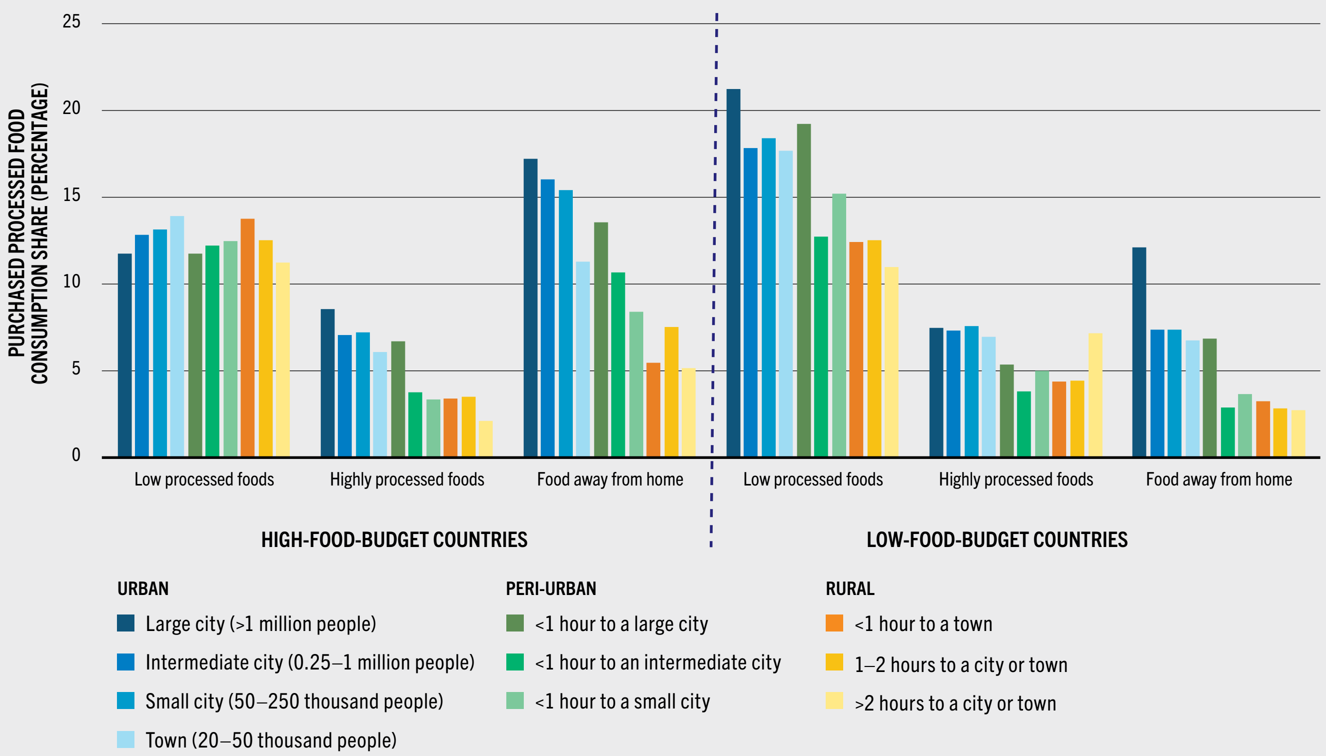
Looking at low processed and highly processed foods separately, we find that in both sets of countries, highly processed foods account for a small proportion of total consumption (Figure 26B). However, the shares are slightly higher in peri-urban areas of small cities and towns and rural areas of low-food-budget countries compared to the same areas in high-food-budget countries. The shares of highly processed foods are also found to be greater in urban areas than in rural areas, in both sets of countries. The results highlight the penetration of highly processed foods into rural areas, even those living 1 to 2 hours or more from a city or town. »

FIGURE 26 IN THE 11 COUNTRIES IN AFRICA, RURAL HOUSEHOLDS ARE CONSUMING PROCESSED FOODS, INCLUDING HIGHLY PROCESSED FOODS, EVEN THOSE LIVING 1 TO 2 HOURS OR MORE FROM A CITY OR TOWN

A) AVERAGE CONSUMPTION SHARES OF PROCESSED FOODS AND FOOD AWAY FROM HOME ACROSS THE RURAL–URBAN CONTINUUM FOR SELECTED HIGH- AND LOW-FOOD-BUDGET COUNTRIES IN AFRICA

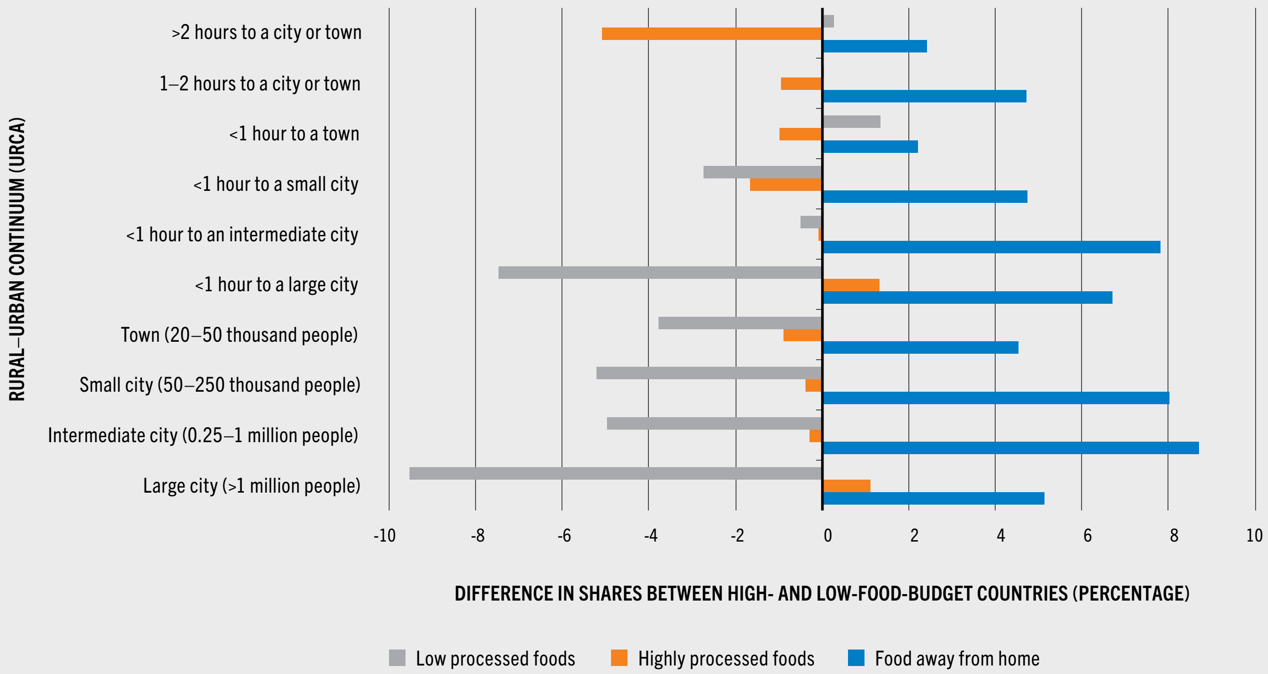


B) COMPOSITION OF AVERAGE CONSUMPTION SHARES OF PROCESSED FOODS ACROSS THE RURAL–URBAN CONTINUUM FOR SELECTED HIGH- AND LOW-FOOD-BUDGET COUNTRIES IN AFRICA



NOTES: The figures show household food consumption of processed foods (low and highly processed foods) and food away from home as a percentage share of total household food consumption (at market value) across the rural–urban continuum (URCA). All surveys are for 2018/19, except Malawi (2019/20). The classification of food items by level of food processing was adapted from the NOVA food classification system. See **Annex 5** for the full definition of variables. See Table 10 for the definition and list of high- and low-food-budget countries.
SOURCE: Dolislager, M.J, Holleman, C., Liverpool-Tasie, L.S.O. & Reardon, T. (forthcoming). *Evidence and analysis of food demand and supply across the rural–urban continuum in selected countries in Africa.* Background paper for *The State of Food Security and Nutrition in the World 2023.* FAO Agricultural Development Economics Technical Study. Rome, FAO.

FIGURE 27 IN THE 11 COUNTRIES IN AFRICA, LOW PROCESSED AND HIGHLY PROCESSED FOOD CONSUMPTION SHARES ARE HIGHER ACROSS THE RURAL–URBAN CONTINUUM IN LOW-FOOD-BUDGET COUNTRIES, WHILE SHARES OF FOOD AWAY FROM HOME ARE HIGHER IN HIGH-FOOD-BUDGET COUNTRIES



NOTES: The figure shows the difference in household food consumption percentage shares (at market value) of low processed foods, highly processed foods and food away from home, comparing high-food-budget countries with low-food-budget countries across the rural–urban continuum (URCA). The classification of food items by level of food processing was adapted from the NOVA food classification system. All surveys are for 2018/19, except Malawi (2019/20). See **Annex 5** for the full definition of variables. See Table 10 for the definition and list of high- and low-food-budget countries.
SOURCE: Dolislager, M.J, Holleman, C., Liverpool-Tasie, L.S.O. & Reardon, T. (forthcoming). *Evidence and analysis of food demand and supply across the rural–urban continuum in selected countries in Africa.* Background paper for *The State of Food Security and Nutrition in the World 2023.* FAO Agricultural Development Economics Technical Study. Rome, FAO.

» Highly processed foods are primarily packaged with extended shelf-life,[17] which may enhance their spread to more remote rural areas given their storability.

In both sets of countries, the consumption value shares of low processed foods are higher compared to highly processed foods, but in urban and peri-urban areas of low-food-budget countries the difference is much greater. This is not unlike the pattern seen in other countries with initial higher penetration of low processed rather than highly processed foods.[14]

However, there is a marked difference in the food consumption shares (at market value) of both low processed and highly processed foods and food away from home between high- and low-food-budget countries. To more clearly see these differences, Figure 27 shows the difference between the food value shares of the two categories of processed foods and food away from home comparing high- and low-food-budget countries.

In low-food-budget countries, low processed food consumption in urban and peri-urban areas is higher than in high-food-budget countries. Not as high – but still higher in low-food-budget countries – is the share of highly processed foods in all areas, except large cities and their surroundings. This is surprising because, as highlighted earlier, it is expected that highly processed foods would be greater in high-food-budget countries. On the other hand, food away from home is higher as a share of total household food consumption in high-food-budget countries (Figure 27). This could suggest that there is more off-farm employment in rural areas of high-food-budget countries. This makes sense as food away from home is correlated with working outside the home and commuting within cities or from rural to urban areas or other rural areas (see **Chapter 3**). Such employment patterns emerge with development and urbanization, both correlated with high-food-budget countries.

As was done for food purchases, an econometric analysis was undertaken to look into the determinants (i.e. location effect of each URCA, household income, non-farm employment, etc.) of the share of purchases of highly processed foods as a value share of total household food consumption. Table A7.2 in **Annex 7** presents the statistically significant results, of which the key points are highlighted below.

Holding other factors constant, the effects of location across the rural–urban continuum corroborate the descriptive findings: the farther from a large city, the smaller the share of highly processed foods in total household food consumption for high-food-budget countries, except for more remote areas in low-food-budget countries. The finding on the location effect is similar to that observed for the United Republic of Tanzania (not included in this analysis), according to a study using detailed household budget survey data with urban, peri-urban and rural gradations.[17] It is also similar to findings for rural and urban areas in Bangladesh, Indonesia, Nepal and Viet Nam.[9]

The pure effect of income is associated with a higher share of highly processed foods in both country food-budget groups, but with a greater impact in low-food-budget countries (Table A7.2 in **Annex 7**). This corroborates findings from other recent studies in Africa, for example in Uganda and the United Republic of Tanzania.[17] In both high- and low-food-budget countries, more non-farm employment leads to a higher share of highly processed foods in total household food consumption. This finding is particularly true for male non-farm employment, as the effect is found to be statistically significant in 8 out of the 11 countries analysed. The effect for female non-farm employment is similar to that for male non-farm employment in high-food-budget countries, but is not statistically significant in low-food-budget countries.

All other things equal, the primary schooling of the household head is significantly correlated with a greater consumption value share of highly processed foods in only three countries, while the household head being female is correlated with a greater share in most high-food-budget countries, except for a dampening effect in Ethiopia (Table A7.2 in **Annex 7**). In the former, this is supported by other studies showing that women substitute processed foods for meal preparation to free up time for other household chores, as well as off-farm work.[14] But in poorer countries, it could be that women managing the household alone have less time (and therefore less access) to buy these foods. However, these results require further exploration. Finally, larger households have a lower share of highly processed food purchases in some of the high-food-budget countries, whereas the effect is mixed in low-food-budget countries (Table A7.2 in **Annex 7**). The higher the dependency ratio[y] in both country food-budget groups, the higher the share of highly processed foods purchased.

Household food consumption by various food groups varies over the rural–urban continuum, driven by patterns of urbanization, income and non-farm employment

Urbanization is implicitly associated with shifts in household food consumption, in which urban households purchase a more varied diet, one that is less dominated by staple foods and comprises a larger variety of foods from other food groups, including more expensive foods such as meat and dairy (see **Chapter 3**). However, some studies suggest that it is higher income in urban areas, rather than urbanization per se, that is causing these shifts.[18] This section provides further analysis of these issues.

y Dependency ratio takes into account the consumption needs of young and elderly people, and the productivity of middle-aged people.

All food items are categorized into eight food groups: i) staple foods including cereals, roots, tubers, plantains and their products; ii) pulses, seeds, nuts and their products; iii) animal source foods including milk, eggs, meat, fish, shellfish, insects/grubs and all their products; iv) vegetables and their products; v) fruits and their products; vi) fats and oils; vii) sweets, condiments and beverages; and viii) meals eaten outside the home (food away from home). See Table A5.6 in **Annex 5** for definitions of food group aggregates. Given the number of food groups to be analysed, the ten URCA categories are further aggregated into three categories – urban, peri-urban and rural – to facilitate the presentation of some figures (see Table 9).

Looking at household food composition in terms of the value shares of food consumption by food group, a diet transition is clearly occurring across the rural–urban continuum (Table 11). This involves a diversification of diets at the household level, including the consumption of more expensive food items, like animal source foods and fruits. This suggests the transition is also occurring in rural areas, though lagged and to a lesser extent than in urban and peri-urban areas.

Interestingly, in this small group of countries in Africa, there are no major differences between high- and low-food-budget countries. This might suggest a convergence in the diet transition occurring across the set of countries. The finding that consumption value shares of non-staple foods are similar in the two food-budget groups is somewhat paradoxical. This could be because in both sets of countries, low-cost non-staple foods – such as vegetables or pulses – are accessible and also desired by households. Another study in Senegal[19] found that household expenditure shares were similar in urban and rural areas, but the absolute levels of expenditure were lower in rural areas and among the poor. This may be similar to saying that low-cost pulses figure largely in the diets of the poor. The findings do not negate Bennett's law,[z] but make its slope more gradual.

z In agricultural economics and development economics, Bennett's law observes that as incomes rise, people eat relatively fewer calorie-dense starchy staple foods and relatively more nutrient-dense meats, oils, sweeteners, fruits and vegetables.[8]

Staple foods as a share of household food consumption in value terms are on average 30 percent (high-food-budget countries) and 28 percent (low-food-budget countries) in urban areas (Figure 28). Note that this share is just slightly above the share of 25 percent in Asian cities.[9]

Consumption value shares of staple foods, including market-valued own-produced staple foods, are similar in peri-urban and rural areas, but roughly 12 percentage points higher than in urban areas. The average share of staple foods in total houseold food consumption is similar in high- and low-food-budget countries: 41 percent and 40 percent (respectively) in peri-urban areas, and 42 percent and 43 percent (respectively) in rural areas.

As expected, following Bennett's law, as household income rises the share of staple foods in total household food consumption falls (Figure 28). This holds true across the rural–urban continuum, whether looking at urban, peri-urban or rural aggregate categories (as shown in Figure 28) or at more disaggregated URCA categories (not shown).

Overall, the value shares of staple foods comprise a minority of total household food consumption, not only in urban areas but across the rural–urban continuum. It is striking that the diversification of household food consumption, which is the inverse of dependence on staple foods, is similar in urban areas of both country food-budget groups. Furthermore, the ratio of the shares of staple foods in rural areas to urban areas is nearly the same in high- and low-food-budget countries (1.4 and 1.5, respectively), suggesting an intercountry convergence.

The smaller staple food shares in urban areas are generally offset by larger shares of animal source foods and food away from home (Figure 29A). This is expected, as urbanization is generally associated with urban households procuring more varied foods, including more expensive foods such as meat, but also eating outside the home more often. With this analysis, however, as previously mentioned, it is not possible to assess the types of foods consumed away from home, whether they contribute to diversity, and their level of processing.

TABLE 11 IN THE 11 COUNTRIES IN AFRICA, A DIET TRANSITION AT THE HOUSEHOLD LEVEL IS OCCURRING ACROSS THE RURAL–URBAN CONTINUUM AND IN HIGH- AND LOW-FOOD-BUDGET COUNTRIES – EVEN IN RURAL AREAS, THOUGH LAGGED AND TO A LESSER EXTENT THAN IN URBAN AND PERI-URBAN AREAS

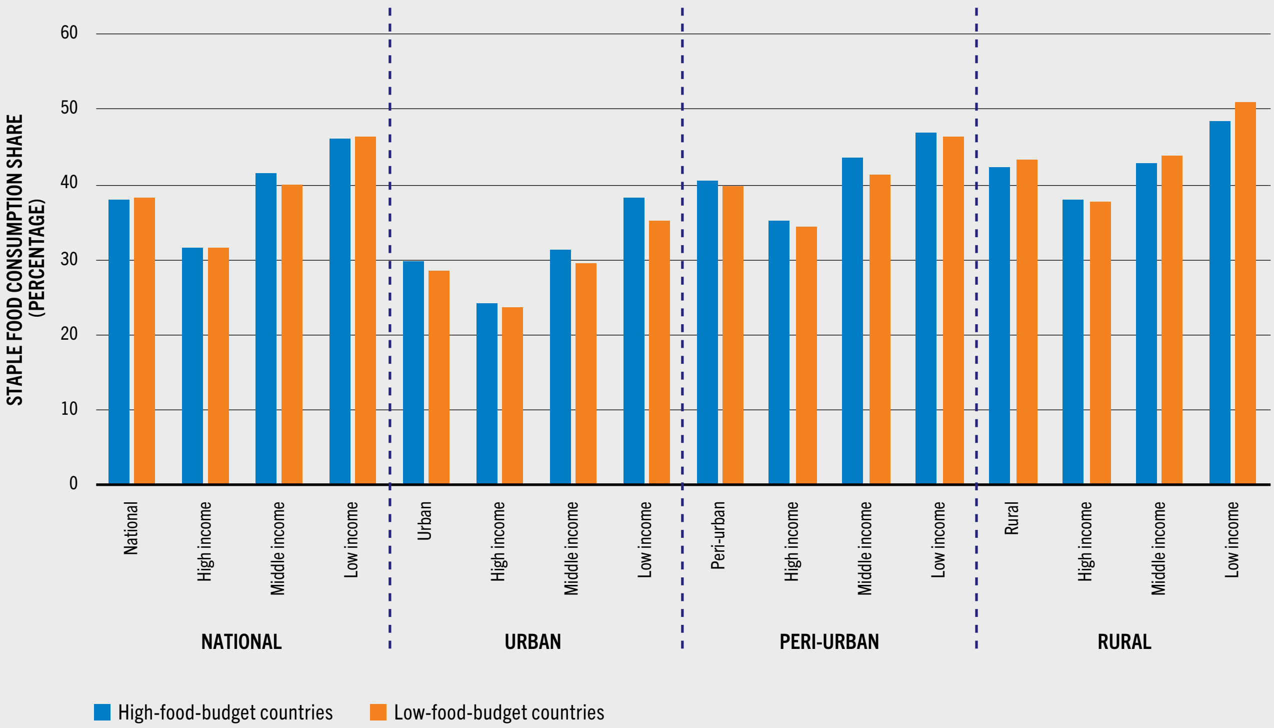
		Large city (>1 million people)	Intermediate city (0.25 –1 million people)	Small city (50–250 thousand people)	Town (20– 50 thousand people)	<1 hour to a large city	<1 hour to an intermediate city	<1 hour to a small city	<1 hour to a town	1–2 hours to a city or town	>2 hours to a city or town
		(%)									
High-food-budget countries	Staple foods	26	32	31	34	34	41	44	45	41	47
	Pulses, seeds and nuts	5	6	6	7	7	8	8	6	8	10
	Animal source foods	22	17	17	17	18	13	12	16	14	10
	Vegetables	12	12	12	11	11	11	10	9	11	10
	Fruits	3	2	3	3	3	2	2	1	2	1
	Fats and oils	5	6	6	7	6	6	6	5	5	5
	Sweets, condiments and beverages	9	8	9	10	7	8	9	12	11	12
	Food away from home	17	16	15	11	14	11	8	5	8	5
Low-food-budget countries	Staple foods	25	31	30	34	33	43	40	44	43	44
	Pulses, seeds and nuts	3	4	4	5	6	8	8	8	8	6
	Animal source foods	25	23	22	20	19	15	16	15	15	14
	Vegetables	14	14	14	13	14	14	13	11	13	12
	Fruits	4	3	4	3	4	2	3	3	3	2
	Fats and oils	5	5	5	5	5	4	5	4	4	5
	Sweets, condiments and beverages	13	12	13	13	12	11	12	11	12	15
	Food away from home	12	7	7	7	7	3	4	3	3	3

NOTES: The table shows household food consumption by food group as a percentage share of total household food consumption (at market value) across the rural–urban continuum (URCA) for high- and low-food-budget countries. All surveys are for 2018/19, except Malawi (2019/20). See **Annex 5** for the full definition of variables. See Table 10 for the definition and list of high- and low-food-budget countries.
SOURCE: Dolislager, M.J, Holleman, C., Liverpool-Tasie, L.S.O. & Reardon, T. (forthcoming). *Evidence and analysis of food demand and supply across the rural–urban continuum in selected countries in Africa.* Background paper for *The State of Food Security and Nutrition in the World 2023.* FAO Agricultural Development Economics Technical Study. Rome, FAO.

In urban areas, on average across the countries analysed, animal source food consumption value shares (which include milk, eggs, meat, fish, shellfish and insects) are 40 percent higher than in peri-urban areas and 44 percent higher than in rural areas. Looking at low-food-budget countries, the share in urban areas is 1.5 times higher than in peri-urban areas and 1.6 times higher than in rural areas. For high-food-budget countries, the differences are smaller: urban shares are 1.4 times higher than peri-urban and rural (not shown here, see Figure A7.1A in **Annex 7**). There is also a notable decrease in value shares of pulses, seeds and nuts in urban areas compared to peri-urban areas and rural areas (40 percent and 47 percent lower than in peri-urban and rural areas, respectively) (Figure 29A). This finding is typical, as these items are cheaper sources of nutrient-rich foods, but

Animal source foods and food away from home increasingly substitute staple foods, moving from rural to urban areas across the continuum

FIGURE 28 IN THE 11 COUNTRIES IN AFRICA, THE SHARE OF STAPLE FOODS REPRESENTS A MINORITY OF TOTAL HOUSEHOLD FOOD CONSUMPTION IN VALUE TERMS, AND RISES AS INCOME FALLS ACROSS THE RURAL–URBAN CONTINUUM IN BOTH HIGH- AND LOW-FOOD-BUDGET COUNTRIES



NOTES: The figure shows household staple food consumption as a percentage share of total household food consumption (at market value) by national, urban, peri-urban and rural area (URCA), and by income tercile (low-income, middle-income and high-income households) within each category. All surveys are for 2018/19, except Malawi (2019/20). See **Annex 5** for the definition of urban, peri-urban and rural. See Table 10 for the definition and list of high- and low-food-budget countries.
SOURCE: Dolislager, M.J, Holleman, C., Liverpool-Tasie, L.S.O. & Reardon, T. (forthcoming). *Evidence and analysis of food demand and supply across the rural–urban continuum in selected countries in Africa.* Background paper for *The State of Food Security and Nutrition in the World 2023.* FAO Agricultural Development Economics Technical Study. Rome, FAO.

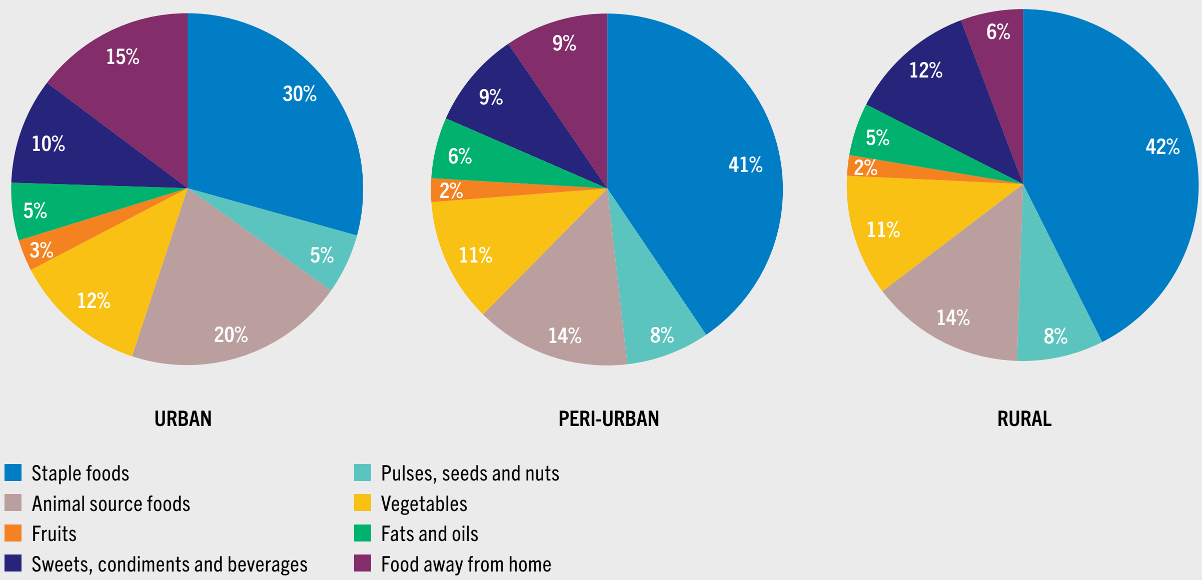
tend to be supplanted by animal source foods (if only by milk in partially vegetarian countries such as India) as people's incomes increase.

Across all countries, shares of food away from home are higher in urban areas, and decline steeply moving to peri-urban and rural areas (Figure 29). On average, shares are 1.6 times higher in urban areas than in peri-urban areas, and 2.6 times higher than in rural areas. This pattern is stronger in low-food-budget countries, with urban shares 2.4 times higher than in peri-urban areas, and 3.2 times higher than in rural areas (see Figure A7.1B in **Annex 7**).

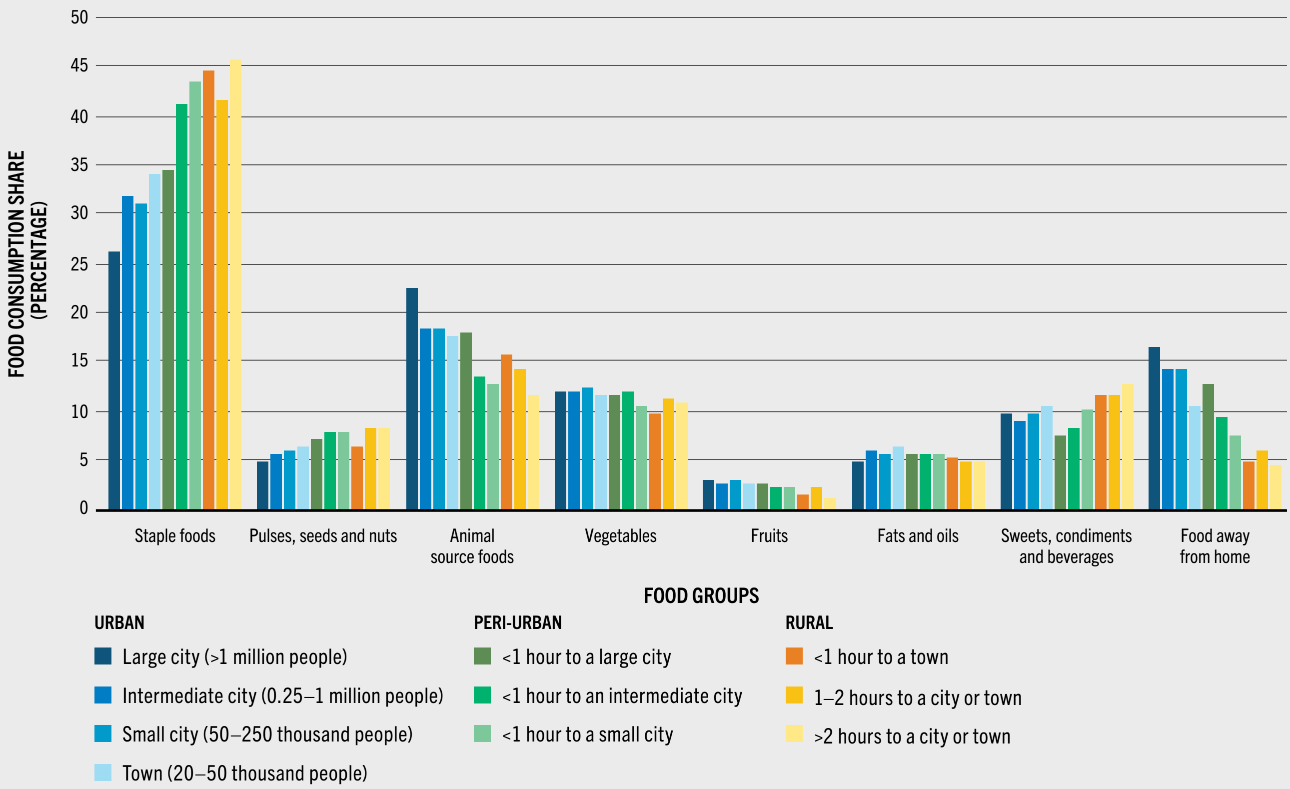
A more disaggregated look at the consumption value shares by food group shows that on average across all countries, there is no abrupt rural–urban divide across the continuum (Figure 29B). Again, this is a surprise, as it is generally assumed there is a marked difference between urban and rural areas. Moving across the continuum from urban to rural areas (Figure 29B), there is an increasing share of staple foods and pulses, seeds and nuts, and a decreasing share of animal source foods and food away from home. In contrast, shares for vegetables, fruits, and fats and oils are fairly uniform across the rural–urban continuum. Although there are some variations, »

FIGURE 29 IN THE 11 COUNTRIES IN AFRICA, ANIMAL SOURCE FOODS AND FOOD AWAY FROM HOME SUBSTITUTE STAPLE FOODS, MOVING FROM RURAL TO URBAN AREAS

A) AVERAGE SHARES OF HOUSEHOLD FOOD CONSUMPTION VALUES BY FOOD GROUP AND URBAN, PERI-URBAN AND RURAL AREAS (URCA)



B) AVERAGE SHARES OF HOUSEHOLD FOOD CONSUMPTION BY FOOD GROUP ACROSS THE RURAL–URBAN CONTINUUM (URCA)



NOTES: The figures show household food consumption by food group as a percentage share of total household food consumption (at market value), by urban, peri-urban and rural area (URCA) (Figure A), and by rural–urban continuum (URCA) (Figure B). All surveys are 2018/19, except Malawi (2019/20). See **Annex 5** for the definition of urban, peri-urban and rural. See Table 10 for the definition and list of high- and low-food-budget countries.
SOURCE: Dolislager, M.J, Holleman, C., Liverpool-Tasie, L.S.O. & Reardon, T. (forthcoming). *Evidence and analysis of food demand and supply across the rural–urban continuum in selected countries in Africa.* Background paper for *The State of Food Security and Nutrition in the World 2023.* FAO Agricultural Development Economics Technical Study. Rome, FAO.

» sweets, condiments and beverages also are uniform (see Table 11 for disaggregated values by high- and low-food-budget countries).

An econometric analysis of the determinants of consumption of the different food groups provides further insights. For example, the determinants of consumption of animal source foods and food away from home corroborate the descriptive trends. Increases in the share of consumption of animal source foods in household food consumption are mainly driven by statistically significant increases in income (see Table A7.3 in **Annex 7**).

For the shares of food away from home, the effect of income is mixed across high- and low-food-budget countries, but it shows an average higher consumption share as income increases when all countries are pulled together (Table A7.4 in **Annex 7**). However, in both country food-budget groups, more male non-farm employment leads to a higher share of food away from home and the effect is higher in high-food-budget countries than in low-food-budget countries. This may reflect employment that is more spatially dispersed, with longer commutes, and thus a greater need for food away from home. It may also be the case that in some high-food-budget countries, restaurants and vendors (i.e. food services) that prepare meals (for food away from home) are more plentiful.

The location effect across the rural–urban continuum is present and statistically significant in low-food-budget countries. In this case, the consumption value share of food away from home is much greater in large cities than in towns, but decreases incrementally in peri-urban areas the larger the size of the closest city, and decreases moving from towns to rural areas, with the largest decrease occurring in areas 1 to 2 hours from any urban centre. The location effect is statistically significant for fewer URCA categories in high-food-budget countries. It shows a greater consumption of food away from home in large and intermediate cities compared to towns, and a decrease in rural areas, with the largest drop occurring in areas more than 2 hours from any urban centre. These results corroborate the descriptive findings: the larger the urban city, the higher the share of food away from home in total consumption; the greater the distance from a large city, the smaller the share (Table A7.4 in **Annex 7**). The consumption of food away from home is often linked to commuting for work; therefore these patterns reflect how much farther workers have to commute from home in cities compared to rural areas.

For household consumption, shares of animal source foods are driven by income, while shares of fruits and vegetables are determined by access and availability.

In contrast to animal source foods and food away from home, the analysis of the determinants of the share of vegetables in total household food consumption suggests that this consumption is driven more by access and availability than by income. The effect of income on vegetable consumption is mixed, but overall negative and statistically significant, indicating a reduction in vegetable consumption shares as income increases (Table A7.5 in **Annex 7**).

On the other hand, considering all countries together, there are statistically significant location effects on the share of vegetables in total household food consumption across the rural–urban continuum – after controlling for income. Large, intermediate and small cities and areas less than 1 hour from large and intermediate cities have higher shares of vegetable consumption than do towns (Table A7.5 in **Annex 7**). For low-food-budget countries, there is also a notable decrease in the share of vegetable consumption in rural areas. These findings may reflect the presence of major horticultural commercial zones near cities, or in well-watered areas near highways and rivers, in both low- and high-food-budget countries.

In both high- and low-food-budget countries, the effect of non-farm employment is mostly non-significant (Table A7.5 in **Annex 7**). However, if the household is headed by a woman, there is a positive effect on the share of vegetable consumption in both country food-budget groups. Since the effect of income is taken into consideration at the same time, this can be interpreted as an indication that female diet choices for households make a difference, as women, for example, choose food with greater nutrient and vitamin content. ■

4.2 COST AND AFFORDABILITY OF A HEALTHY DIET, AND FOOD SECURITY AND NUTRITION ACROSS THE RURAL–URBAN CONTINUUM

KEY MESSAGES

➔ In the 11 African countries analysed, the cost of a healthy diet in urban areas is much higher (on average 1.2 times higher) than in peri-urban areas, and it then decreases the smaller the city size and moving closer to rural areas. This trend is less pronounced in high-food-budget countries, which show similar costs across all urban areas.

➔ The higher cost of animal source foods, compared to the other food groups, drives up the cost of a healthy diet across the rural–urban continuum, especially in urban areas and remote rural areas.

➔ The lower cost of a healthy diet in peri-urban areas of the 11 countries analysed compared to urban areas does not translate into more affordable healthy diets, as income levels are a considerable factor. The percentage of the population unable to afford a healthy diet in peri-urban areas is higher than in urban areas and similar to rural areas.

➔ In the 11 countries in Africa, the cost of a healthy diet exceeds average food expenditure for low- and middle-income households in both high- and low-food-budget countries. Low-income households living in peri-urban and rural areas are especially disadvantaged, as they would need to more than double what they currently spend on food to secure a healthy diet.

➔ In many of these African countries studied, the prevalence of moderate or severe food insecurity in urban and peri-urban areas is similar to that in rural areas, and in some cases, slightly higher, indicating that food insecurity is not exclusively a rural problem in most of the countries analysed.

➔ In the three countries analysed in Africa, the prevalence of child stunting generally increases as cities become smaller and as one moves away from urban centres. Child wasting and overweight are lower and exhibit less evident trends across the rural–urban continuum.

Based on the latest estimates (**Chapter 2**), we are not on track to end all forms of malnutrition by 2030. For instance, still 148.1 million children under five years of age were stunted in 2022, while 45 million were wasted and 37 million were overweight. According to the Global Burden of Disease Study, in 2019 dietary risk was the second largest Level 2 risk factor[aa] for attributable deaths among females and the third among males.[20]

All forms of malnutrition have multiple causes, but healthy diets can help reduce the risk of malnutrition in all its forms, including micronutrient deficiency, stunting, wasting, overweight and obesity, as well as diet-related NCDs.[21] The determinants of consumption of healthy diets are similarly highly complex and include behavioural and cultural factors, food placement and promotion within the food environment. It is clear, however, that to ensure access to healthy diets, nutritious foods must be both available and affordable. Availability refers to the existence of food coming from either own production or the market, while affordability refers to people's financial capacity to acquire sufficient food, which in turn depends on household income and food prices. Low incomes constrain how much food households can economically access, but relative prices and systematic food price dispersion[ab] will greatly influence the types of foods selected and, as a result, may influence diet-related nutrition outcomes.[22]

aa The Global Burden of Disease Study[20] estimates the prevalence of exposure and attributable deaths for, among others, 23 age groups; males, females, and both sexes combined; and 204 countries and territories. The study uses a risk factor hierarchy of 87 risks or clusters of risks. Level 1 risk factors are behavioural, environmental and occupational, and metabolic; Level 2 comprises 20 risk factors or clusters of risks; Level 3 comprises 52 risk factors or clusters of risks; and Level 4 comprises 69 specific risk factors.

ab Food price dispersion emerges when the same kind of foods are sold at different prices by stores in the same market.

It is worth recalling that the affordability indicator is a measure of economic access. It measures not the number of people not eating a healthy diet, but rather the number who do not have enough resources to acquire a healthy diet. As such, the contribution of social protection programmes such as school feeding programmes are not taken into consideration. On the other hand, social programmes such as cash-based transfers, whether in-kind or monetary, or food donation programmes, are considered part of the household income.

The 2020 edition of this report showed the existence of within-country variations in the cost and affordability of a healthy diet, but it did not cover variations across the rural–urban continuum. Studies suggest that urbanization may directly exert upward pressure on food prices in poor countries.[18] This is because most households now depend on food supplied by markets rather than their own production. This is particularly true in urban areas where – as shown in Figure 24 in **Section 4.1** – food purchases constitute more than 78 percent of household consumption in the 11 sub-Saharan African countries analysed. However, it also holds true in peri-urban and rural areas, where households of almost all countries analysed acquire more than 50 percent of the food consumed in markets. Such high shares increase the risk of food hoarding when prices are expected to rise, which itself can contribute to higher prices.

This section presents a new descriptive analysis of indicators of healthy diet access, food security and nutrition for selected countries. The analysis relies on the geospatial URCA dataset (see Box 2 and Box 3 in **Chapter 3**, and **Annex 4**, **Section A**); while there is no comparable global dataset to support the analysis, there are microlevel national survey data that, once merged with the URCA dataset, could provide insights on differences across the rural–urban continuum. The analysis focuses on the 11 sub-Saharan countries covered in **Section 4.1**, using the same household survey data (see Table A5.1 in **Annex 5**), and still grouping them into high-food-budget countries (2.3 PPP dollars per capita per day) and low-food-budget countries (1.6 PPP dollars per capita per day) (see Table 10 for the list of countries by category).

Similar to **Section 4.1**, patterns, differences and similarities are also analysed across ten URCA categories of the rural–urban continuum, as well as a further aggregation into urban, peri-urban and rural categories (see Table 9 and **Annex 5**, **Section B** for further details).

Cost and affordability of a healthy diet across the rural–urban continuum

The calculation of subnational cost and affordability of a healthy diet follows the same methodology as the global monitoring CoAHD indicators presented in **Chapter 2**. However, national estimates derived from the aggregation of subnational indicators are not comparable with global CoAHD indicators due to differences in data sources. For further information and the full description of the data sources and methodology, see **Annex 8**.

Cost of a healthy diet

Across the 11 African countries analysed, the cost of a healthy diet in urban centres is much higher (on average 1.2 times higher) than in peri-urban areas and it then decreases the smaller the city size and moving closer to rural areas. The higher cost of a healthy diet in urban centres in almost all countries analysed may be associated with the widespread diffusion of supermarkets in cities. While diffusion of supermarkets may increase access to a more diverse diet (see **Chapter 3**), it may also push the cost of a healthy diet up, making it less affordable for poorer households in urban centres.

However, there are exceptions to this cost pattern. For example, in Guinea-Bissau, the cost in peri-urban areas is slightly higher than in urban areas. This is likely attributed to the unique geographic concentration of cities in the south around the port of Bissau and to poor infrastructure, particularly in ferry and road transport systems linking urban and peri-urban areas that are 1 hour away or less (Figure A6.1D in **Annex 6**).[23] In Ethiopia and Togo, the other exceptions, the cost is higher in rural areas than in peri-urban areas; this is directly related to the dispersed urbanization pattern in these countries (see Figure A6.1C in **Annex 6**), with poor rural areas inadequately connected to urban areas due to poor and limited road infrastructure.[24]

Generally, in these three exceptional cases, poor transport infrastructure is a major factor hampering availability of nutritious foods (often highly perishable) and pushing up their cost in rural areas.

Average values across countries also hide differences between high- and low-food-budget countries as shown in Figure 30A. The cost of a healthy diet in high-food-budget countries is 23 percent – 22 percent and 28 percent higher than in low-food-budget countries, comparing urban, peri-urban and rural areas. The higher cost in high-food-budget countries is mainly due to the higher cost of vegetables and animal source foods (29 percent and 32 percent higher than in low-food-budget countries, respectively). For both country food-budget groups, the largest decrease in the cost occurs moving from urban to peri-urban areas, while in rural areas the cost is similar to (in high-food-budget countries) or only slightly lower than (in low-food-budget countries) that in peri-urban areas.

A more disaggregated view of the rural–urban continuum (i.e. considering the ten URCA categories) reveals a much closer convergence in the cost of a healthy diet in high-food-budget countries, particularly in urban areas (Figure 30B). On the other hand, the range in the cost is wider for low-food-budget countries. The greater convergence in the cost of a healthy diet in high-food-budget countries points to their better connectivity in food supply chains across the rural–urban continuum compared to low-food-budget countries.

Looking at the cost pattern across the rural–urban continuum for individual countries also provides further insights (Table A9.2 in **Annex 9**). For example, in Benin and Togo, households living in urban centres face a cost, respectively, 1.4 and 1.7 times higher than households living in peri-urban areas – and most of the population of these countries is concentrated in peri-urban areas of small cities. This suggests that a more dispersed urbanization pattern, likely involving decentralized markets served by local producers, may significantly drive the cost of healthy diets down.

Finally, and differently from that seen for low-food-budget countries, the cost of a healthy diet basket is particularly high in very remote rural areas, more than 2 hours from any urban centre in high-food-budget countries (Table A9.2 in **Annex 9**). Among the high-food budget countries, the cost difference between these remote areas and rural areas 1 to 2 hours from any urban centre is particularly high in Nigeria. This may be a reflection of the different urbanization patterns in those countries, which have undergone a metropolitan expansion process with most of the population living in large and/or intermediate cities and in peri-urban areas 1 hour away or less. In this situation, a more abrupt separation from more remote rural areas can be expected, with disruption in the food supply chain and higher prices.

The cost structure by food group of a healthy diet does not present any striking differences across URCAs, with each of the six food groups contributing to the total cost of a healthy diet in about the same percentage, independently of the catchment area for both high- and low-food-budget countries (Figure A9.1 in **Annex 9**). The largest cost contribution by food group to a healthy diet comes from animal source foods (31–41 percent), followed by vegetables (17–22 percent), staple foods (16–21 percent), fruits (10–18 percent), fats and oils (6–8 percent), and pulses, seeds and nuts (6–8 percent).

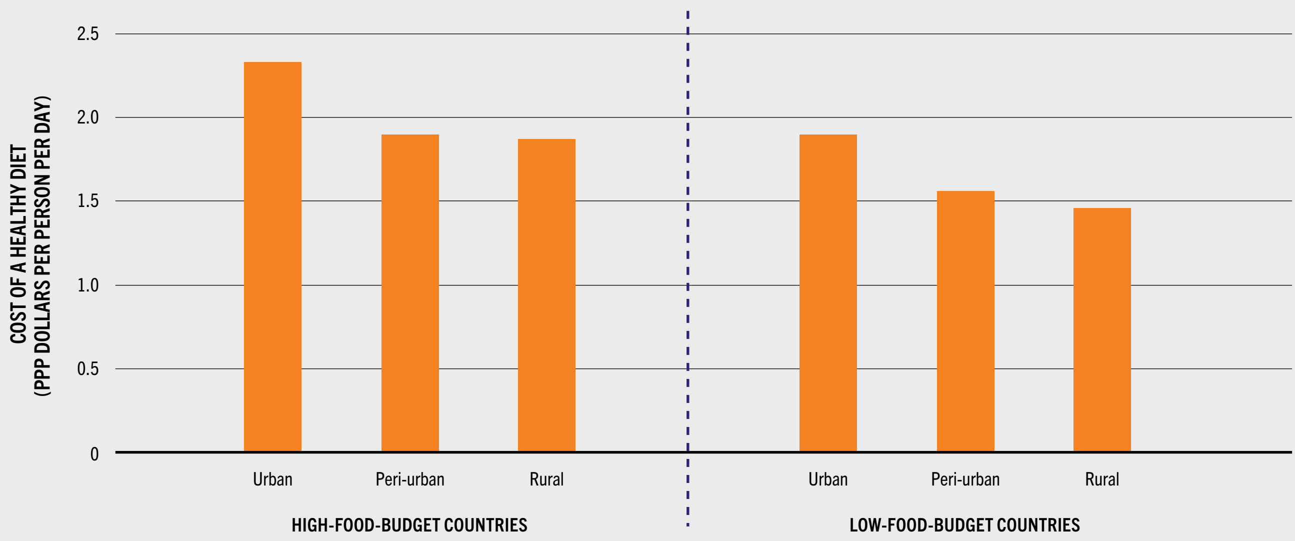
However, it is worth noting the higher cost share of animal source foods in all urban centres and peri-urban areas of high-food-budget countries, compared to low-food-budget countries (between 2 and 6 percentage points difference) (Figure A9.1 in **Annex 9**). The largest cost difference is found in towns, where households in high-food-budget countries spend USD 0.29 more per person per day on animal source foods than do households in low-food-budget countries (Figure 31).

The other trend to highlight is the higher cost contribution of animal source foods compared to all other food groups, even vegetables and fruits combined, in almost all URCAs in both country food-budget groups. The main outliers are large cities of low-food-budget countries, due to the higher share of fruits in the cost of a healthy diet (Figure A9.1 in **Annex 9**).

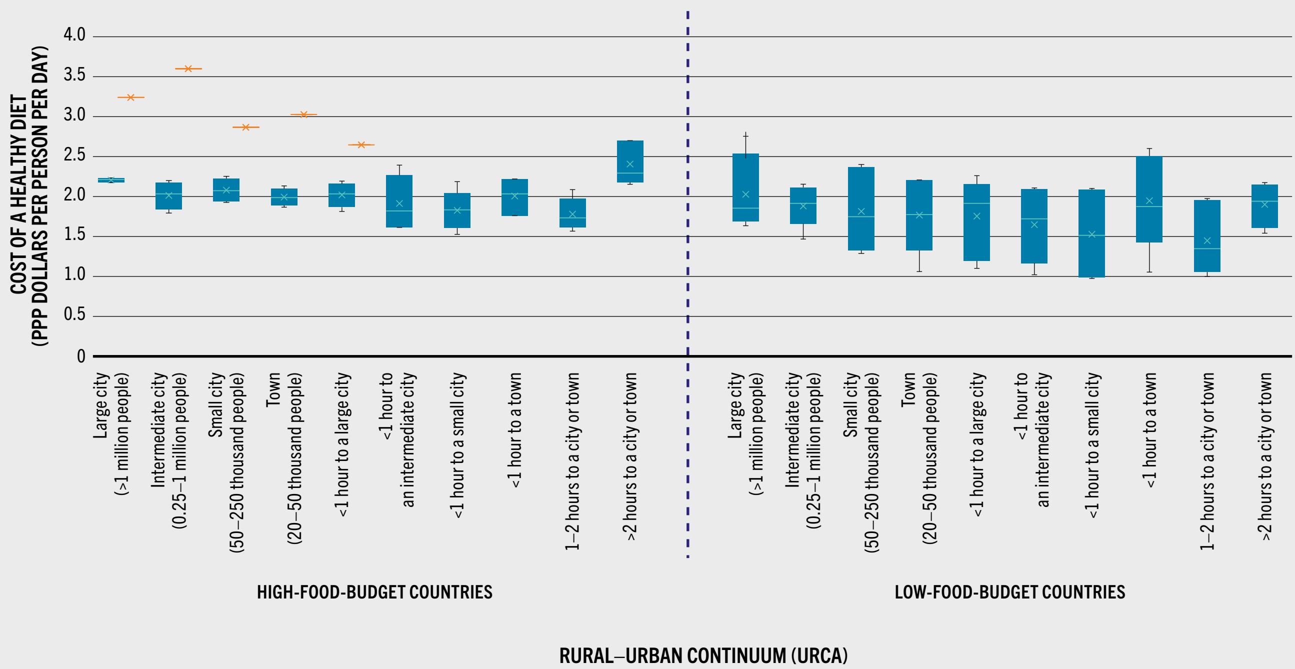
Finally, the cost contribution of animal source foods in the total cost of a healthy diet (both as »

FIGURE 30 IN THE 11 COUNTRIES IN AFRICA, THE COST OF A HEALTHY DIET IN URBAN AREAS IS MUCH HIGHER THAN IN PERI-URBAN AREAS, AND IT DECREASES THE SMALLER THE CITY SIZE AND MOVING CLOSER TO RURAL AREAS; THIS TREND IS LESS PRONOUNCED IN HIGH-FOOD-BUDGET COUNTRIES, WHICH SHOW SIMILAR COSTS ACROSS ALL URBAN AREAS

A) COST OF A HEALTHY DIET IN URBAN, PERI-URBAN AND RURAL AREAS (URCA)



B) COST OF A HEALTHY DIET ACROSS THE RURAL–URBAN CONTINUUM (URCA)



NOTES: Figure A shows the cost of a healthy diet in urban, peri-urban and rural areas (URCA). In Figure B, each bar visualizes the median, 25th and 75th percentile range, and whiskers of 1.5 times that range of the cost of a healthy diet for the 11 countries analysed across the rural–urban continuum (URCA) by high- and low-food-budget countries, in PPP dollars per person per day (PPP = purchasing power parity). Crosses in the high-food-budget figure are cost of heathy diet in urban centres in Ethiopia, classified as outlier compared to the values of other countries in the same URCAs. All surveys are for 2018/19, except Malawi (2019/20). See Table 10 for the definition and list of high- and low-food-budget countries.
SOURCE: Holleman, C. & Latino, L. (forthcoming). *Variations in the subnational cost and affordability of a heathy diet – Evidence from sub-Saharan Africa.* Background paper for *The State of Food Security and Nutrition in the World 2023*. FAO Agricultural Development Economics Working Paper. Rome, FAO.

» share and in terms of money value) is also high in more remote areas (more than 2 hours travel to a city or town) in both high- and low-food-budget countries. On the other hand, it is lower in peri-urban areas of intermediate and small cities, as well as in areas 1 to 2 hours from a city of any size (Figure 31 and Figure A9.1 in **Annex 9**).

The lower cost of animal source foods in peri-urban areas, coupled with the high cost of fruits and vegetables in large cities, particularly in low-food-budget countries, explains the decrease in the overall cost of a healthy diet basket from urban to rural areas across the continuum (Figure 31). The lower cost of fruits, vegetables and animal source foods in the outskirts of cities is clearly a consequence of the proximity to the production site of these perishable products. In fact, the increasing demand for animal source foods from better-off urban dwellers is attracting more medium- and large-scale livestock operators to urban and peri-urban areas (such operators had moved farther away when urbanization first began to intensify).[25] Furthermore, the wider cost difference for animal source foods across the rural–urban continuum of low-food-budget countries is likely due to the higher constraints in the cold supply chain.

Cost of a healthy diet compared to actual household food expenditure

The food demand analysis in **Section 4.1** shows the patterns of food consumption across the rural–urban continuum, including the market value of the foods consumed by food group. From this analysis, however, it is not possible to determine whether the consumed diet provides the quantity of calories and nutrients, and the diverse intake of foods from different food groups that would constitute a healthy diet. This would require a different set of data and information, which is not available. On the other hand, it is possible to compare the cost of a healthy diet to what households are actually spending on food (including market value of own food production), in order to determine whether they would have to spend more or less of the income they have available to secure a healthy diet. This is a useful comparison, especially as estimates can be disaggregated by URCA category and household income level.

On average at the national level, the cost of a healthy diet is lower than the amount households spend on food in the high-food-budget countries analysed (see Table A9.1 in **Annex 9**). For high-food-budget countries, the cost of a healthy diet is 86 percent of average food consumption, varying from 74 percent to 97 percent among the countries in this group. For low-food-budget countries, there is more variability. In two countries (Burkina Faso and the Niger), the cost of a healthy diet is almost 40 percent greater than average food consumption. However, in the others, the cost of a healthy diet is lower than the actual amount spent on food.

The national averages, however, obscure the fact that for low- and middle-income households in both country food-budget groups, the cost of a healthy diet actually exceeds average expenditure on food (Figure 32A). For low-income households, the cost of a healthy diet basket is about twice the amount that households spend on food: specifically, 2.3 times higher in low-food-budget countries and 2 times higher in high-food-budget countries. Middle-income households would also need to increase current spending to have access to a healthy diet (i.e. by 34 percent in low-food-budget countries and 17 percent in high-food-budget countries).

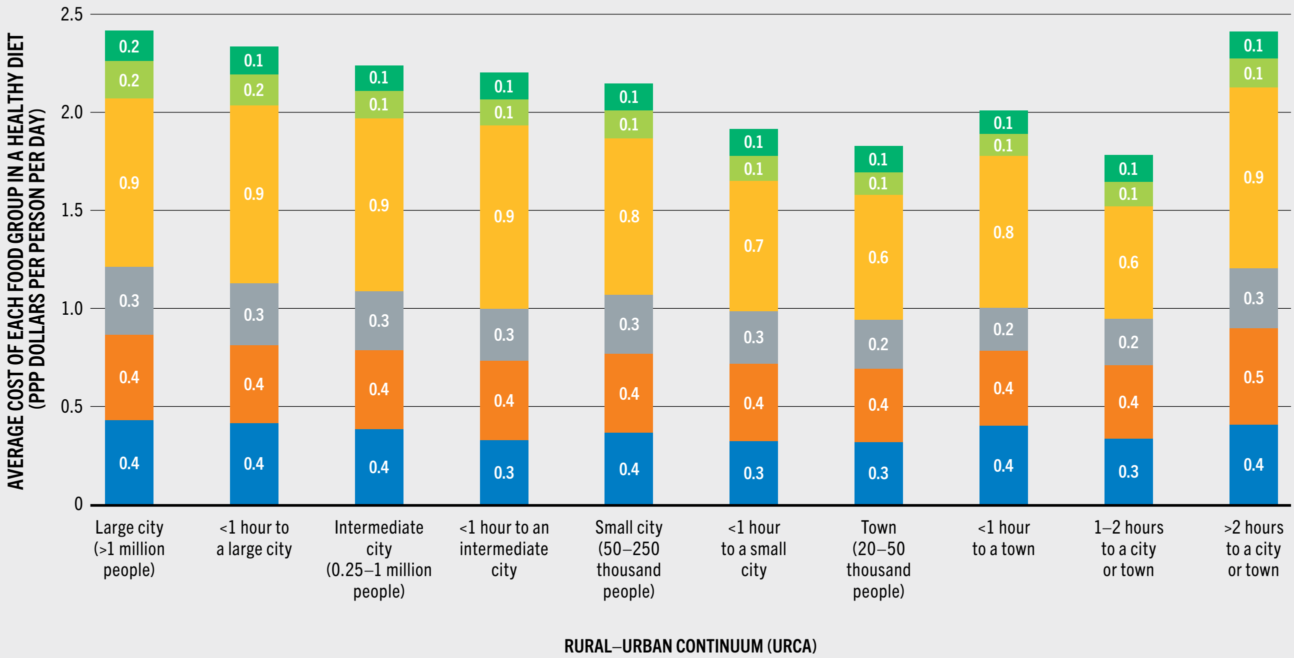
This problem is seen for all low- and middle-income households in both high- and low-food-budget countries across the rural–urban continuum, although it becomes particularly acute moving from urban to peri-urban areas (Figure 32B). Low-income households living in peri-urban and rural areas are especially disadvantaged, as they would need to more than double what they currently spend on food to secure a healthy diet.

Affordability of a healthy diet across the rural–urban continuum

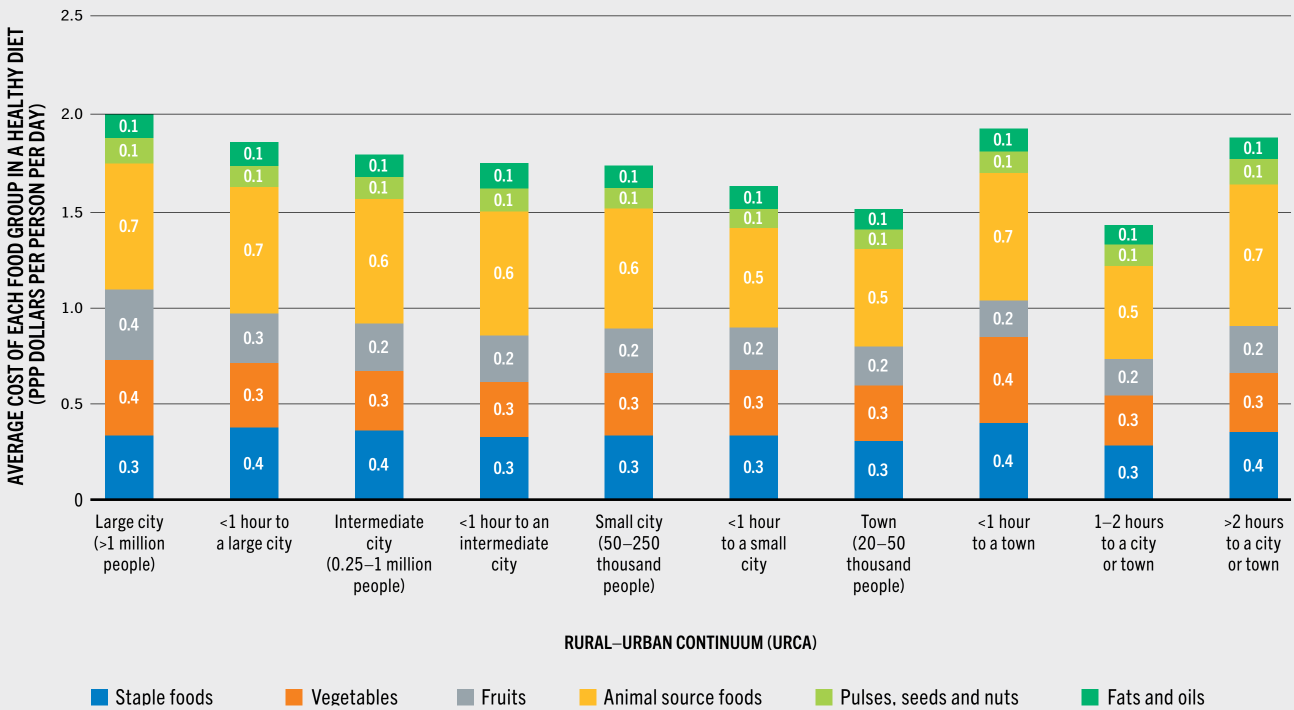
Affordability, or the cost of a healthy diet relative to income that households can credibly reserve for food, reflects the ability to access a healthy diet. Tracing this affordability across each URCA in the 11 countries analysed shows how economic access to a healthy diet follows different paths in countries with different levels of development and urbanization. Importantly, high costs do not necessarily translate into greater unaffordability, and vice »

FIGURE 31 IN THE 11 COUNTRIES IN AFRICA, THE HIGHER COST OF ANIMAL SOURCE FOODS DRIVES THE HIGH COST OF A HEALTHY DIET ACROSS THE RURAL–URBAN CONTINUUM, ESPECIALLY IN URBAN AND REMOTE RURAL AREAS

A) AVERAGE COST OF EACH FOOD GROUP IN A HEALTHY DIET ACROSS THE RURAL–URBAN CONTINUUM IN HIGH-FOOD-BUDGET COUNTRIES



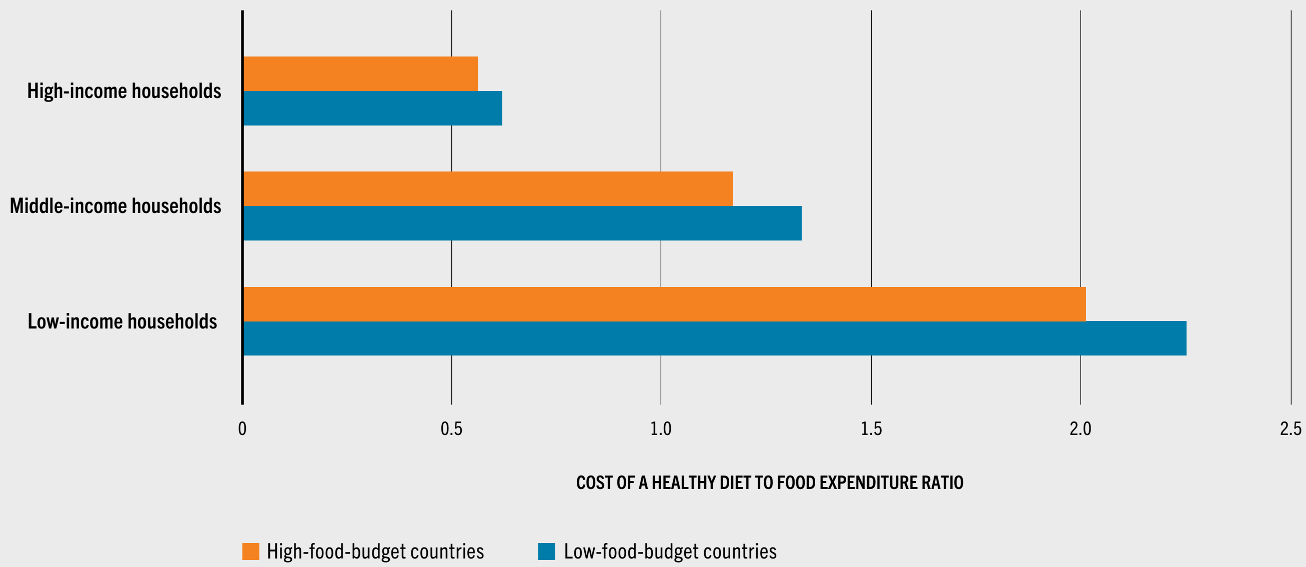
B) AVERAGE COST OF EACH FOOD GROUP IN A HEALTHY DIET ACROSS THE RURAL–URBAN CONTINUUM IN LOW-FOOD-BUDGET COUNTRIES



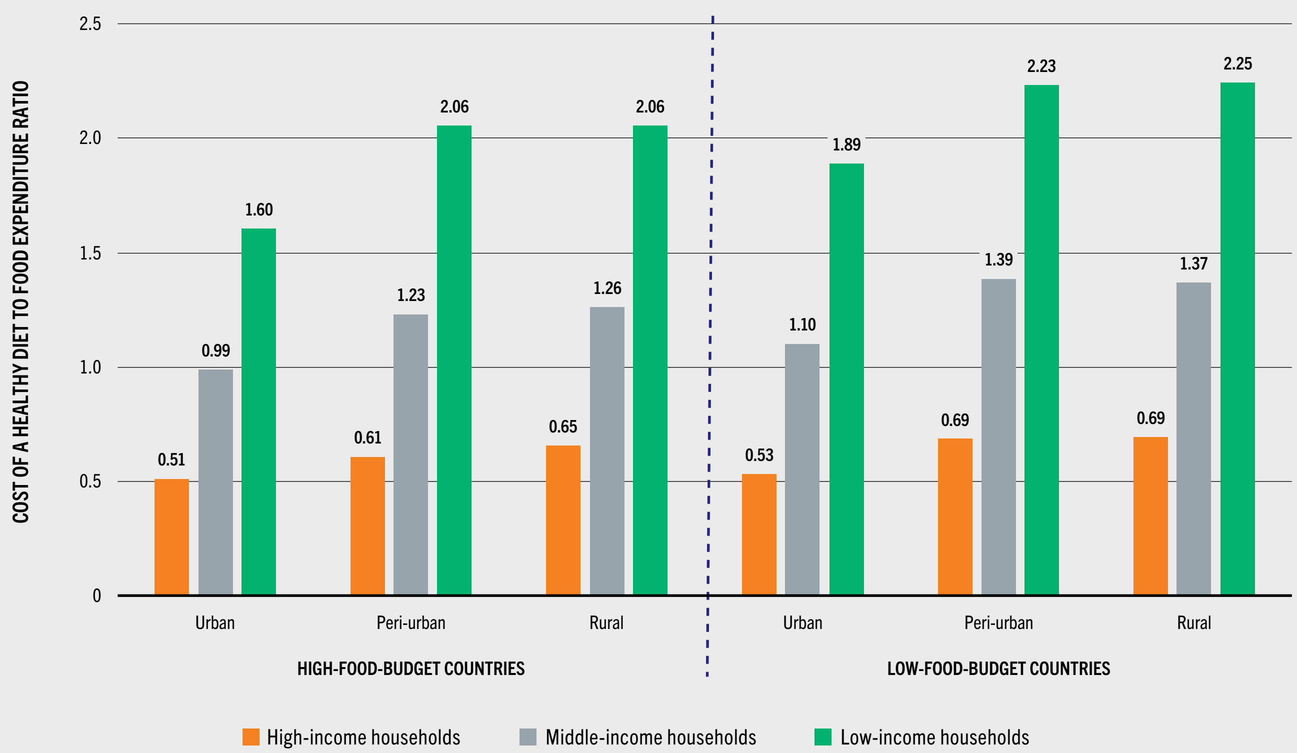
NOTES: The figures show the average cost of each food group in a healthy diet across the rural–urban continuum (URCA), for high-food-budget (Figure A) and low-food-budget (Figure B) countries. The cost of a healthy diet is expressed in PPP dollars per person per day (PPP = purchasing power parity). All surveys are for 2018/19, except Malawi (2019/20). See Table 10 for the definition and list of high- and low-food-budget countries.
SOURCE: Holleman, C. & Latino, L. (forthcoming). *Variations in the subnational cost and affordability of a heathy diet – Evidence from sub-Saharan Africa*. Background paper for *The State of Food Security and Nutrition in the World 2023*. FAO Agricultural Development Economics Working Paper. Rome, FAO.

FIGURE 32 THE COST OF A HEALTHY DIET EXCEEDS AVERAGE FOOD CONSUMPTION FOR LOW- AND MIDDLE-INCOME HOUSEHOLDS IN BOTH HIGH- AND LOW-FOOD-BUDGET COUNTRIES IN THE 11 COUNTRIES ANALYSED IN AFRICA

A) RATIO OF THE COST OF A HEALTHY DIET AND AVERAGE FOOD CONSUMPTION BY HOUSEHOLD INCOME LEVEL IN HIGH- AND LOW-FOOD-BUDGET COUNTRIES

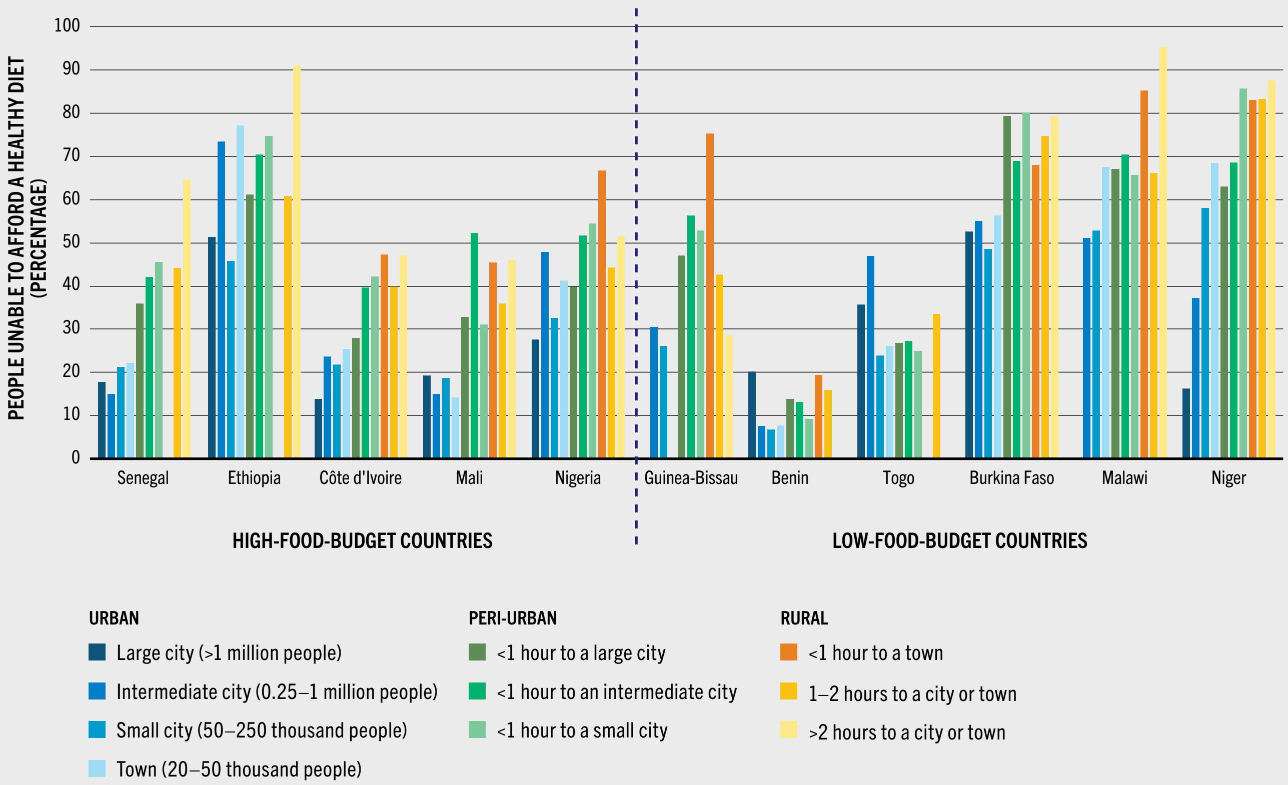


B) RATIO OF THE COST OF A HEALTHY DIET AND AVERAGE FOOD CONSUMPTION BY HOUSEHOLD INCOME LEVEL AND BY URBAN, PERI-URBAN AND RURAL AREA (URCA) IN HIGH- AND LOW-FOOD-BUDGET COUNTRIES



NOTES: In the figures, total household consumption (at market value) serves as a proxy for household income, and terciles are calculated to classify low-, middle- and high-income households. A ratio greater than 1 shows how many times a healthy diet is more expensive than average household food consumption. All surveys are for 2018/19, except Malawi (2019/20). See Table 10 for the definition and list of high- and low-food-budget countries.
SOURCE: Holleman, C. & Latino, L. (forthcoming). *Variations in the subnational cost and affordability of a heathy diet – Evidence from sub-Saharan Africa.* Background paper for *The State of Food Security and Nutrition in the World 2023.* FAO Agricultural Development Economics Working Paper. Rome, FAO.

FIGURE 33 IN THE 11 COUNTRIES IN AFRICA, THE PERCENTAGE OF THE POPULATION UNABLE TO AFFORD A HEALTHY DIET IN PERI-URBAN AREAS IS HIGHER THAN IN URBAN CENTRES AND SIMILAR TO RURAL AREAS



NOTES: All surveys are for 2018/19, except Malawi (2019/20). See Table 10 for the definition and list of high- and low-food-budget countries.
SOURCE: Holleman, C. & Latino, L. (forthcoming). *Variations in the subnational cost and affordability of a heathy diet – Evidence from sub-Saharan Africa.* Background paper for *The State of Food Security and Nutrition in the World 2023.* FAO Agricultural Development Economics Working Paper. Rome, FAO.

» versa, as this depends on the level of income relative to the cost.

Indeed, this is a key finding from the analysis. Although the cost of a healthy diet in peri-urban areas is lower than in urban areas (Figure 30A), this does not translate into a more affordable healthy diet in the former (Figure 33). On average, the percentage of the population unable to afford a healthy diet in peri-urban areas is 1.5 times higher than in urban centres and similar to rural areas.

In the Niger, a low-food-budget country with the highest percentage of population living in areas more than 1 hour from any urban centre among the 11 countries analysed, the percentage of population unable to afford a healthy diet grows as cities get smaller and as one moves into rural areas. In this case, there is an increase of 52 percentage points between large cities and towns (Figure 33 and Table A9.3 in **Annex 9**). Surprisingly, Burkina Faso and Guinea-Bissau, both low-food-budget countries, follow a pattern similar to that of high-food-budget countries, with affordability levels within each country remaining more or less constant across urban centres.

In low-food-budget countries (except Benin and Togo), moving away from urban centres introduces a structural change, with the percentage of population unable to access a healthy diet increasing significantly. In high-food-budget countries (except Ethiopia), this jump occurs one step farther along the continuum, crossing peri-urban areas of large and intermediate cities. Finally, in high-food-budget countries, the percentage of the population unable to afford a healthy diet increases across peri-urban areas as the size of the closest urban centre decreases (Figure 33).

Food insecurity across the rural–urban continuum

The comparison of food insecurity among rural, peri-urban and urban populations at the global and regional levels based on the Degree of Urbanization (DEGURBA) classification,[ac] presented in **Chapter 2**, indicates that food insecurity is lower in urban areas at the global level. At the regional level, Africa and Latin America and the Caribbean follow this pattern, but not Asia nor Northern America and Europe, revealing context-specific differences that defy generalization. An analysis of patterns of the prevalence of moderate or severe food insecurity based on the Food Insecurity Experience Scale (FIES), using household survey data for 9 of the 11 countries studied up until now, grouped by food budget (see Table 10) and according to the URCA-defined rural–urban continuum (see Table 9), sheds light on some context-specific differences and has the potential to complement the analysis in **Chapter 2**.

In many of the analysed countries, the prevalence of moderate or severe food insecurity in urban and peri-urban areas is similar to that in rural areas (e.g. Côte d'Ivoire, Senegal) or sometimes even slightly higher (e.g. Niger, Nigeria) (Figure 34). This suggests that food insecurity is not exclusively a rural problem in most of the countries analysed.

The FIES analysis shows a different pattern across the rural–urban continuum in high- and low-food-budget countries. In general, low-food-budget countries show larger differences and varying patterns in food insecurity (Figure 34A). In Malawi, moderate or severe food insecurity is much lower in urban areas and increases significantly moving to peri-urban and rural areas, with extremely high levels of severe food insecurity in both areas. Moderate or severe food insecurity in urban and peri-urban areas is about the same in Benin, but in Burkina Faso it is higher in urban areas than in peri-urban areas. Only in Guinea-Bissau and Togo is there a gradual increase moving from urban to rural areas.

In contrast, in high-food-budget countries, the prevalence of moderate or severe food insecurity is about the same across the rural–urban continuum (Figure 34A). In the case of Nigeria, there is some indication that moderate or severe food insecurity may be highest in peri-urban areas and lowest in rural areas (Figure 34A).

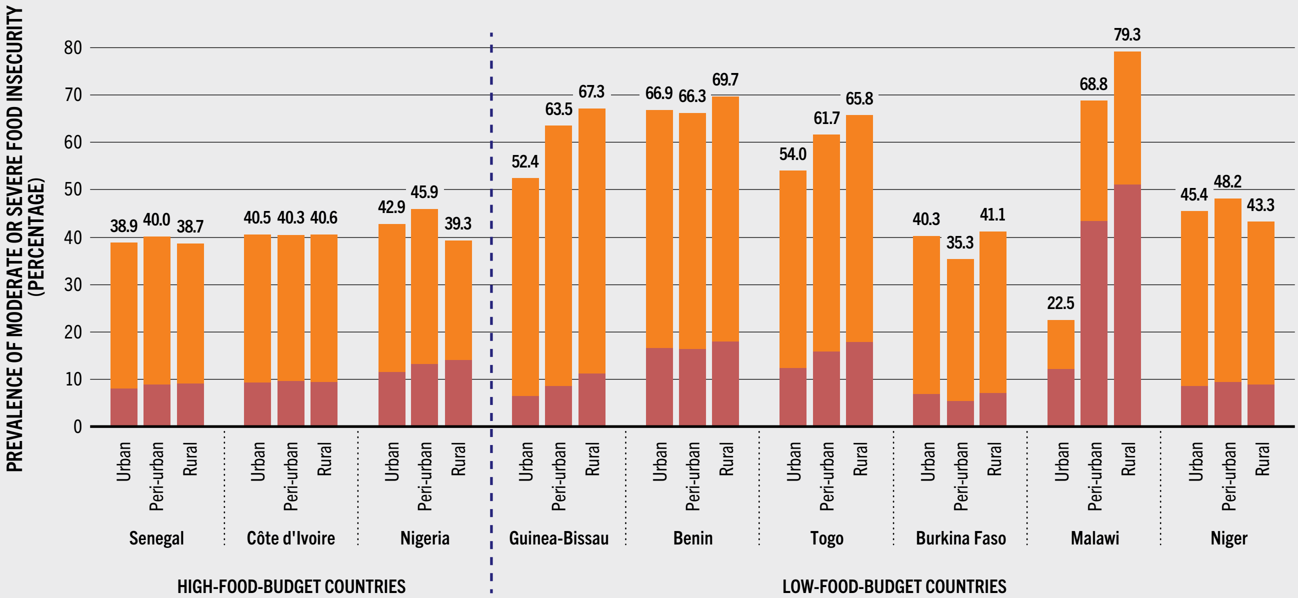
Further disaggregation reveals some additional differences. However, the sample sizes in each category are small and the margins of error are very large, so the observed patterns must be interpreted with caution (see the full set of results in Table A10.1 and Table A10.2 in **Annex 10**). For example, in Nigeria, a high-food-budget country, the prevalence of food insecurity is positively associated with city size: the bigger the city, the higher the prevalence of food insecurity (Figure 34B). Moreover, levels of severe food insecurity in large and intermediate cities (15 percent and 14 percent, respectively) are even higher than in more remote areas (10 percent in areas more than 2 hours travel to any urban centre). This is likely related to the presence of slums outside the larger cities. A similar pattern is also observed in Burkina Faso, a low-food-budget country with a more dispersed urbanization pattern.

In the Niger, the pattern is reversed: the prevalence of moderate or severe food »

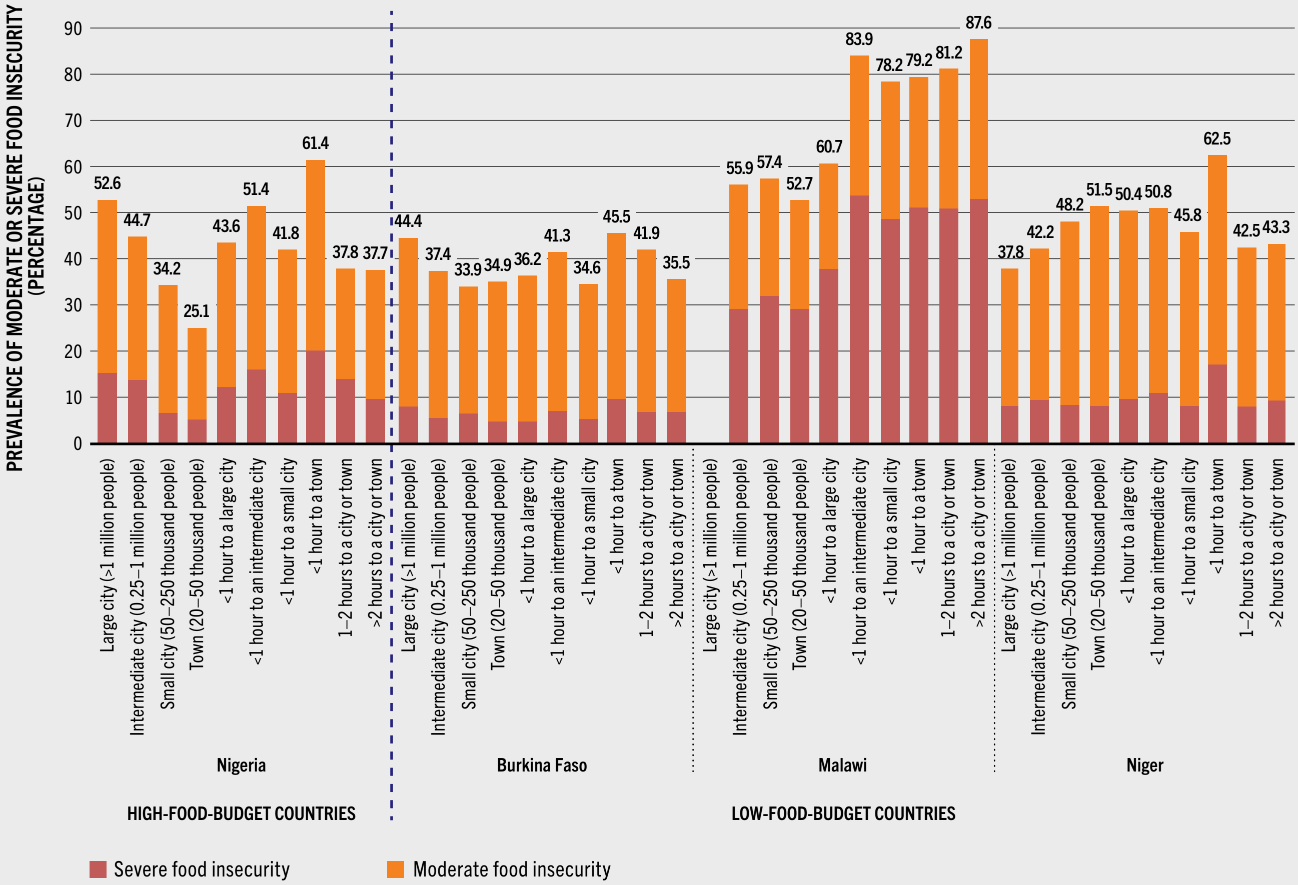
ac The DEGURBA classification was developed by EUROSTAT, ILO, FAO, OECD, UN-Habitat and the World Bank and was approved at the 51st session of the UN Statistical Commission in March 2020.[26] This differs from the Urban Rural Catchment Areas (URCA) criteria used for the analysis of subsets of countries in this section (see Box 3).

FIGURE 34 IN MANY OF THE NINE COUNTRIES ANALYSED IN AFRICA, THE PREVALENCE OF MODERATE OR SEVERE FOOD INSECURITY IN URBAN AND PERI-URBAN AREAS IS SIMILAR TO THAT IN RURAL AREAS, AND IN SOME CASES, SLIGHTLY HIGHER, INDICATING THAT FOOD INSECURITY IS NOT EXCLUSIVELY A RURAL PROBLEM IN MOST OF THE COUNTRIES ANALYSED

A) PREVALENCE OF MODERATE OR SEVERE FOOD INSECURITY IN URBAN, PERI-URBAN AND RURAL AREAS (URCA) BY HIGH- AND LOW-FOOD-BUDGET COUNTRIES



B) PREVALENCE OF MODERATE OR SEVERE FOOD INSECURITY ACROSS THE RURAL–URBAN CONTINUUM (URCA) FOR SELECTED COUNTRIES



NOTES: All surveys are for 2018/19, except Malawi (2019/20). See Table 10 for the definition and list of high- and low-food-budget countries.
SOURCE: Authors' (FAO) own elaboration.

» insecurity increases as the size of the city decreases (Figure 34B) – similar to the pattern found for the percentage of the population unable to afford a healthy diet basket in those countries – but then begins to fall moving into peri-urban areas, with the exception of a sharp uptick in areas less than 1 hour from a town. Malawi, on the other hand, presents evidence of a structural change: a sudden worsening of food insecurity, most notably severe food insecurity, for households living in areas less than 1 hour travel to an intermediate city, with high levels of food insecurity moving to remote rural areas more than 2 hours travel to any city or town (Figure 34B).

Another analysis of food insecurity based on FIES from 21 rural development projects worldwide, looking at the ten URCA categories of the rural–urban continuum, is presented in Box 6. While this analysis is not nationally representative, it provides some perspective beyond the nine African countries analysed above, even if at project level.

In summary, the results of the analysis of nationally representative FIES datasets from the nine African countries, as well as of the FIES data collected in the context of these rural development projects, tend to indicate that food insecurity is not exclusively a rural problem in many places. While it is not possible to draw general conclusions given the limited number of countries in this chapter's FIES analysis (all from one region), the results – including those from the 21 rural development projects – signal that further research is needed to guide more targeted policies and investments across the rural–urban continuum.

Nutritional status across the rural–urban continuum

The prevalence of malnutrition across the ten URCA categories was also estimated only for 3 of the 11 countries of the sections above (i.e. Benin, Nigeria and Senegal),[ad] due to data limitations. The analysis is based on 2018 data from demographic and health surveys (Table A5.1). See Table A10.3 in **Annex 10** for the full table of results.

In the three countries, generally the prevalence of stunting in children under five years of age gradually increases as cities become smaller and as one moves away from urban centres. The biggest increase in Nigeria occurs moving to areas less than 1 hour travel to a small city, while in Benin it is seen moving into more remote rural areas (i.e. more than 2 hours travel to an urban centre). The prevalence of stunting is notably lower in Senegal, and while there is a general pattern of increases, with some variations as one moves away from urban areas, the increases are smaller with some variations (e.g. there is a notable decrease in areas less than 1 hour travel to large and intermediate cities, as well as to a town).

Furthermore, as already emerged in the analysis of the cost and affordability of a healthy diet across URCAs, the data suggest that the size of the closest urban centre plays a role in the prevalence of stunting in peri-urban areas, with the prevalence being higher in areas closest to small cities and towns in Benin and Nigeria. This result is aligned with other studies that find high levels of food insecurity and malnutrition in the sprawling poverty-stricken areas surrounding many cities in Africa. Food access is limited, and many of these peri-urban slums are food deserts, where residents' access to diverse, fresh or nutritious foods is limited or even non-existent due to the absence or low density of food entry points (see Box 4 in **Chapter 3**) and inadequate access to services, including health and education. »

ad The choice of the three countries was data driven in Benin and Nigeria, as they are the only countries among the 11 for which georeferenced data on malnutrition for 2018/19 exist.

BOX 6 FOOD SECURITY ACROSS THE RURAL–URBAN CONTINUUM: EVIDENCE FROM 21 RURAL DEVELOPMENT PROJECTS WORLDWIDE

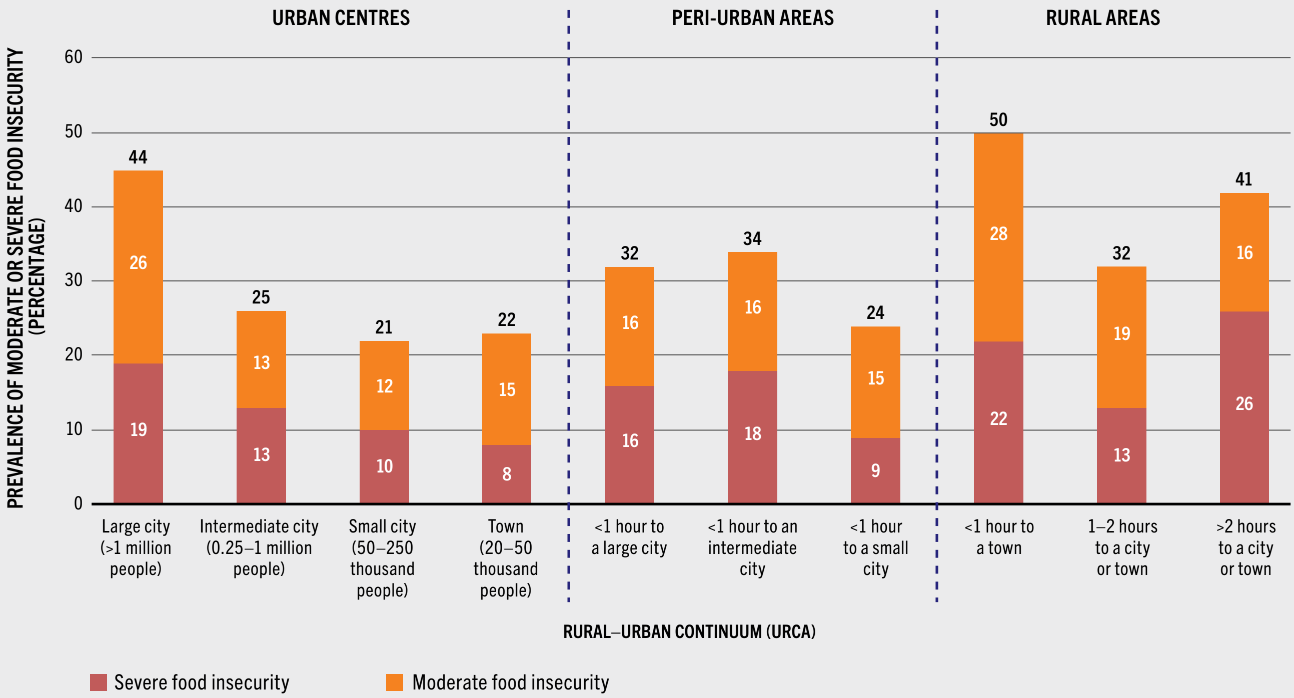
Between 2019 and 2021, household-level data with GPS coordinates were collected from 21 rural development projects supported by IFAD and implemented in most regions of the world. This includes five countries in Asia and the Pacific; six in Eastern and Southern Africa; four in Latin America and the Caribbean; four in Near East, Northern Africa, Europe and Central Asia; and three in Western and Central Africa (see **Annex 5, Section D** for the full list of countries and projects). These datasets contain information from more than 41 000 households and are representative of small-scale producers who are engaged in projects financed by international financial organizations. The data were merged with the Urban Rural Catchment Areas (URCA) dataset (using GPS coordinates), and households were thereby classified across the ten URCA categories of the rural–urban continuum.

Figure A shows the prevalence of moderate or severe food insecurity across the rural–urban continuum using the pooled sample of the 21 rural development projects. It is important to clarify that for some URCA categories, the sample size is too small to draw any statistically significant inference, thus the results are presented and interpreted in terms of a description of food insecurity across the rural–urban continuum.

Results show that the prevalence of food insecurity varies across the rural–urban continuum. There is a higher prevalence of moderate or severe food insecurity in areas close to towns (less than 1 hour travel) compared to areas more than 1 hour from a city or town. In addition, there is a much higher prevalence of moderate or severe food insecurity in larger cities compared to smaller cities or towns, and it is even higher than those living 1 to 2 hours or more than 2 hours from a city or town. This bears some similarity to findings shown in Figure 34B. On the other hand, severe food insecurity is highest in rural areas that are less than 1 hour to a town and more than 2 hours to a city or town. However, of surprise is that severe food insecurity is also very high in large cities, as well as high in peri-urban areas of large and intermediate cities. This analysis adds information on food insecurity patterns that could be more specifically addressed and targeted, but which are generally not visible when looking at only the three urban, peri-urban and rural categories.

In summary, the prevalence of moderate or severe food insecurity among a selected number of small-scale producers in urban and peri-urban areas is high – in some cases as high or even higher than in rural areas. This is similar to the findings for many of the nine African countries analysed (Figure 34).

FIGURE A PREVALENCE OF MODERATE OR SEVERE FOOD INSECURITY AMONG HOUSEHOLDS OF 21 RURAL DEVELOPMENT PROJECTS ACROSS THE RURAL–URBAN CONTINUUM (URCA)



NOTES: The figure shows the prevalence of moderate or severe food insecurity based on the Food Insecurity Experience Scale (FIES) across the rural–urban continuum for 21 rural development projects implemented in countries from all regions of the world. See **Annex 5, Section D** for the list of countries and projects, data sources and methodology.
SOURCE: Authors' (IFAD) own elaboration.

FIGURE 35 THE PREVALENCE OF CHILD STUNTING GENERALLY INCREASES AS CITIES BECOME SMALLER AND MOVING AWAY FROM URBAN CENTRES; CHILD WASTING AND OVERWEIGHT ARE LOWER AND EXHIBIT LESS EVIDENT TRENDS ACROSS THE RURAL–URBAN CONTINUUM

NOTES: Figures show the prevalence of malnutrition in children under five years of age in three Western African countries, by URCA category (2018). Gaps in URCA indicate missing data.
SOURCE: Authors' (UNICEF) own elaboration.

» The prevalence of wasting in children under five years of age is lower than that of stunting in all three countries and exhibits less evident trends across the rural–urban continuum (Figure 35B). Nevertheless, there are hints of increased wasting in some peri-urban and rural areas in Nigeria and Senegal. Similarly, the prevalence of overweight in children is low in all countries and does not present a clear trend across the rural–urban continuum (Figure 35C). However, it is worth noting there is a suggestion towards lower overweight in peri-urban areas and higher overweight in some rural areas compared to urban areas. ■

NETHERLANDS (KINGDOM OF THE)
Hanging tomatoes ripening on their stalks in an industrial greenhouse. ©Shutterstock/ Sergey Bezverkhy

CHAPTER 5
POLICIES AND SOLUTIONS TO LEVERAGE AGRIFOOD SYSTEMS TRANSFORMATION FOR HEALTHY DIETS ACROSS THE RURAL–URBAN CONTINUUM

KEY MESSAGES

➔ Actions, policies, new technologies, and consequently needed investments to overcome the challenges and seize the opportunities that urbanization creates require a clear understanding of the interaction between agrifood systems and the rural–urban continuum.

➔ The policy approach needs to leverage the progressive connectivity between urban, peri-urban and rural areas through investments in infrastructure, public goods and enhanced capacities, in order to increase access to affordable healthy diets and achieve food security and nutrition for everyone across the continuum.

➔ In the face of a gradual convergence in dietary patterns across the rural–urban continuum, including the consumption of highly processed foods, policies and legislation are needed to promote healthy food environments, both formal and informal, and to empower consumers to make nutritious food choices.

➔ In intermediate and small cities and towns and their peri-urban and rural surroundings, the midstream activities of agrifood systems (i.e. logistics, processing and wholesale) can play an essential role in economic development, reducing the cost of nutritious foods and improving income opportunities. This is particularly the case for new investments that enable small and medium enterprises to expand.

➔ The rural–urban continuum lens is critical to determine what and where support is most needed to address the insufficient worldwide availability of and access to nutritious foods, particularly fruits and vegetables. Improved access to production inputs and irrigation infrastructure are needed across the whole rural–urban continuum, but support should target especially smallholder farmers in rural areas and urban and peri-urban agriculture (UPA) elsewhere.

➔ Public investment in research and development needs to be increased to develop technologies and innovations to create healthier food environments and increase the availability and affordability of nutritious foods. Technology can be particularly important to boost the capacity of UPA to supply nutritious foods in cities and towns.

➔ To strengthen rural–urban continuum connectivity and linkages, agrifood systems governance mechanisms and institutions need to cross sectoral and administrative boundaries. Subnational and local governments must play a key role in designing and implementing policies beyond their administrative authority, engaging with agrifood systems stakeholders at all levels.

➔ Evidence from multilevel and multisector governance mechanisms implementing school feeding, UPA and/or public procurement suggests these are potential entry points for making healthy diets available and accessible.

Patterns of urbanization, as well as the size and clustering of urban agglomerations and the surrounding rural areas, are transforming agrifood systems with implications for access to affordable healthy diets, as well as food security and nutrition (**Chapter 3**). The increased links across the rural–urban continuum, coupled with closer interactions between the components of agrifood systems, create a number of opportunities and challenges for the availability and affordability of healthy diets. This chapter argues that such interactions also create a number of policy and programme entry points to support agrifood systems transformation towards affordable healthy diets. However, a change of direction in policy is needed which considers both agrifood systems and spatial dynamics, and their interactions and interconnectedness. A systems approach is therefore better suited for effective solutions.[1]

Such an approach should also consider the increasing convergence in food demand and supply patterns across the rural–urban continuum (**Chapter 4**). The growing importance of food purchases, and of processed foods in dietary patterns, opens up the opportunity for leveraging midstream and downstream agrifood systems activities which link primary production to the final consumer. At the same time, the strong growth of small and intermediate cities and towns (SICTs), which, as shown in Figure 19B of **Chapter 3**, comprise almost one-third of the global population, needs to be considered in policy and planning. Scholars have called them the "hidden" and the "missing" middle, respectively.[ae] Therefore, policies, investments and legislation supporting the "hidden/missing middle" can leverage the increased interconnectedness driven by urbanization to facilitate the creation of scale economies for smallholder farmers and agrifood small and medium enterprises (SMEs), increase off-farm employment opportunities and rural household incomes, and reduce the cost of healthy diets.

The interaction between agrifood systems and the rural–urban continuum introduces the notion of a "territory" as a unit of analysis and policymaking for agrifood systems transformation towards improving food security and nutrition.[4] A territory in this context includes one or more urban areas which are connected to each other and to the rural hinterland through a dense set of agrifood systems links. Those links can be leveraged to promote a place-based agrifood systems transformation for improved access to affordable healthy diets across the rural–urban continuum leading to win–win situations.[af] For instance, increased off-farm income opportunities in peri-urban and rural areas in midstream and downstream activities could increase economic access to healthy diets, while improved efficiency in the connectivity between producers in rural areas, midstream activities in peri-urban and urban areas, and consumers could reduce the cost of nutritious foods.[ag]

The policy approach should take into consideration the development and adoption of technologies and innovations as essential elements for transforming agrifood systems inclusively and sustainably towards improved access to affordable healthy diets.[7, 8] Reinforcing the science–policy interface is fundamental to leverage transformative opportunities,[8] and can be an essential complement for many policies, investments and legislations oriented to shift dietary preferences towards healthy diets, improve the efficiency of midstream activities and increase the supply of nutritious foods. Given the multiple entry points created by urbanization, however, there will be no "one-size-fits-all" technological or innovative solutions to address all the challenges and take advantage of the opportunities for current agrifood systems.

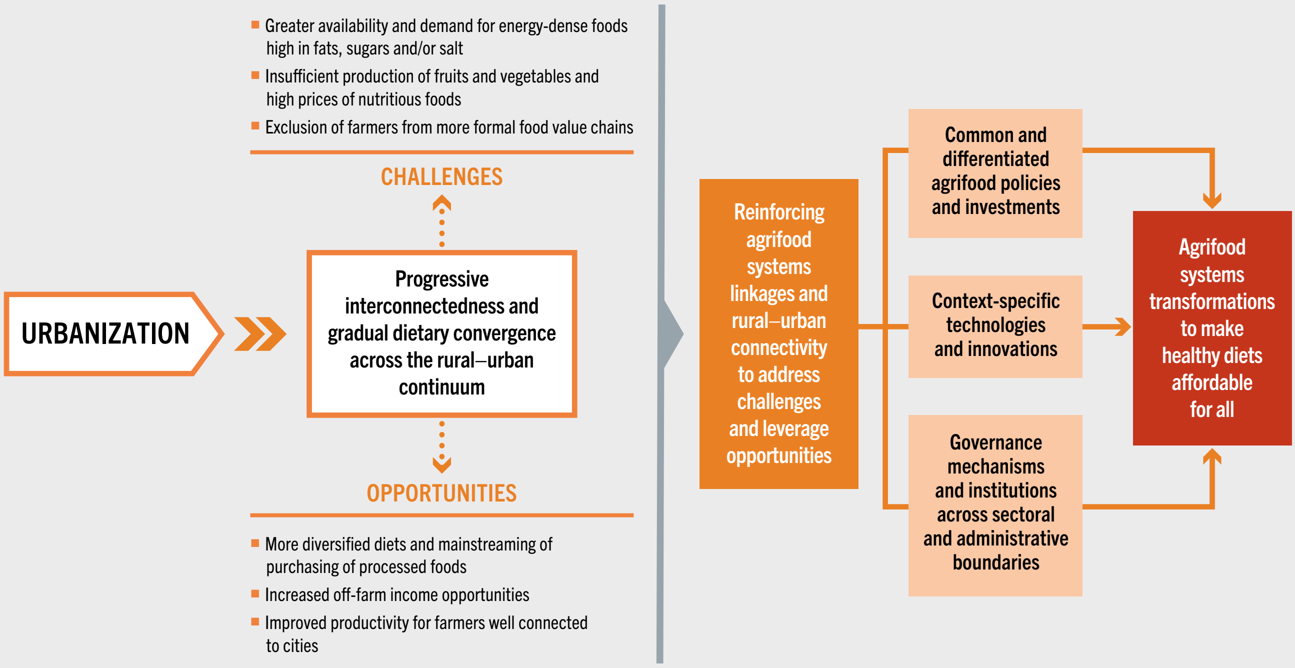
Finally, a policy approach which considers the territory is inherently intersectoral and involves different agrifood systems stakeholders: public, private and civil society. The success of this territory-oriented policy approach rests therefore on the coordination of several actors and stakeholders. Strong institutions and governance mechanisms are required to coherently implement policies, investments and legislation on one side, and leverage technology and innovation on the other, but they have to be

ae The "hidden middle" is attributed to Reardon (2015)[2] and refers to the agrifood component between primary producers and final consumers. It includes the "midstream" and "downstream" segments as defined in **Chapter 3** of this report. The "missing middle" is attributed to Christiaensen and Todo (2014)[3] and refers to small- and medium-sized cities. In both cases, the terms have been used to indicate that policies often miss the particularities and dynamism of the two "middles".

af This approach is also called "agroterritorial development" and is analysed in detail in the 2017 edition of *The State of Food and Agriculture in the World*.[5]

ag As indicated in the 2020 edition of this report,[6] inadequate food logistics and poor public infrastructure, especially for perishable foods, are key drivers of the cost of nutritious foods.

FIGURE 36 REINFORCING AGRIFOOD SYSTEMS LINKAGES AND RURAL–URBAN CONNECTIVITY TO MAKE HEALTHY DIETS AFFORDABLE ACROSS THE RURAL–URBAN CONTINUUM



SOURCE: Authors' (FAO) own elaboration.

oriented to enhance agrifood systems linkages through the growing rural–urban connectivity. In particular, subnational governments and local governance mechanisms are key factors for improving linkages across the rural–urban continuum.[9] Figure 36 provides a visual summary of this approach to address the challenges and leverage the opportunities that urbanization creates in agrifood systems for ensuring access to affordable healthy diets across the rural–urban continuum.

This chapter first analyses different policy alternatives available among the components of agrifood systems, through a rural–urban continuum lens, to address the challenges and leverage the opportunities for access to affordable healthy diets identified in the previous chapters. As such, this chapter focuses on policies to promote healthy food environments; policies and investments to leverage the economic potential of the midstream of agrifood systems in SICTs, which can lead to reduced cost and improved affordability of healthy diets; and food production policies to increase the supply of nutritious foods. It then identifies technological and innovative solutions across the different agrifood systems components that show potential to support agrifood systems transformation towards affordable healthy diets, noting those that can particularly work. Finally, the chapter examines governance mechanisms deemed most appropriate to manage the proposed policy approach across administrative and sectoral boundaries, and highlights the role of subnational governments and local administrations in designing and implementing such mechanisms. ■

5.1 POLICIES AND INVESTMENTS FOR HEALTHY DIETS ACROSS THE RURAL–URBAN CONTINUUM

Food environments and consumer behaviour policies

Households obtain foods through various sources, for example through own production, purchases or gifts. As has been noted previously, the majority of households across the rural–urban continuum acquire foods through purchases. In addition, processed foods are an important part of households' food consumption, not only in big cities but also in small towns and rural areas.

Certain aspects of retail food environments[ah] are becoming more similar across the rural–urban continuum, for example, the presence of food outlets and their role in making highly processed foods more available. However, there are also differences in the level of formality of food outlets (e.g. supermarkets or smaller food shops). Large and formal outlets are more common in urban settings and their surroundings, and less so in rural areas far from cities where informal vendors or "traditional" outlets (i.e. open-air or wet markets) are more prevalent.[11, 12] Yet these informal vendors still play an important role in retail food environments even in large or intermediate cities, particularly in low-income neighbourhoods and slums.[13] Influencing food environments through supportive nutrition policies is an important entry point to facilitate better access to safe, affordable and nutritious foods and reduce consumption of highly processed foods of high energy density and minimal nutritional value. For this, an understanding of the specificities of retail food environments across the rural–urban continuum will be key to identify common policies for the entire continuum but also differentiated policy entry points for key "nodes" across the continuum (e.g. food environments in small cities or towns versus food environments in large cities).

Regulation of food and beverage marketing can be important in a variety of settings across the continuum.[ai] Advertising of highly processed foods in rural settings is common and, depending on the country, sometimes even more widely used than in urban areas.[11] Examples of local initiatives to create healthier retail food environments include restricting advertising of energy-dense foods high in fats, sugars and/or salt in the vicinity of schools[15] in Mandurah (Australia), and on public transport in London.[16, 17]

Taxation of energy-dense foods and beverages high in fats, sugars and/or salt has been implemented in 85 (for sugar-sweetened beverages) and 29 (for foods high in fats, sugars and/or salt) countries[18] and has shown clear evidence of providing disincentives for buying these foods,[19] contributing to shifting the demand towards more nutritious foods.[14] A recent systematic review in six countries (Australia, Canada, Mexico, South Africa, United Kingdom of Great Britain and Northern Ireland, and United States of America) found not only evidence of the impacts of such taxation on reducing the sales of energy-dense foods, but also that the health-related benefits largely exceed the possible health costs of not intervening.[20] Taxation can also encourage product reformulation to reduce the content of the target component (e.g. sugars, salt, unhealthy fats), thus improving its nutrient profile.

Nutrition labelling, by providing information on the nutrition properties and the quality of foods to aid purchase and consumption decisions, has the potential to help rebalance a food retail environment currently skewed towards foods that undermine healthy diets.[21] Marketing influences children's food preferences, purchase requests and dietary intakes. Governments have a legal obligation to protect child rights, including those that are threatened by harmful marketing.[22]

ah Also called "built" food environments, they include informal and formal markets where available food is chosen and purchased.[10]

ai For more details regarding how these policies contribute to healthy diets, please refer to the 2022 edition of this report.[14]

Supporting healthier food outlets will be key for enabling access to healthy diets, as this has shown positive impacts on dietary quality.[23] While small neighbourhood food shops are important for the food security of households, particularly for low- to middle-income ones, consumers are disproportionately exposed to energy-dense highly processed foods in these shops.[10] This could be particularly important in rural areas, where food is increasingly purchased in these kinds of food outlets.[11, 12] Policy incentives are necessary to encourage shops to stock and sell greater amounts of fresh and minimally processed foods, for instance, by improving their cold storage facilities.[24] The availability of healthier food outlets in particular areas across the rural–urban continuum can be improved through land-use planning and zoning regulations; tax credits or exemptions; or licensing agreements.[14] Although land-use planning tools are generally underutilized to support healthy diets, a combination of financial and zoning incentives has been used at the city level to increase the availability of healthy and affordable food options in shops in under-served areas.[25] Measures in place to restrict outlets that predominantly sell energy-dense foods high in fats, sugars and/or salt include, for example, local authority zoning measures that limit the establishment of hot food takeaways or fastfood restaurants in or around schools[26, 27, 28, 29] or in particular neighbourhoods.[30]

In rural areas, where food sources include purchased food and own production, some policies could have positive effects not only in shifting dietary patterns but also on the availability and accessibility of healthy diets. **Nutrition education**, while more common in urban settings, has proven vital to encourage more diverse and healthier dietary patterns at the household level. Several studies have found that in rural settings, nutrition education at home or in schools could increase dietary diversity in food consumption and, at the same time, incentivize diversification of food production, possibly improving the availability of nutritious foods at the community level.[31, 32]

Considering that income is a main determinant of the affordability of healthy diets, **cash transfers** are also important for poor households across the rural–urban continuum. In rural areas, these can contribute to improve dietary patterns and promote diversification of food production through the alleviation of liquidity constraints.[33, 34] In addition, cash transfer programmes associated with nutrition education offer greater chances to improve child nutrition and health.[35]

Turning to urban and peri-urban settings, street food and food away from home businesses[aj] play a particularly important role in both employment provision and food security for the most vulnerable populations. Street foods are especially convenient for low-income workers and households who may not have the resources, facilities and/or time to prepare dishes at home.[1] In some contexts, informal street vendors can also be a key source of both nutritious foods and livelihood; for example, in a peri-urban area of Dar es Salaam where 70 percent of vegetables were sold by informal vendors, often most of these vendors were women (i.e. for 95 percent of green leafy vegetables).[36] However, street food does not always contribute to healthy diets among poor urban and peri-urban food consumers.[37] A critical aspect is to ensure the **safety and nutritional quality of street foods**, considering both the high degree of informality of the street food sector and the fact that street foods are consumed by an estimated 2.5 billion people worldwide every day.[38] Informal street vendors play a major role in providing food to the most vulnerable populations in low-income countries (LICs) of Africa and Asia, particularly in urban settings.[1] There are multiple infrastructure and regulatory gaps along the street food supply chain and many street vendors have temporary structures with no running water or cold storage and sanitation facilities. Important food safety actions include ensuring a supply of water of acceptable quality for food preparation, clean places for preparation and consumption of food, sanitary facilities for workers in food outlets, training for street vendors and consumer education.[38] Interventions at national and local government levels are also required to ensure nutritional quality for street foods in each local situation (see Box 7).

aj All food and beverage outlets where food and drink can be purchased and consumed outside the home, either on or off the premises. See the **Annex 11** for a full definition of food away from home.

BOX 7 INITIATIVES FOR MORE NUTRITIOUS FOOD AWAY FROM HOME IN SOUTH-EASTERN ASIA

Ready-to-eat foods sold in restaurants, small-scale eateries or online, and also sold by food hawkers and street vendors, make up an important part of the diets of many urban populations in South-eastern Asia. Many people consume food away from home at least once a day, and sometimes for all three daily meals.[41, 42] Food away from home is also of cultural and economic importance in the region, with many people relying on the informal food sector for their livelihood.

Singapore has implemented a comprehensive, multistakeholder approach, led by the Health Promotion Board, to improve the supply of healthier options in the food away from home sector, while also increasing demand for these options among consumers.

To improve the availability and accessibility of nutritious foods, the government provides research-based support to industry to produce healthier base ingredients such as wholegrain noodles with a high fibre content. The Healthier Dining Programme[43] – building on the earlier Healthier Hawker Programme and the creation of hawker centres in the early 1970s to improve the safety of street foods[44] – supports food outlets to incorporate healthy options through reformulation grants.[33] These grants can, for example, help in covering the cost of buying healthier ingredients, paying for healthy cooking classes or funding research and development. Separate grants are available for promotion of healthier food and drink options.[45]

To help increase demand, awareness-raising campaigns have used simple messages to highlight healthy options. Food items endorsed by the Healthier Dining Programme are clearly labelled with "Healthier Choice" meal identifiers on menus/menu boards, counter tops, shelves and packaging. In addition, the Eat, Drink, Shop Healthy Challenge campaign[46] promotes healthier options and offers rewards for selection of healthier choices through a smartphone app.

These elements are supported by a whole-of-government approach, including a commitment to use healthier ingredients in all catering services in government institutes including schools. This pledge was important for encouraging investment in product innovation and reformulation.

Finally, it is important to consider that gender plays an important role in accessing affordable healthy diets and, in turn, food security and nutrition. **Improving women's status and gender equality** positively influence the nutritional status of women and their families. Therefore, eliminating structural gender inequalities and unleashing women's potential can play a fundamental role in improving access to affordable healthy diets. For instance, evidence demonstrates that most transport systems are biased towards the travel needs of men.[39] In Blantyre, Malawi, reduced transport options to peri-urban and rural informal markets, which are often more affordable than urban markets for poor people, have reduced access to affordable sources of food for female-headed households.[40] This points to the need for multifaceted and targeted territorial planning to address gender-related challenges to access affordable healthy diets. Efficient transport systems can reduce the time between home and work, as can strategically locating city food outlets that supply nutritious, diverse food on the routes that women take in their daily lives.[39]

Midstream food supply chain policies: strengthening the role of the "hidden/missing middle" in making healthy diets affordable for all

As countries grow and transform, urban populations also grow but follow differential clustering patterns in different countries or contexts (**Chapter 3**). Structural transformation is accompanied by a rapid increase in large cities in some countries, while in others by the growth of SICTs reducing the space between large cities and the rural hinterland.[47, 48] Differential patterns of population agglomerations have been found to be associated with different rates of economic growth and poverty reduction,[3, 49] and have implications for agrifood systems and healthy diets and nutrition.

Food production, especially that of perishables (such as fruits and vegetables, which are important elements of healthy diets), tends to be located in the proximity of urban markets to minimize transactions and transport costs.[50] However, as agrifood systems are transformed by urbanization, it is not physical distance but travel time that matters. Thus, food production located in areas far from urban centres but with better access to natural resources (e.g. high-quality soil, water) can be better suited for supplying these centres, provided the cost of transport is low and midstream activities such as processing, logistics and transport are available and efficient.

The key role of small and intermediate cities and towns in agrifood systems transformation

Chapter 3 indicated that one-fourth of the global population live in peri-urban areas of small and intermediate cities and towns. For poor populations seeking to increase their physical, economic and social mobility, SICTs serve as a "first step" towards migration to bigger cities (or abroad) but also as an end destination for permanent migration.[3] Proximity of SICTs to rural areas allows agricultural and rural households to increase and diversify their incomes through daily commuting to nearby towns, seasonal or permanent migration, and remittances.

In general, the clustering of populations in only a few localities (i.e. urban concentration in metropolises) is associated with higher overall economic growth as a result of economies of scale and agglomeration when driven by structural transformation (**Chapter 3**). Nevertheless, low skill employment opportunities in non-farm economic activities generated in SICTs may be more readily accessible to the poor, who tend to be unskilled and semi-skilled.[38, 39] Properly targeted public policies and investments in SICTs could attract private investments including in agrifood activities, thus creating employment, increasing demand for food from local agriculture, and enabling poor people in those locations to escape poverty and increase their access to healthy diets (Box 8). Investing in SICTs is likely to have a more significant impact on healthy diets both for their populations and for the populations of their catchment areas compared to the benefits that trickle down from growth in large cities.[ak]

However, in most cases, especially in lower-middle-income countries (LMICs), SICTs are constrained from delivering on their potential for catalysing inclusive agrifood systems transformation and improving access to affordable healthy diets. Urban expansion is unplanned and unregulated, while local governance is characterized by weak capacity to plan and execute programmes and insufficient resources (from national transfers or local revenue raising) to finance them. This translates into lack of basic infrastructures and services (road networks, ports, housing, access to markets, health, education and social protection), which in turn limits private investment in growth sectors and the potential for employment and income generation.[54] For instance, absence of transport infrastructure connecting rural areas to nearby towns and intermediate cities has been shown to negatively affect agricultural productivity and nutrition.[55, 56]

Addressing some of the challenges faced by SICTs can allow agrifood systems to be the driver of inclusive rural development through the creation of on- and off-farm employment for rural households, as well as of increases in food production and productivity due to increased food demand, scale economies and expanded market outlets. This also creates opportunities for SMEs, which have an essential role to play in this development, as discussed below.

Supporting midstream small and medium enterprises to increase availability and affordability of nutritious foods

Small and medium enterprises (SMEs), especially in LMICs, play a key role in ensuring connectivity between primary producers and final consumers. From a spatial point of view, SMEs connect the rural hinterland to expanding urban and peri-urban agglomerations of all sizes. They include a constellation of midstream activities involving rural and urban traders

ak This is particularly important considering the analysis presented in **Chapter 2**, which shows that the prevalence of moderate or severe food insecurity tends to be higher in peri-urban and rural areas around the world. Please refer also to **Chapter 3**, in which the importance of SICTs for poverty reduction is analysed.

BOX 8 THE ROLE OF URBAN PROXIMITY IN AGRICULTURAL INTENSIFICATION: CASE STUDIES IN ETHIOPIA AND INDIA

Evidence largely shows that agriculture practised in proximity to urban centres is more productive due to better input prices received, access to input markets and increased adoption of modern agricultural inputs. However, less is known about how patterns of urbanization and the size of urban centres affect agricultural production.

A study in Ethiopia shows that the proximity to cities of different sizes has differentiated implications for farmers' agricultural intensification decisions: rural farmers living near a large city such as Addis Ababa use more modern inputs and achieve higher yields than farmers near small and intermediate cities and towns (SICTs). However, in the absence of SICTs, farmers excluded from the central market in a large city would most likely remain subsistence oriented. But when the population is partially distributed in SICTs, farmers who were initially located too far from a large city to produce for its market can meet urban demand for food from SICTs.[51]

A study focused on the large Indian city of Bangalore and its surroundings provides evidence that may confirm the essential role of SICTs in increasing the use of modern agricultural inputs in rural areas, by offering improved linkages with markets. In some cases, farmers located farther from Bangalore show a higher use of modern inputs due to the influence of the town of Doddaballapura.[52] In addition, evidence of the potential of SICTs for improving rural livelihoods through non-agricultural jobs emerges in a later study in Ethiopia, which shows that the expansion of SICTs has a positive short-term effect on household welfare, driven by increased participation in the non-agriculture sector.[53]

Policy can strengthen intensification and increased productivity in farming close to SICTs, by improving connectivity between farms and input and output markets, thus reducing the cost of access to both domestic and international markets and fostering farmers' access to and use of modern inputs.

and retailers, truckers, third-party logistics firms, storage service providers, processors and distribution networks.

For SMEs located in SICTs, many are taking advantage of, *inter alia*, the closeness to production areas. However, this is not always the case: the location of SMEs depends on a number of other factors including regular supply of agricultural products, perishability of raw materials, bulkiness and value of agricultural commodities *vis-à-vis* processed products, the state of infrastructure and transport networks, electrification, and access to water.[57, 58, 59]

Midstream SMEs can be fundamental for rural investment, off-farm employment, modernization of the agrifood sector, upgrading utilities such as water and energy, and linking small farms to expanding urban food markets.[60] As such, they can support livelihoods for agricultural households and communities and for nearby populations.[61] Strengthening their efficiency and expansion can also contribute to gains in the production and productivity of nutritious foods, and a possible parallel reduction in the cost of food for consumers. For example, in Kenya more than 95 percent of the fresh fruits and vegetables consumed are grown domestically, mainly by smallholders, and are supplied mainly by SMEs through informal supply chains.[62]

The presence of processed foods in household diets across the whole rural–urban continuum constitutes a driving force for expansion of the services provided by SMEs in processing and distribution, as these enterprises are involved in a wide range of processed foods (Box 9).[63]
By transforming perishable raw materials into palatable products with a long shelf-life, SMEs contribute to broadening options for consumers, helping offset seasonality and reducing food loss. Increased demand for agricultural inputs, and downstream processing and related services and logistics, constitute additional drivers for expansion.

BOX 9 SUPPORTING INCLUSIVE FOOD VALUE CHAINS IN AFRICA

Investing in agrifood processing creates opportunities for developing local entrepreneurship and generating employment and value addition in rural and peri-urban areas of Africa.[65] While most processed agrifood products have traditionally been imported from outside Africa, local sourcing of these products is on the rise, including from cottage industries. This increase is largely in response to the growing peri-urban and rural market demand for processed foods.[66, 67] If investments in domestic agrifood processing are not made in African countries, there will be a continued dependence on imports for these products.

Capitalizing on this potential requires channelling of substantial resources towards local agrifood processing in addition to lowering of barriers faced by local processors to entry in new and distant (including export) markets. This requires, *inter alia*, supportive financial and market linkage services to connect small-scale producers in rural areas with traders and aggregators in peri-urban and urban areas. However, there could be other approaches. Future research could focus on how a variety of measures – such as international transfers as well as trade and fiscal measures in high-income countries – might also help address the challenges to financing agrifood processing that African and other low- and middle-income countries face.[14]

There are already examples of investments in agrifood processing in peri-urban areas of Africa. For instance, in Ghana, the Rural Enterprises Programme works to improve the livelihood of rural small and medium enterprises by increasing profitability and generating growth and employment opportunities. The project has established sustainable district-level delivery systems for business development services in peri-urban centres; offered capacity building and training related to manufacturing processing equipment and testing prototypes; and facilitated linkages with participating financial institutions including rural and peri-urban banks. Total income, durable assets, and business income were, respectively, 50 percent, 55 percent and 25 percent higher for beneficiary households *vis-à-vis* non-beneficiary ones,[68] and household dietary diversity increased by 10 percent. Furthermore, women were more likely to manage self-employment activities jointly with men and have higher decision-making power related to access to credit.

In the United Republic of Tanzania, the Marketing Infrastructure, Value Addition and Rural Finance Support Programme was created to, *inter alia*, provide support to small-scale producers to overcome the main barriers encountered along the agrifood value chain. Such barriers include limited access to credit and inputs, absence of functioning post-harvest storage facilities, difficult access to markets, and the dearth of skills to use available technology. The project rehabilitated rural roads, strengthened agrifood processing and agricultural market information systems, supported production and decision-making capacity of producers and traders regarding purchase and sale of inputs and outputs, and increased the capacity of rural and peri-urban financial institutions, for example by linking them to the formal banking sector. This resulted in significant increases in agricultural income, livestock assets and productive assets for beneficiary households representing 16 percent, 11 percent and 7 percent, respectively.[69] Crop yields and crop revenues increased by 29 percent and 18 percent, respectively; household dietary diversity was also found to have increased by 4 percent. Moreover, women were more likely to hold decision-making power regarding crop revenues jointly with men, and were also more likely to be members of influential groups in their communities.

Small and medium enterprises can contribute to nutrition improvements in rural areas by enhancing smallholders' access to markets and inputs. In addition, they can stimulate upgrading at the farm level by providing inputs and finance[64] and offering differentiated pricing based on quality. For these reasons, SMEs have great potential to contribute to rural poverty reduction and access to healthy diets, by expanding employment opportunities in the SMEs themselves, boosting farming incomes and increasing the supply of nutritious foods.

However, a number of challenges prevent SMEs from fulfilling their potential and taking advantage of growth opportunities.

These challenges are often neglected in research and national policy formulation aiming at agrifood systems transformation, inclusive rural development or urban planning.[70, 71, 72] In LMICs, SMEs are often scattered, numerous, and small to very small in size; they are predominantly informal, and family owned. They face high transaction costs due to their size but also weak infrastructure, while their growth is limited by insufficient access to finance, lack of support for accessing improved technologies, and lack of policy initiatives targeting their growth. Because many of them depend on local sourcing rather than on a diversified base of commodity supplies, they face covariate risks with local farming. The existence of multiple constraints limits their potential to accumulate assets and expand operations, including as sources of employment and income diversification and as contributors to healthy diets.[60] There is also public underinvestment in specific value chains that would contribute towards increased availability of nutritious foods: namely, a disproportionate amount of public investment is directed towards staple crop productivity.[14]

Furthermore, SMEs located in SICTs are at a competitive disadvantage *vis-à-vis* larger firms. Scattered evidence shows that economies of scale and scope feature more prominently when intermediaries serve an urban population concentrated in large cities, rather than one that is spread across many mid-sized cities, although more systematic research is needed on this aspect.[70] Women are also heavily engaged in SMEs, both as workers and as entrepreneurs; however, they systematically face constraints to scaling up their business due to financial, mobility and empowerment gaps.[73] In addition, many SMEs involved in midstream activities are informal, which may exclude them from public services and policies that are mostly oriented to formal agribusinesses.[74]

It is also important to note that unleashing the potential of SMEs does not come without trade-offs between growth and employment and healthy diet outcomes. Increasing the productivity and reducing the cost of unhealthy processed foods (e.g. sugary drinks, bleached flour, refined starches, oils and sugars) lowers the price of those foods, thereby creating a cost advantage *vis-à-vis* minimally processed or unprocessed items such as fruits and vegetables.[6, 75]

The growing middle class food markets in LICs can be leveraged to increase supplies of processed nutritious foods.[76, 77] In this context, there are opportunities to invest in processing SMEs, through the identification of specific value chains and products that can both be nutritious and provide value-added livelihood opportunities for value chain participants. Examples of this are moringa (moringa powder) and a range of non-timber forest products.[78]

Policies and investments to leverage the potential of the “hidden/missing middle” to provide affordable healthy diets for all

Policies to enable the potential of SICTs for growth, poverty reduction and improved access to affordable healthy diets should facilitate the flow of people, products and resources between such cities and their rural catchment areas, but also expand the reach of local agriculture to more distant markets. These improvements in connectivity are also critical for SMEs. Better linkages between producers, agro-industrial processors,[al] agricultural and non-agricultural services, and other downstream segments of the agrifood value chain could provide more opportunities for SME development and, from a spatial perspective, could turn SICTs into crucial “food exchange” nodes.[am, 5]

Building **rural infrastructure**, including quality rural and feeder roads to connect remote farms and enterprises to main road networks, is essential for unlocking the productive potential of SICTs and their catchment areas.[55, 56] There is ample evidence that rural roads lead to other

al Within the manufacturing sector, agro-industry develops, transforms and distributes inputs to and outputs from agriculture, fisheries and forestry. It includes agroprocessing, a subset of manufacturing that processes raw materials and intermediate products derived from agriculture, including food, beverages, tobacco products, textiles and clothing, wood products and furniture, paper products and rubber products.

am As stated by Sonnino (2016, p. 190),"by highlighting the centrality of the relationships between urban and rural areas and actors as targeted intervention areas, the analysis raises the need for a tighter scholarly and policy focus on 'connectivities' – i.e. the role of food exchange nodes and of governance coordination in the design and implementation of more effective food security strategies."[79]

BOX 10 STRENGTHENING CAPACITIES OF SMALL AND MEDIUM ENTERPRISES TO OFFER SAFE AND NUTRITIOUS FOODS

Small and medium enterprises (SMEs) can play an important role in improving the availability of and access to healthy diets. However, they often face managerial and technical capacity gaps. These shortcomings are compounded by the lack of systematic support to value chains for producing nutritious foods, especially those in which the myriad of SMEs are involved.

To strengthen their role in the supply of safe and nutritious foods, SMEs' capacities need to be improved across a range of skills such as business management, financial planning, marketing, technical aspects of sustainable agriculture, food quality and safety, processing, and nutrition. Ensuring food safety is one of the biggest challenges, as SMEs often operate in inadequate structures and/or unhealthy surroundings with no access to basic utilities, using rudimentary or obsolete technologies, and with limited application of updated productive, manufacturing and hygiene practices.[85, 86] Filling these gaps will not only facilitate access to more lucrative markets, it will also add value to public support programmes that invest in technologies suited to SMEs (e.g. low-cost cold storage or solar dryers, affordable packaging solutions, and labour-, water- and energy-saving processing technologies). For example, the demand for aquatic foods has led to the development of innovative practices to turn processed by-products (about 50 percent of processed fish with the greatest concentration of nutrients) and other underutilized aquatic foods such as seaweed into processed foods to include in local school feeding programmes.[87, 88]

Capacity development for SMEs needs to be integrated into broader programmes to strengthen value chains of nutritious foods, in order to overcome the rising production costs associated with unreliable access to raw materials within fragmented value chains and upgrade the inadequate storage, power and transport infrastructures.

investments that can improve nutrition, such as schools and health services,[80] and have positive impacts on rural dietary diversity, productivity, incomes and food security outcomes.[81] There is also evidence that as infrastructure and services develop, midstream activities (especially agrifood processing) tend to get relocated in SICTs.[82]

Public investments (in addition to roads) to support linkages between (mainly small) farms and SMEs could include **warehousing, cold storage, dependable electrification, access to digital tools** and **water supply**. Providing this infrastructure, which forms the basis for a diversified service industry, is a critical step towards more efficient functioning of SMEs (Box 10). Such investments build resilience and contribute to smoothing income shocks from seasonality, market volatility and weather variability.[83] In order to attract private sector investment, these public investments need to be more targeted and part of more comprehensive national strategies for infrastructure development. For example, building "last-mile" infrastructure and logistics that enable delivery from a distribution centre or facility to the end user, opens up possibilities for producers to reach bigger markets and, in the process, creates conditions that foster agribusiness development.[5, 84]

Investment for improving access to markets is also important for hinterland communities that are far away from SICTs catchment areas, as is the case of some Indigenous Peoples. They often face great difficulty accessing markets, and thereby have to rely on traders and aggregators, which may leave them prey to rent extraction. Existing evidence indicates that improving market access of Indigenous producers in remote areas could lead to significant improvements in economic and livelihood outcomes. In Brazil, for example, a cooperative effort to improve market access among Indigenous Peoples' communities so they could purchase larger boats, thereby allowing small-scale fishers to deliver fish directly to markets, contributed to a 27 percent increase in income,[89] mainly as a result of fishers receiving higher prices for their fish. In the Philippines, a project aimed at improving the livelihoods of poor households in Indigenous Peoples' communities by developing market access infrastructures and community watersheds, and providing financial capital and capacity-building training, improved small-scale producers' market participation by 13 percentage points. As a result, total income was 32 percent higher in treatment households than in control households, and income sources became more diversified by 6 percent.[90]

Investments targeting the midstream may also address multiple constraints elsewhere in the agrifood value chain leading to win–win situations of greater economic development and increased production of nutritious foods. Combinations of investments in wholesale markets and feeder roads in China have had important effects on farming in the market catchment areas of SICTs by reducing transaction costs for farmers to reach local markets. This has increased adoption of vegetable farming and intensified production.[91] In Bangladesh, the government has made extensive investments in fish wholesale markets in rural areas to serve as nodes for the formation of wholesale and logistics SME clusters across fish-farming areas, which has encouraged and facilitated commercialization, intensification, and species diversification in fish farming.[92] In general, investments in connectivity between locations and components of agrifood systems in SICTs have spurred substantial development of and investments by SMEs and the creation of spontaneous clusters of wholesale and logistics SMEs. Such clusters, in turn, induce farmers to increase their crop variety and to use more inputs.[91,93] In India, the confluence of factors such as increased demand from urban areas and improved roads and transport linkages from rural areas to SICTs, boosted the expansion of cold storage facilities for potato farmers in places like Agra and Bihar. The result was reduced seasonality of potato supply, a diminished role for traditional rural brokers and shorter supply chains between farmers and consumers.[70]

Moreover, recent studies have shown that investments in public goods such as roads or storage facilities can reduce trading costs, thus encouraging farmers to produce highly profitable foods such as fruits, instead of low-profitability staple foods for self-consumption.[94, 95] Lower trading costs could provide the right incentives for smallholder farmers to shift their production to more nutritious foods which, considering their availability gap, could be key for making healthy diets more available and affordable for all. This is aligned with one of the main insights of the 2022 edition of this report, which indicated that repurposing and stepping up food and agriculture policy support towards general services support (which includes investments in roads and other public goods) could play a key role in the affordability of healthy diets.

Territorial food markets, including wholesale markets, constitute a key linkage between producers, intermediaries, retailers and consumers in Latin America and the Caribbean,[96] South-eastern Asia, and Africa, and are often the most important marketing place for fruits and vegetables.[97] Investing in improved and gender-sensitive[an] wholesale market infrastructure (e.g. in territorial food markets) could improve supply of fresh products and facilitate compliance with food safety and quality standards by smallholder producers (see Box 11),[97] incentivize producers to supply higher-quality foods that could bring them better returns, and increase the quantity and variety of food supply through vertical and horizontal scaling.[13]

The increased reliance on, and demand for, processed foods presented in **Chapter 3** and **Chapter 4** present both a challenge and an opportunity regarding healthy diets. Although food processing is often associated with highly processed foods high in fats, sugars and/or salt, it can also be used to improve food nutritional quality and reduce the cost of a healthy diet. For instance, improving the nutritional quality of processed foods and beverages through **reformulation** is essential across the rural–urban continuum:[99] it can enhance diet quality, increasing nutrient content and reducing the intake of saturated and trans-fatty acids, sugars

an Women account for only 35 percent of wholesale workers worldwide but, on the other hand, represent 53 percent of all retail workers in agrifood systems.[98]

BOX 11 TERRITORIAL FOOD MARKETS, FOOD SAFETY AND HEALTHY DIETS

Territorial* food markets are key retail outlets not only for fruits and vegetables, but also for animal source and staple foods, among others. From small villages to large metropolitan cities, they are an important food supply source of many products, and are also part of the social fabric of communities. These markets are a primary source of affordable, nutritious and fresh foods for many low- and middle-income groups, and an important source of livelihood for millions of urban, peri-urban and rural inhabitants worldwide.[106]

Territorial food markets are also critical sales outlets for local producers. In Africa's food sector, for example, 80 percent of domestic food supplies are purchased in markets comprising primarily small and medium enterprises, while only 20 percent remain within farm households (for own consumption).[107] Furthermore, these food markets are also crucial for providing employment opportunities to women, who make up a significant share of retailers. For example, in markets mapped in Malawi, Paraguay and the United Republic of Tanzania, women retailers represent a clear majority, between 57 and 81 percent.[108]

However, if not well managed, territorial food markets may represent a global public health risk, as shown by the major outbreaks of zoonotic foodborne diseases periodically occurring on every continent.[109] The causes of such outbreaks are manifold, including human–animal interactions, poor infrastructure and deficient post-harvest handling practices leading to food contamination by viruses, bacteria, parasites, prions and chemicals (including toxins, pesticides, industrial chemicals, metals and persistent organic pollutants).[110]

Ensuring that nutritious foods are available, affordable, safe and desirable in territorial food markets can positively influence people's dietary preferences and choices, and thus help to improve their nutritional status and health. To this end, appropriate regulation and investment in rehabilitation and renovation of territorial markets play an important role in promoting food safety and quality, improving health, enhancing food security, and strengthening the economy. These food markets are also ideal settings for engaging stakeholders (e.g. vendors and local authorities) and the public to inform consumers about outbreaks and promote general health (including information on nutrition).[38] The latter is key to nudging consumers to purchase foods with higher nutritional quality (e.g. fruits, vegetables, legumes, nuts and fish).[111]

NOTES: * Territorial markets refer to markets that are directly linked to local, national and/or regional agrifood systems, and which are mostly organized horizontally among the various stakeholders. They have multiple functions (economic, social, cultural, etc.) in their respective territory beyond food supply, and are the most remunerative for smallholder farmers.[112]

and/or salt in purchased foods.[ao] In many high-income countries (HICs), and increasingly in LMICs, a significant proportion of sodium in the diet comes from processed foods such as bread, cereal and grains, processed meats, and dairy products. Introducing maximum limits for sodium in such processed foods can promote reformulation and improve the nutritional quality of food available.[101] To date, 65 countries have implemented policies to reformulate manufactured food to contain less sodium and almost half of the world's population are covered by mandatory trans-fatty acid limits.[101, 102, 103] While reformulation of processed foods can lead to products with a healthier profile, it does not eliminate the concern for high consumption levels of highly processed foods. For example, often free sugars are replaced by non-nutritive (or artificial) sweeteners, which alone does not improve diet quality. Instead, free sugars should be replaced with sources of naturally occurring sweetness, such as fruits, as well as minimally processed unsweetened foods and beverages.[104] Similarly, **fortification** is the practice of deliberately increasing the content of one or more micronutrients (i.e. vitamins and minerals) in a food or condiment to improve the nutritional quality of the food supply and provide a public

ao For instance, in the Kingdom of the Netherlands, a reduction in the intake of trans-fatty acids was observed after the implementation of a voluntary reformulation agreement. However, no effects were observed in saturated fat intakes.[100]

health benefit with minimal risk to health. Food vehicles for fortification range from basic commodities such as various types of flour, sugar and salt which can be ingredients of processed foods, to processed foods that are fortified at the point of manufacture or use.[105]

Food production policies

As has been indicated in **Chapter 3**, the availability of fruits and vegetables per capita per day is insufficient to meet the requirements of a healthy diet in most parts of the world. This makes it essential to boost the production of nutritious foods and, in general terms, support the diversification of food production, which has shown to have positive effects on food supply and food security.[113] In addition, changing food expenditure patterns across the rural–urban continuum, as highlighted in **Chapter 4**, could send important signals for redesigning food production policies.[ap]

Access to inputs such as seeds is key for supporting production of fruits and vegetables,[115] and this is true across the rural–urban continuum. Supporting smallholder farmers in diversifying their production will have positive effects not only on the overall supply of nutritious foods, but also on the accessibility of healthy diets in rural areas. For example, different kinds of **input subsidies** (direct distribution of inputs, vouchers or targeted preferential prices) have been shown to have positive impacts in improving access to diverse and more nutritious foods at the household level.[116] In Ethiopia, a study found that rural vegetable producers earned more income and were more food secure than non-vegetable producers.[118] **Agricultural extension** is also important in rural areas, and can have positive effects on dietary diversity and quality at household levels.[81] However, currently extension programmes are often oriented towards staple crops rather than nutritious foods such as fruits and vegetables. Changing the focus of these programmes could be essential for increasing the availability of these foods.[115]

As mentioned in the previous section, investing in infrastructure is key for enhancing agrifood systems linkages across the rural–urban continuum. From a productive perspective, investing in **irrigation** is important for boosting fruit and vegetable production, to the point that in India, producers that have access to irrigation infrastructure show better dietary diversity outcomes.[119] In cases in which the conditions and capabilities for producing diverse nutritious foods have yet to be developed, **biofortification** has shown to be a valid alternative method to improve the nutrient intake and dietary quality of rural populations.[aq] The adoption of biofortified crops by smallholder farmers can improve the supply of essential micronutrients not only via own consumption, but also through commercialization in local markets and inclusion in social protection programmes including in-kind food transfers and school meal programmes (the latter in all kinds of settings across the rural–urban continuum).[120]

It is important to highlight that many studies in rural settings have found that **women's empowerment** is one of the most important pathways through which food production policies can have positive effects on access to nutritious foods and, in turn, on food security and nutrition outcomes, particularly in rural areas. Several studies have found positive associations between women's empowerment and household dietary diversity,[117, 121] making the closure of the gender gap in rural areas a key consideration for any food production policy oriented towards improving access to affordable healthy diets.

On the other hand, in cities and their surroundings, **urban and peri-urban agriculture (UPA)** has the potential to increase the availability of fruits and vegetables for urban dwellers.[122] In fact, it has been found that households involved in urban agriculture improve their dietary diversity through own

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ap For instance, a study found changing expenditure patterns in Zambia from maize towards other cereals such as wheat, as well as to vegetables and animal source foods, between 1996 and 2015, driven by income growth and urbanization. However, Zambian agricultural policy is still focused mostly on maize, undermining the possibilities for production diversification.[114]

aq Please see **Section 5.2**.

production, and in turn reduce their food expenditure.[123, 124, 125] However, this evidence is limited compared to that for rural areas, as there is a gap in the analysis of direct policy instruments oriented towards food production in urban areas.[ar] Still, it has been observed that the inclusion of urban agriculture objectives in city planning and regulations, often in HICs, can create adequate conditions for the development of urban agriculture.[as, 126]

The development of UPA is closely linked to the adoption of productive technologies and innovations, which can lead to increased yields and reduced environmental impacts. Considering the scarcity in urban areas of natural resources such as land and water needed for the production of nutritious foods, technology could play an essential role in making urban agriculture a sustainable alternative for food supply.[126] The next section provides a detailed analysis of these technological innovations, as well as other agrifood systems innovations that could boost the effects that the different kinds of policies analysed here could have in making healthy diets affordable across the rural–urban continuum. ■

5.2 TECHNOLOGY AND INNOVATION: A KEY ENABLER FOR AGRIFOOD SYSTEMS TRANSFORMATION UNDER URBANIZATION

In an urbanizing world, the strategic deployment of technology and innovation can be a critical catalyst of agrifood systems transformation.[127] This section discusses the potential of technology and innovation to contribute to increasing efficiency, inclusiveness, resilience and sustainability of agrifood systems under urbanization, which are key for making healthy diets available and affordable for all and, in turn, achieving food security and nutrition.

Countries have varied needs and capacities with respect to technologies and innovations, and there are important differences within countries and between segments of agrifood systems. Urbanization offers additional opportunities for agrifood systems to rapidly evolve and innovate across the rural–urban continuum (see Figure 21 in **Chapter 3**). Of course, no single "silver bullet" technology or innovation will meet all needs in all contexts across the rural–urban continuum. Furthermore, innovations cannot be considered in isolation: potential trade-offs and co-benefits must be considered, both among the innovations themselves and in relation to other agrifood systems interventions. For example, automation can lead to unemployment, especially for manual labourers/low-skilled workers, when it is incentivized through government subsidies in areas where labour is abundant. However, it also has the potential to stimulate employment in logistics and processing due to increased production as well as generate new jobs that demand high levels of cognitive ability (this entails building the knowledge and skills of agricultural workers to facilitate the transition).[128] Therefore, the development and use of technologies and innovations should be guided by the assessment of their socioeconomic, environmental and ethical impacts.

A plethora of technologies and innovations is available (though not necessarily accessible to all countries and social groups) spanning entire agrifood systems. Whether these technologies and innovations are inclusive for all depends not only on their adoption and impact, but also on how research and development (R&D) is shaped. Between 1981 and 2016, there was a doubling of global public investment in agricultural R&D, and larger middle-income countries (MICs), in particular Brazil, China and India, significantly increased their investment in agricultural R&D.[129] However, smaller LMICs continue to have insufficient investment compared to other components of general services support such as

ar Some cases show direct support of city governments to urban agricultural producers, but no assessment of their impact has been found.[126]

as See **Section 5.3** for more details.

infrastructure investments.[at, 14] The long time lag between investments and their impact on the ground, as well as the "invisible" nature of research and innovation compared to tangible investments in physical infrastructure, are contributing factors for this neglect.

Public spending on agricultural R&D is still lower than private spending. From 1990 to 2014, private spending on agricultural R&D worldwide more than tripled (with companies based in HICs accounting for 88 percent of global private agricultural R&D spending), but was still focused on a relatively small number of commodities.[131] Venture capitalist investments in the agrifood technology sector reached USD 29.6 billion in 2022, though this represented a 44 percent decline from 2021.[132] However, the increasingly important role of the private sector in R&D poses challenges. The concentration of some key agrifood markets in the hands of a few multinational corporations and the increased vertical integration could lead to an R&D agenda that favours certain financial interests over sustainability considerations, and promotes the adoption of high-tech and high-cost technological and innovative solutions above others.[133, 134] Indeed, looking at research and innovation trends, it appears that in highly concentrated markets, the focus of innovation is primarily on "defensive" R&D, aimed at safeguarding existing products or technologies rather than promoting novel ideas.[135] Nevertheless, innovative business approaches used in the private sector could still be beneficial for agrifood systems: for instance, the idea of the "circular economy"[au] is promoting the development of innovative approaches to reduce food loss and waste at different stages of the food supply chain, including at the domestic level.[134]

An exhaustive and complete listing of technologies and innovations (including those in the ever-expanding pipeline) is beyond the scope of this section. Illustrative examples are provided to showcase diverse options that could be bundled together in contextually appropriate packages, and considered as integral elements of a portfolio of policies, investments and legislation for transforming agrifood systems to make healthy diets affordable for all.[137] In particular, there are a multitude of rapidly advancing digital innovations that cross-cut all segments of agrifood systems, opening up the possibility of transforming these systems in unprecedented ways across the rural–urban continuum, including offering LMICs opportunities to leapfrog existing technologies that are less efficient. It is estimated that by 2050 each farm alone could produce around 4.1 million data points daily (compared with 190 000 data points produced per farm per day in 2014).[138] Extrapolating across various aspects of agrifood systems, such data can improve the use of public funds by identifying the most effective and efficient policy options as well as reducing transaction costs along the policy cycle (from implementation to monitoring and compliance to evaluation). For instance, the use of geospatial data could provide evidence for policymaking using a rural–urban continuum lens,[139] and it could be particularly important for improving common and differentiated policy entry points.

However, innovations in digital technologies risk increasing the digital divide across socioeconomic groups (e.g. income, gender and age), geographies (e.g. rural and urban populations) and geopolitical groups, in addition to raising concerns around control of information and power, democracy and human rights. Some of the factors to address include the high cost of some digital technologies, absence of digital infrastructure, lack of digital skills and literacy, and sociocultural barriers linked to gender as well as issues of information asymmetry, data ownership and management, privacy, and cybersecurity. Worldwide, 2.7 billion people do not have access to the internet, and fixed or mobile broadband services are too expensive for the average consumer in most low-income countries.[140] Moreover, in LMICs, women are 16 percent less likely to utilize mobile internet compared to men, while adults residing in rural areas are 33 percent less likely to use mobile internet than their urban counterparts.[141]

at For instance, an analysis of food and agriculture public expenditure in 13 African countries (Benin, Burkina Faso, Burundi, Ethiopia, Ghana, Kenya, Malawi, Mali, Mozambique, Rwanda, Senegal, Uganda and United Republic of Tanzania) found that none of these reached the African Union target of spending an equivalent of 1 percent of their agricultural GDP on R&D.[130]

au A circular economy aims to maintain the value of products, materials and resources for as long as possible by returning them into the product cycle at the end of their use, while minimizing the generation of waste.[136]

Food environments and consumer behaviour-oriented technology and innovation

In urbanizing contexts, where consumers are increasingly exposed to highly processed foods, increasing the demand for nutritious foods is particularly important. The application of **behavioural science** is an essential innovation that enables governments, scientists and the public to work together to develop evidence-based approaches to increase access to affordable healthy diets, as well as empower consumers to choose healthy diets. When employed as an iterative, innovation process, behavioural science can help identify barriers to consuming a healthy diet as well as help design, test and scale solutions to overcome them. Considering that food outlets are a major source of foods all across the rural–urban continuum, nudges[av] at the point of purchase can be used to interrupt automated behavioural responses and redirect them towards healthier food choices.

Nudging interventions in school cafeterias or local grocery shops have produced positive results in steering individual dietary choices towards more nutritious foods in high-income countries,[143, 144] and they would not be too costly for lower-income countries to emulate as a useful adjunct to important regulatory and economic policy tools. For example, a trial involving ten primary schools in Australia aimed to encourage the selection of healthier foods and beverages from the online school menu. By introducing multiple nudges including placement (listing healthy items first), prompts and appealing descriptions of target foods, the intervention was able to significantly lower the energy, saturated fat and sodium content of children's school lunches compared to a non-intervention control.[145]

Food labelling can contribute to a healthy food environment by providing information to the consumer about the content of foods, drawing consumer attention to the benefits and risks of particular nutrients or ingredients of public health concern, and motivating manufacturers to produce foods which have healthier nutrition profiles.[146] **Nutrient profiling** is a method that assesses the nutritional quality of processed foods and beverages. It is also a tool to guide policy interventions such as **front-of-package (FOP) or menu labelling** and restrictions on marketing to children to help inform and empower consumers to shift demand towards healthy diets. For example, the OBAASIMA project in Ghana has used a FOP seal and social marketing campaign to encourage local SMEs to produce nutritious products. The project has shown promising preliminary results in increasing consumer awareness and SME capacity and is expanding to more cities.[54] Regional nutrient profiles have also been developed as a resource for national or local policymakers.[147, 148, 149, 150, 151]

Promoting – while preserving – traditional foods originating from Indigenous Peoples' agrifood systems through **labelling and certification** (including territorial labels, geographic indications and participatory guarantee schemes) can create niche markets and enhance awareness of the specificity of such products. For example, in Ecuador, the Chakra label primarily targets local markets and sensitizes consumers about the distinctive sociocultural aspect of the Chakra system as well as the nutritional value of local products.[152] However, given the large number of different labels on the market and existing barriers to compete with global commodity prices, innovative labels alone may not enable an upscaling of Indigenous Peoples' product sales. Therefore, building relationships and collective processes together with trusted representatives of the private sector, especially relevant market players, as well as governments and researchers in both social and natural sciences, can be critical in developing sustainable marketing strategies for Indigenous Peoples' food products.

The use of **whole genome sequencing** can be an effective tool for identifying and tracing foodborne pathogens, and for detecting contaminants as well as outbreak investigations.[153] **Traceability data**, including through mobile applications, helps inform consumers about the origin of food sold in supermarkets, promoting transparency in pricing and making supply chains more efficient and accountable.[154]

av A nudge is any form of choice architecture that alters people's behaviour in a predictable way without restricting options or significantly changing their economic incentives.[142]

Online **food sharing services** can gather and redistribute food surpluses across local communities and supermarkets in urban and rural areas, thus helping to reduce food waste. They can also have a positive impact on food environments, especially when surplus nutritious foods such as fruits and vegetables are "rescued" and redistributed. Smartphone applications that enable users to make small donations to specific initiatives can provide support for a range of operations, from building resilience to implementing school feeding programmes to delivering food assistance in emergency situations.[155]

The increased use of mobile phones in LMICs has contributed to the adoption of other services such as **mobile money**, enabling reduced transaction costs and enhanced financial inclusion. Mobile money can improve farmers' access to higher-value markets (thus increasing their income) and to off-farm income sources as well.[156] In Kenya, Uganda and the United Republic of Tanzania, it has been shown to have positive impacts on household welfare, including in some cases by diversifying food purchases and improving dietary diversity.[157] While the benefits of using mobile money in rural areas are already established, the advantages for urban areas are now being recognized as well – as seen in Zimbabwe, for instance, where cash transfers are delivered in urban settings through mobile money.[158]

Food labs involve the coming together of a group of people in complementary roles in order to experiment with finding novel solutions[159] to complex challenges in agrifood systems, including food insecurity and unaffordability of healthy diets. Experimenting with, *inter alia*, technologies, policies, participatory approaches, actions and ideas can be an important source of innovation and capacity building. For example, the Uganda Food Change Lab was set up to address district-level issues of limited local processing facilities, depleted local soils and child malnutrition, largely a result of undiversified diets. The lab carried out food dialogues, research and workshops with a group of diverse actors[aw] in agrifood systems, including those not normally given a voice, in order to generate stakeholder awareness. The country's first People's Summit on Food was then convened, resulting in a range of commitments from all stakeholder groups.[160] In Brazil, the collaborative platform, Urban Laboratory of Public Food Policies (LUPPA), supports the development and strengthening of an integrated urban food agenda, while providing data and content on municipal experiences. It includes a year-long programme that delivers an extended repertoire of tools for cities to become better able to develop their local food policy strategies. LUPPA's participant cities encompass Brazil's 5 regions, covering 18 of the 26 Brazilian states, and comprising more than 11 million people.[161]

Midstream food supply chain-related technology and innovation

Urbanization is leading to a growing demand for packaged and pre-prepared foods, even in low-income countries. As analysed in **Chapter 4**, consumption of processed foods and food away from home is higher in urban areas, but there is a diffusion across the rural–urban continuum. There is also a noticeable rise in the number of midstream SMEs involved in wholesale, transport and processing, as well as upstream SMEs involved in supplying inputs, especially in Africa and Southern Asia.[162] Small and medium enterprises are typically embedded in rural agricultural areas and play an important role in expanding market opportunities and strengthening the linkages between urban and rural areas. As such, innovative approaches that enhance the capacity of SMEs to increase the availability of nutritious and safe food, improve the food environment, and facilitate the consumption of healthy diets are key.

Innovative business models such as the Egg Hub operator model (Box 12) can support the consumption of healthy diets, while providing small-scale producers with quality inputs and services as well as market access.

The increasing demand for perishable products such as fruits and vegetables, dairy products, meat and aquatic foods has led to a proliferation of **freezing and packaging technologies**.

aw Including civil society organizations, local politicians, food vendors, farmers and traders.

BOX 12 EGG HUB OPERATOR MODEL: A SCALABLE WIN–WIN SOLUTION FOR SMALL-SCALE PRODUCERS AND LOW-INCOME CONSUMERS

The Egg Hub operator model has been piloted by Sight and Life, a non-profit foundation, in several countries including Ethiopia, India and Malawi. This model offers rural small-scale producers access to urban and peri-urban markets for their surplus. The producers are organized into groups of five and given input packages, loans, training and market support to sell their eggs, as well as wholesale rates for improved feed. The eggs produced by these groups are primarily sold within their communities, and not to commercial establishments where eggs would be used as ingredients. Any excess eggs are collected and sold in urban and peri-urban markets. The farmers repay their loans within three to five years, and the money from the loan repayments is used to create a revolving fund to help increase the number of farmers in the hub. An Egg Hub operator and its affiliated farmers can cater to a catchment area with a maximum radius of 100 km.

In Malawi, the first Egg Hub operator model aimed to produce over 10 million eggs annually for small-scale producers and rural communities. The model's 175 farmers increased their egg production threefold, allowing them to sell eggs to consumers at a 40 percent discount, reaching an estimated number of 210 000 rural poor. Women particularly benefited, as they were extensively involved in small animal raising. The Egg Hub model also provided an added advantage by helping small-scale producers transition from backyard rearing to small-scale farm rearing, reducing the risk of children's exposure to chicken faeces and infections. Additionally, the Malawi model proved to be more sustainable, requiring 69 percent less land usage, 33 percent less water usage, and generating 84 percent fewer greenhouse gas emissions compared to backyard poultry, primarily due to lower levels of egg wastage and better biosecurity. Another crucial aspect of the Egg Hub model is its ability to address the challenge of small-scale producers accessing bank loans. By providing access to quality inputs and a guaranteed market for their products, the model offers farmers a better chance of secure funding for their business.[163]

Mobile pre-cooling and pack house units offer farmers the option of pre-cooling their produce when there is no immediate access to cold storage technology.[164] Cold chains can be augmented with internet of things[ax] sensors and big data, allowing for real-time decision-making for temperature-sensitive products and perishables as they move across the chain or are maintained in storage.

Cold chains provide benefits in terms of maintaining food quality (including nutritional quality) and safety, reducing food loss and waste, and facilitating market access, and they are also key to maintaining the integrity of veterinary medicines and vaccines to help prevent and manage outbreaks of zoonotic diseases. However, cold chains pose significant risks in terms of environmental damage that the refrigeration equipment can cause. Furthermore, many barriers impede the use of cold chains in LMICs: lack of access to reliable power and equipment, limited resources for public and private sector investments, inability of small-scale farmers to afford cooling technologies, and lack of technical skills, among others.[166] Within LMICs, cold chain capacity and utilization is much greater for exported food products than for food destined for domestic markets. Climate-friendly refrigeration systems based on renewable energy can help cold chains become more sustainable, though challenges such as access to reliable and affordable energy need to be addressed.[167]

Innovations in food packaging can maintain the quality, safety and nutritional value of food products, meet consumer needs and preferences, reduce food loss and waste, and reduce the cost of nutritious foods, especially across longer

ax A system in which devices – including mobile phones, sensors, drones, machines and satellites – are connected to the internet.[165]

distribution chains. For example, organic sprays of thin lipids on fruits and vegetables can extend shelf-life, offering great benefits in countries with limited refrigeration.[168] "Intelligent" packaging utilizes materials that can monitor the condition and environment of packaged food, alerting retailers or consumers to any compromise or contamination such as changes in colour. It can also include "smart" labels such as QR codes that track products throughout the supply chain, verifying product safety and providing additional information (e.g. details on allergens and sourcing). Alternatives to plastic packaging include **biopackaging solutions** such as bioplastics from organic waste streams, though materials vary significantly in terms of the quantity of renewable resources used in their formulation, and may not be as readily compostable as claimed. Moreover, these solutions remain difficult to upscale as they must be tailored to usage requirements.[169]

Circular packaging solutions can include redesigning packaging formats and delivery models, introducing reusable packaging, and improving the economics and quality of recycled plastic materials.[170] For example, returnable and transit packaging in the form of returnable plastic crates is widely used in agrifood value chains because of its cost-effectiveness, durability and reusability over extended periods. In Bangladesh, the switch from single-use plastics to returnable plastic crates for long-distance transportation of fresh fruits and vegetables, together with the application of good management practices, has improved fresh produce quality and shelf-life and increased stakeholder incomes while safeguarding consumers against food safety risks and considerably reducing post-harvest losses.[171] The development of cross-collaborative engagement among producers, processors, retailers and distributors will be critical in driving the shift from the current, linear "take–make–consume–dispose" model of the agrifood value chain, towards more circular systemic approaches to ensure sustainability.[172]

E-commerce platforms offer opportunities to increase affordability of healthy diets, by shortening value chains and increasing market access. These platforms can also contribute to women's empowerment by enabling women to earn an independent source of income, work from home, and set their own working hours. Moreover, e-commerce has the potential to reduce the number of intermediaries and balance the power relationships within value chains, resulting in higher prices paid for producers and cheaper produce for consumers.[173, 174] The growth of e-commerce was further accelerated by the COVID-19 pandemic, from 10 to 20 percent per year in China, 30 to 70 percent in India, and 20 to 50 percent in Nigeria,[175] and to some extent, consumers are now more reliant on food e-commerce (and delivery) than they were pre-pandemic.[83] A key barrier to the adoption and scaling of e-commerce, however, is the unequal access to internet connectivity in some regions. This can limit not only the consumer base of e-commerce platforms, but also the possibility for small-scale producers to directly advertise their products on such platforms, therefore maintaining (or even increasing) their reliance on intermediaries for non-traditional supply channels.

With the rising popularity of e-commerce, food safety has become a crucial issue for online retailers. To ensure food safety, retailers must take measures to prevent contamination during storage, transportation and delivery. This includes maintaining appropriate temperatures for perishable goods, using safe packaging materials, and implementing proper sanitation measures. Retailers must also adhere to local and federal regulations governing food safety. Clear and accurate information about the origin, contents and expiration dates of food products is essential for informed consumer choices and to mitigate potential health risks.[176, 177, 178, 179]

The rise of e-commerce due to advances in mobile technology and widespread wireless internet availability is shifting the way people interact with their food environments. This "digitalization" of food environments is enabling food retailers to sell foods online, resulting in unprecedented consumer access to a large variety of foods (both nutritious foods and foods of high energy density and minimal nutritional value). On the downside, online food retail and meal delivery apps often have specific promotions on foods high in fats, sugars and/or salt.[180, 181, 182, 183, 184, 185, 186, 187] Though mainly used in urban settings in high- and middle-income countries, meal delivery apps are growing in popularity and spreading to smaller cities and towns, potentially contributing to an expansion of food swamps by increasing geographic access to foods prepared away from home[188, 189] and/or availability of foods high in fats, sugars and/or salt in areas where physical shops selling nutritious foods are sparse. A study analysing meal delivery apps found, for example, that a greater number of fastfood options were available in the most disadvantaged neighbourhoods.[190]

Food production-related technology and innovation

Family farms produce approximately 80 percent of the world's food in value terms, with farms under 2 hectares producing roughly 35 percent.[191] Additionally, the majority of the world's poor and food insecure live in rural areas and depend on agriculture for their livelihood.[192] Hence it is critical to increase farm productivity and incomes in rural areas, enhance market access for small-scale producers, and improve connectivity to facilitate smoother flows of goods, services and information across the rural–urban continuum.

Simultaneously, rapid urbanization combined with rising incomes is shifting patterns of food supply and demand, accelerating a diet transition. Consumption is also changing in rural areas, leading agricultural production to diversify towards nutritious foods. Growing fruits and vegetables can create economic opportunities for farmers, not only in rural but also in peri-urban and urban areas. Diversification also increases resilience to climate, environmental and market shocks across different production settings.

As already noted, urban and peri-urban agriculture (UPA) can provide easy access to fresh and nutritious foods, and make healthy diets more affordable in peri-urban and urban areas. In addition, it can help optimize the use of scarce urban resources such as land and water, though it is important to exercise caution in areas which may have contamination issues as there could potentially be substantial food safety risks. More than 1 billion individuals residing in urban and peri-urban regions are involved in growing food or agricultural activities, and urban agglomerations encompass a global farm area that exceeds 60 million hectares.[126] Nonetheless, while UPA can improve food security and nutrition in and around cities, it is unlikely that it can satisfy the needs of urban populations, so its development should be complementary to that of rural agriculture and concentrate on activities where there is a distinct comparative advantage, such as production of fresh, perishable foods.

Numerous technologies and innovations can be leveraged for enhancing productivity in rural, peri-urban and urban areas as well as for closing the productivity gap in LMICs, especially in the face of the climate crisis and dwindling natural resources. With water scarcity becoming a reality in many places across the rural–urban continuum, technologies such as **rainwater storage** can optimize water-use efficiency in rainfed agriculture.[193] For example, roof-harvested rainwater can positively impact productivity and improve the sustainable usage of water in UPA.[194] Moreover, the safe use of wastewater can lead to important energy savings for food production, and for cities in general. Nutrients recovered from wastewater can be used instead of inorganic fertilizers as well.[195] In addition, **fog catcher systems** have been implemented in arid zones and have increased the availability of water for food production in several Latin America and the Caribbean countries.[196, 197]

Agroecological innovations[ay] can be market based, institutional, ecological and technological, often with a focus on knowledge co-creation.[199] Agroecology recognizes that food production, distribution and consumption inherently link economic, ecological and social processes, and it is practised in diverse and locally adapted forms across the rural–urban continuum. At the plot, farm and landscape levels, it can help increase farmers' incomes,[200] improve food security and nutrition,[201] use water and soil more efficiently, conserve biodiversity, provide ecosystem services, and enhance nutrient

ay As stated in FAO (2018, p.1) agroecology is "an integrated approach that simultaneously applies ecological and social concepts and principles to the design and management of food and agricultural systems."[198]

recycling, among other benefits.[202] In India, the Andhra Pradesh Community-managed Natural Farming programme that aims to transition all 6 million farmers in the state to agroecological approaches has already reached more than 630 000 farmers, resulting in higher incomes and better yields as well as health benefits.[203] In Ecuador, the Participatory Urban Agriculture Programme emphasizes the social inclusion of vulnerable groups and supports the production, processing and distribution of food from urban and peri-urban areas, generating revenue, creating jobs and promoting agrobiodiversity.[204] It also facilitates the provision of technical assistance, microcredit and capacity building to producers. Blending agroecology with territorial approaches can help empower rural communities and bring agroecology to scale, for example by implementing territorial certification schemes and shorter value chains to improve access to markets and increase incomes of small-scale producers.[205]

As at 2021, **organic agriculture** was practised in 191 countries by nearly 3.7 million producers, but it occupied only 1.6 percent of the total agricultural land.[206] Organic farming systems can provide more profits with less environmental footprint and produce nutritious foods with less pesticide residue.[207] In general, organic agriculture has a positive effect on above- and below-ground biodiversity, soil carbon stocks and soil quality and conservation, but it often produces lower yields than conventional agriculture and has higher labour requirements.[208] MASIPAG, a grassroots farmer-led advocacy network in the Philippines, promotes organic farming as a path for rural development. Farmers are involved in participatory plant breeding of rice varieties, farmer-to-farmer exchanges, and participatory guarantee systems for increased market access of organic products.[209] Organic farming is also a common practice in UPA, with manure and urban waste compost frequently utilized to improve soil fertility. For example, the Kibera Youth Reform Organic Farm, which began on a garbage dump in Africa's largest slum in Nairobi, grows a range of crops for own consumption as well as for sale.[210] Since organic agriculture does not rely on synthetic nitrogen fertilizers, nitrogen availability is the primary impediment to the global expansion of organic agriculture.[211] Additional issues relate to the potential exclusion of small-scale producers due to the cost of certification and to the price of organic products, which are often too high for consumers.[212]

Controlled environment agriculture (CEA), also referred to as **vertical or indoor soil-less farming**, encompasses numerous technologies including hydroponics, aeroponics and aquaponics. Vertical farming requires only a small plot of land and can be carried out indoors, allowing for the cultivation of food in urban and industrial spaces, and leading to shorter supply chains. For short-cycle fast-growing horticultural crops such as lettuce and leafy herbs, production in a controlled environment can cut water use by up to 95 percent while supplying consistent-quality, high-value products all year round. Vertical farms can minimize risks of foodborne illnesses and considerably reduce the need for both inputs (e.g. fertilizers and pesticides) and water (through recycling). For cereals such as wheat, studies have shown that yields in indoor vertical farms could be 220 to 600 times higher than yields in the field, while at the same time using less land.[213] However, the high energy cost of producing artificial lighting and maintaining temperature and air quality makes the adoption of CEA viable mostly in HICs. The largest market share from CEA, and most of its positive results, have been found in this country income group,[214, 215] but it has also been used to support vulnerable communities in LMICs using low-tech hydroponic units.[216]

Biotechnological innovations in genetics and breeding have led to tremendous gains in productivity, adaptation to biotic and abiotic stresses, and enhanced nutritional value. Consumption of **biofortified crops** can enhance nutritional status and promote better health outcomes, especially in rural areas in LMICs, where diets are significantly reliant on self-produced or locally procured staple crops. Hundreds of biofortified varieties of 12 staple crops have been released for planting in over 60 countries, with more than 86 million people in farming households eating biofortified foods. In Nigeria, farmers growing biofortified vitamin A cassava have been linked to aggregators and processors, with labelled processed products sold in rural, peri-urban and urban areas. Additionally, organizing the annual Nutritious Food Fair has been instrumental in fostering linkages among farmers, processors, marketers and consumers.[217]

Gene editing is a relatively new technology that offers improvements in accuracy and precision for plant and animal breeding, with the added advantage of speeding up the component processes at a reduced cost. In particular, gene editing can be exploited to increase the utility of "forgotten" crops as well as neglected and underutilized species that are nutritious and often adapted to harsh environments and conditions. Marketed gene-edited products include a gamma-aminobutyric acid-enriched tomato and two gene-edited fish in Japan, as well as soybean with improved fatty acid composition in the United States of America.[218] There are diverse views, however, on how gene-edited products should be regulated, and legislation can differ widely among countries. In addition, prior debates associated with genetic modification may influence consumer acceptance of gene-edited products. Public perception studies vary on whether consumers can distinguish between genetic modification and gene editing when forming their opinions. In a recent study, respondents viewed gene-edited and genetically modified food similarly, and less favourably than conventional food. Other studies suggest that people may be more accepting of cisgenic[az] modifications than of transgenic[ba] ones, but less accepting compared to conventionally bred crops.[218]

Fundamental lifestyle shifts, income disparities, growing urban population diversity and changing consumer behaviour in response to numerous factors (such as concerns about the impact of food production on environmental sustainability as well as animal welfare) are disrupting the status quo of agrifood systems. New foods and novel ways of producing food are being explored. The popularity of **plant-based alternatives** (e.g. soy- and nut-based products) to animal source foods (e.g. meat, dairy, eggs and aquatic foods) is on the rise, although caution is needed to prevent the inadvertent increase in use of common allergens in diets.[220] In addition to food safety aspects, the price and cultural acceptance of plant-based alternatives must be considered. The affordability of plant-based alternatives is anticipated to improve as consumer demand and supply grow. Currently, plant-based alternatives predominantly cater to a Western-style diet, with limited exploration into more traditional foods in different regions.

While insects have been a traditional part of many cultures' diets for centuries in different regions, the cultivation of **edible insects**, for both human consumption and animal feed, is garnering significant attention worldwide due to the many possible advantages in terms of nutrition, the environment and the economy. Nonetheless, similar to other food items, edible insects can be associated with a number of food safety hazards that require attention and care in the preparation process.[221] Furthermore, a greater push for the consumption of insects could result in the overexploitation of insects in their natural habitats, posing a threat to biodiversity and ecosystem stability.[222]

The commercial landscape for **cell-based food technologies** that use animal or microbial cells grown *in vitro* to produce animal proteins (sometimes referred to as "cultured" or "cultivated" meat) is emerging and rapidly expanding, with Singapore approving the first cell-based "chicken" nuggets in 2020.[223] Cell-based food production is anticipated to require less land than traditional livestock farming, though the latter still plays a vital role in environmental functions such as maintaining soil carbon content and fertility. Further, it is unclear if cell-based foods have a greenhouse gas emissions advantage over livestock when scaled up. Different types of cell-based foods have different environmental impacts; for example, a cell-based food may have high energy requirements but reduced land-use requirements and low eutrophication potential.[220] It is not known how people will perceive cell-based foods and whether they will be acceptable to consumers. Technological advancements for cell-based foods have progressed significantly, but they

az Genetic changes introduced from the same species, such as those produced by some gene-editing technologies.[218]

ba An individual in which a transgene has been integrated into its genome. A transgene is an isolated gene sequence used to transform an organism. Often, but not always, the transgene has been derived from a different species from that of the recipient.[219]

have not yet reached the stage of widespread production or commercialization in the majority of countries. Finally, although the production costs for cell-based foods have fallen, they are still prohibitive for many LMICs.

Digital technologies can guide and facilitate data-driven decision-making at the farm level across the rural–urban continuum by leveraging granular data about fields and animals in conjunction with accurate, timely and location-specific weather and agronomic data. **Precision agriculture** uses information to optimize inputs (especially targeted, timely applications of agrochemicals) and can improve resource-use efficiency in increasingly constrained conditions for agricultural producers. But efficiency gains come with a risk of rebound effects, that is they can lead to enhanced machinery and associated energy use as well as increases in usage of natural resources.[224] **Automation** can replace dull and dangerous manual jobs, address labour shortages in certain areas and attract younger, more skilled workers. For example, agricultural robots can decrease labour and input requirements, and reduce yield losses resulting from the late detection of pests and diseases.[225] However, their high purchase price and operating costs make their use prohibitive for small-scale producers. Additionally, if unskilled workers do not learn new skills quickly enough, it can be difficult to transition to new jobs. Besides, there is a possibility that small-scale producers might be driven out of business and forced to migrate to cities, because they lack the economies of scale to compete if the automation technologies are not scale neutral. Digital services such as **shared asset services** can enhance farmer access to mechanization hire services and significantly reduce transaction costs for small-scale producers.[128] Finally, digital technologies also have the potential to facilitate cost-effective, uninterrupted and scalable extension and advisory services in rural areas. **Mobile phone-based extension systems** can reduce information deficiencies, and in sub-Saharan Africa and India have been estimated to improve crop yields by 4 percent and the odds of adoption of recommended inputs by 22 percent.[226]

Looking ahead: making technology and innovation work well for all across the rural–urban continuum

Globally, urbanization is accelerating, affecting agrifood systems across the rural–urban continuum and consequently the availability and affordability of healthy diets. As evident from the examples provided above, technology and innovation are driving changes in production processes, distribution systems, marketing strategies, and the food products consumed by people, with benefits for producers, consumers, small and medium enterprises and retailers, among others. However, promising technologies and innovations often do not gain traction, especially in low- and middle-income countries, due to issues of contextual readiness and appropriateness, and the lack of an appropriate enabling environment to support development, diffusion and adoption.

The potential of technology and innovation can and must be unlocked for the common good, but all technologies and innovations have pros and cons in terms of how they affect agrifood systems transformation and how they can reinforce inequalities, creating winners and losers across the rural–urban continuum. It is also important to acknowledge regional heterogeneity and the diversity and dynamism of agrifood systems. Therefore, technologies and innovations must be adapted to local needs, opportunities and constraints, to ensure they are accessible to all who want to adopt them. To scale up technologies and innovations in agrifood systems as well as make them more inclusive, policies and investments are needed in a number of areas including infrastructure (e.g. internet and transport connectivity); relevant capacities, skills and knowledge; effective regulatory measures; economic and legal instruments to reduce costs and risks (e.g. overconcentration of market power); appropriate market incentives; and promotion of inclusive agribusiness models. Further, bundling contextually suitable technologies with complementary financial, social and institutional innovations can allow for mitigation of trade-offs, where one innovation can compensate for negative impacts caused by another one.[7]

Increased public investment in agricultural R&D beyond the major staples to include a broader range of plant and animal species (including fruits and vegetables) is necessary to support the diversification of agrifood systems. Further, the research focus must broaden from solely improving productivity to improving the functioning of entire agrifood systems (i.e. the off-farm components that account for up to 70 percent of value added). Urban soils can contain multiple contaminants such as heavy metals, asbestos and petroleum products at different levels, while chemical hazards or pathogens can be found in urban wastewater that has been improperly treated; therefore more research is needed on the potential health risks to humans who consume food that is specifically grown within urban and peri-urban areas. Opportunities exist for achieving more with the resources currently invested by governments. As analysed in the 2022 edition of this report,[14] most of the global support to food and agriculture is oriented towards producers through price incentives and other fiscal subsidies. These subsidies could distort the incentives for adopting certain technologies, favouring some producers over others; instead, public support could be repurposed towards increasing investments in general services support (which includes R&D) to encourage the development and adoption of technologies collectively.[14, 128] Reassessing policy priorities considering the challenges created by urbanization could open the policy window to re-examine – and repurpose – current food and agriculture support.[227] ■

5.3 INTEGRATED PLANNING AND GOVERNANCE MECHANISMS ACROSS THE RURAL–URBAN CONTINUUM

The policies, technologies and innovations presented up until now will require adequate governance mechanisms that, while engaging multiple actors, coherently address the challenges and leverage the opportunities created in agrifood systems under urbanization. Policymaking processes will not work with a traditional, mostly national and top-down approach, because of the need to focus on places and their functional and spatial linkages. Because these linkages often play out across sectoral and administrative boundaries, policymaking processes should facilitate interjurisdictional agreements and regulations, as well as the participation of a variety (including non-governmental) of actors.[5] Hence, agrifood systems governance can be understood as the mechanisms and processes established for stakeholders to articulate their interest, mediate their differences and coordinate around government institutions. Moreover, institutional arrangements need to consider the key role of subnational governments (local and regional) as well as that of non-governmental actors.[5]

Working with the spatial and functional linkages across the rural–urban continuum, with subnational governments as important players, can leverage agrifood systems transformation under urbanization. The national and transnational production-oriented policies and agendas of the last century created gaps in addressing food insecurity and malnutrition. In reaction to these policies, subnational governments have emerged as important players in agrifood systems transformation.

Other factors which have increased the role of subnational governments on the global stage have been the steady increase in political and cultural power of cities of different sizes, the rapid urbanization processes, and the relatively recent wave of decentralization from national to local governments in an increasing number of countries. In the aftermath of these developments, urban food policy pioneers in municipalities around the world got engaged in the agrifood systems agenda to develop food strategies and implement specific local measures.[228]

Due to the multisectoral nature of the challenges and opportunities that urbanization creates across the rural–urban continuum (**Chapter 3**), subnational governments should also be important actors for formulating and implementing coherent policies that go beyond agrifood systems (e.g. environmental, energy,

BOX 13 URBAN FOOD SYSTEMS COALITION: A GLOBAL PLATFORM TO RAISE AWARENESS ON THE KEY ROLE OF SUBNATIONAL GOVERNMENTS IN AGRIFOOD SYSTEMS TRANSFORMATION ACROSS THE RURAL–URBAN CONTINUUM

The United Nations Food Systems Summit, organized in 2021, recognized the importance of subnational governments as key levers for inclusive and sustainable agrifood systems transformation. During the Summit, the Urban Food Systems Coalition was established; it is currently facilitated by the Food and Agriculture Organization of the United Nations and the Global Alliance for Improved Nutrition, and includes UN Agencies, city networks, civil society organizations and academic institutions as active members operating across the rural–urban continuum in multiple countries. The coalition[229] aims to support national and subnational governments to transform their agrifood systems by facilitating coherent, coordinated policies and actions. It supports subnational governments to engage in global policy debates and establish themselves as key players in the overall agrifood systems transformation. Moreover, the coalition works across the rural–urban continuum to identify context-specific mechanisms for bridging national and local agrifood systems governance gaps.

health and other systems). They are in close contact with local stakeholders and can ensure that these policies are adapted to local conditions by promoting advantages and addressing bottlenecks. The launch of the Milan Urban Food Policy Pact in 2015 was a global marker of subnational governments' increasing role in formulating and implementing policies at urban and regional levels, promoting agrifood systems linkages across the rural–urban continuum and integrating different systems approaches in local, regional and territorial development plans. The New Urban Agenda, endorsed by the United Nations General Assembly in 2016, has been a turning point in terms of recognizing the role of subnational governments in agrifood systems transformation, as it called for integration of food security and nutrition in urban and territorial planning. This recognition has also been carried over into global processes such as the United Nations Food Systems Summit, with the establishment of the Urban Food Systems Coalition in 2021 (see Box 13).

Subnational agrifood systems governance mechanisms

An important starting point towards streamlining governance based on functional dimensions across the rural–urban continuum is the development of locally based agreements between multiple administrative zones and multistakeholder platforms and networks.

Multistakeholder agrifood systems governance mechanisms, involving multiple non-state actors, farmer organizations, civil society organizations, the private sector and academic institutions, are increasingly emerging as crucial instruments to address gaps in local policies and planning related to food. Among such mechanisms, **food policy councils** (sometimes also referred to as committees, food groups, platforms, etc.) serve as advisory bodies to local or subnational governments, support policy design and implementation, promote stakeholder engagement, and facilitate monitoring and evaluation of progress in policy implementation, effectiveness, efficiency and impact (see Box 14).

There is currently very limited evaluation of the collective impact of food policy councils on changing policy or shifting conventional food governance paradigms.[230] Some food policy councils are formed through bottom-up, citizen-led processes, which makes them cautious about the degree to which they associate with or are dependent on local government, as formalized links with government may compromise the original vision and direction of the platform and restrict the ability to propose

BOX 14 SUBNATIONAL AGRIFOOD SYSTEMS GOVERNANCE AGREEMENTS AMONG METROPOLITAN, INTERMEDIARY AND SMALL CITIES IN PERU

In November 2019, the Peruvian municipalities of Lima, Huancayo, Arequipa, Piura and Maynas signed an agreement with the objective of strengthening agrifood systems linkages across the rural–urban continuum. The agreement covers: i) linkages between producers, markets and fairs in different cities; ii) knowledge exchange on practices related to agroecology and its promotion in rural and peri-urban areas; iii) modernization of food retail market spaces; and iv) context-specific strategies to improve access to healthy diets. It also includes peer-to-peer learning practices, which allow for sharing experiences in areas such as development of new urban food environment ordinances, public purchase of family farming products, and establishment of the food policy council in Lima.

One experience shared with municipalities involves an ordinance in Lima designed to create healthy food environments in both schools and out-of-home areas.[231] The ordinance prohibits the sale or marketing of energy-dense foods high in fats, sugars and/or salt within 200 metres of schools. It also sets minimum health requirements for food and drinks provided to students on school premises, and requires schools to ensure access to fresh drinking water. Furthermore, as part of the Lima Come Sano (Lima Eats Healthy) programme, the ordinance requires local restaurants to adopt new practices to reduce salt and sugar intakes. To promote healthy eating, restaurants are encouraged to prominently display the caloric content of menu items, and to only provide salt shakers and condiments when customers ask for them.

In addition, in October 2020, Lima established the Food System Council of Metropolitan Lima (CONSIAL), which aims to plan, organize, develop and implement sustainable and resilient food policies that guarantee the human right to food and generate a positive impact in reducing rates of poverty and malnutrition. Since its establishment, the council has enacted several local ordinances to promote healthier urban food environments, urban agriculture, the use of public spaces for agroecology farmers' markets, and the recovery of unsold food in wholesale markets. The council includes multiple actors such as representatives from urban and peri-urban agriculture platforms, rural producer organizations, civil society promoters of healthy eating, research centres and universities, the private sector, and non-governmental organizations active beyond the administrative boundaries of the Lima metropolitan area. Likewise, the council is currently developing an agrifood systems strategy across the rural–urban continuum, aligned with the national and international agendas related to agrifood systems, climate change and sustainability.

The city of Hancayo has also established the Comité de Sistemas Alimentarios (Food Systems Council) which is linked to the CONSIAL in Lima, creating the basis for strengthening agrifood systems governance across the rural–urban continuum.

changes to government structures and policy. Others are formed directly within or even by the municipality itself and therefore have strong ties with local government. The strength of food policy councils with closer ties to government is that they can be in a better position to make policy recommendations and receive more support. Being located within a government department can also increase the chances of receiving dedicated resources and ensure continuity.

Food policy councils have existed for 30 years, the earliest in Northern America, but they still require scaling up and strengthened capacity in order to reach their full potential. For example, in Africa, the informal sector is expanding, and street food vending remains key for food purchases. Informal food vendors provide poorer households with better opportunities to achieve food security, as they are spatially accessible and can offer assistance through credit;[232] however, they are barely considered in governance mechanisms, not even in food policy councils, which in most cases are still in an emerging state (Box 15). Support to organize these informal food actors in groups (e.g. cooperatives) can be crucial for their

BOX 15 INCLUSIVE AGRIFOOD SYSTEMS GOVERNANCE MECHANISM IN KISUMU COUNTY, KENYA, LINKING URBAN AND RURAL AREAS

In Kisumu County, Kenya, a food liaison advisory group (FLAG) was established in 2020 under the leadership of the county and with representatives from academia, civil society organizations, the private sector, and farmer organizations operating across the rural–urban continuum. The FLAG provides a space to enable dialogue among different actors and identify priority actions intended to promote local food production and processing as well as employment opportunities and business incubators for women and youth. This group is currently in the process of finalizing the development of an agrifood systems strategy encompassing both rural and urban areas of the county. The strategy identifies priority areas of intervention to foster rural–urban linkages, such as improvement of market infrastructure to improve the spatial and functional connection between Kisumu and other counties and as a way to reconnect rural producers with urban consumers. The strategy is also in the process of considering inclusivity among its priorities, particularly in relation to recognizing and formalizing women street food vendors and improving their businesses.

integration in the decision-making process.[233] However, if formalized, it is important that new forms of democratic governance do not become yet another bureaucratic mechanism. On the contrary, they must remain a place where problems are addressed through participatory multistakeholder processes in a holistic way, and measures are adopted in a way that includes the interests of multiple stakeholders including the most vulnerable.[232]

Once an agrifood systems governance mechanism has been established, a major common challenge in local institutions is to ensure its continuity. Monitoring and evaluation – but also adaptation as necessary – are required for continuous learning of local institutions and to report progress to a wider audience, which could potentially bring new stakeholders on board and provide access to additional funding and technical resources.[234]

Experience shows that agrifood governance mechanisms such as food policy councils perform better if they are institutionalized within subnational governments. Institutionalization refers to the formalization of structures, rules and practices that enable agrifood initiatives to endure. It involves creating the policy and governance infrastructure that will allow a municipality and key stakeholders to design new agrifood initiatives and adapt existing policies and strategies in consideration of new circumstances;[235] to do so requires the mobilization of human and financial resources. Finding an institutional "home" to host agrifood systems-related multistakeholder platforms, usually in the format of an agrifood systems "unit" within a municipality, is key to the sustainability of these initiatives.[236]

A dedicated budget is also crucial for sustaining continuity. In most cases, multistakeholder platforms have limited power to influence budget allocation for agrifood systems initiatives. Municipalities themselves have therefore a critical role to play in integrating the initiative of an informal food governance platform into the municipality's regulatory framework and budget via ordinances, annual budgetary and programme planning, or other types of formal decisions. Due to the diversity of organizational structures and priorities, there is no single model for successfully securing funding. And ultimately, there is no guarantee that agrifood systems governance will continue in perpetuity. However, institutionalizing governance processes can make it harder for future administrations to erode or dismantle them.[237]

Integrated local agrifood systems policies and planning

The design and implementation of local agrifood systems policies, investments and legislation for addressing multiple agrifood systems challenges and opportunities require working outside the municipal departmental "silos" and bridging the gaps between departments and policy areas in order to achieve systemic changes. Until now however, most urban food policies have targeted specific sectors such as food production, food distribution, waste management, public health or the environment.[238] In the process of integrating food into urban planning and policy, holistic **food strategies** (connecting different and relevant sectoral domains, municipal departments and disciplines) are just emerging, setting the overall framework and agenda within which targeted policies and actions can be implemented.[239] Furthermore, local institutions can align agrifood systems goals with their broader development goals through different **planning instruments** such as ordinances, by-laws, declarations, resolutions and codes.

Local agrifood systems policies, planning and strategies are quite often introduced through dynamic leadership of "champions" in municipalities of cities of all sizes, in some cases working in collaboration with other government levels and with non-state actors such as non-governmental organizations, civil society organizations and academic institutions.[240, 241, 242] The history of local agrifood systems strategies[bb] over the past decades has demonstrated how it is possible to create an effective enabling environment for mainstreaming agrifood systems within the local agenda[243] and improve the linkage between rural and urban areas. Specifically, the development of local agrifood systems policies, ordinances and regulations has led to scaling up of ad hoc initiatives and projects, contributing to the overall agrifood systems transformation at the national level with clear multistakeholder engagement (Box 16).

Gathering evidence is the first crucial step to support the development of local agrifood systems policies and planning. This process can include a wide range of instruments and tools: assessment studies, indicators, open databases, information sharing platforms, etc. Multiple tools have already been developed that can inform policymakers about agrifood systems bottlenecks – i.e. points in the systems that produce constraints in economic, social, health or environmental terms – in order to prioritize interventions, measure progress and, just as important, draw lessons on how to effectively integrate agrifood systems into urban and territorial planning. Developing comprehensive agrifood systems profiles without losing the systemic view remains a challenge for urban policymakers.

The Rapid Urban Food Systems Appraisal Tool is one example of a tool supporting evidence-based policymaking at local levels.[bc] It assists policymakers and other agrifood systems stakeholders in developing policies and strategies that improve food security and nutrition of urban dwellers and promote sustainable development of agrifood systems (see Box 17).

Agrifood systems analysis is usually complemented with evidence gathered through multistakeholder engagement. While the availability of disaggregated data for the local level may be limited, engagement with local agrifood systems stakeholders can generate deeper insights for identifying bottlenecks and prioritizing action. However, it should be noted that partnerships with stakeholders with interests that run counter to improving human and ecosystem health can result in damage and mistrust. New models for private–public sector funding will be required to avoid conflicts of interest and ensure impartiality, accountability and transparency.[244] It is always important to safeguard against conflicts of interest in policy development and decision-making – particularly when multiple stakeholders are involved – and tools are available to help countries prevent and manage such conflicts of interest.[245, 246]

bb Food strategies can initially be developed as a strategic declaration or a food charter (including strategic lines and communicative in nature). They can then be further developed as an action plan (including operative content and defined interventions) and can be politically endorsed with a budget allocated for their implementation.[242]

bc Agrifood systems analysis across the rural–urban continuum is also included in other tools such as the City Region Food System Toolkit, an online repository of global resources.

BOX 16 LOCAL AGRIFOOD SYSTEMS STRATEGIES LINKING LARGE METROPOLITAN AREAS WITH RURAL HINTERLAND IN ANTANANARIVO, NAIROBI AND QUITO

In **Madagascar,** the Municipality of Antananarivo (Analamanga region), collaborating with the Ministry of Agriculture and other stakeholders, created a stakeholder advisory group through which the Agrifood Systems Resilience Strategy 2023–2028 for the city of Antananarivo and its surrounding region was developed and validated. The strategy promotes multisectoral, multilevel and multistakeholder collaboration, recommending coherent and integrated implementation of policies and programmes such as: i) the Integrated Water Resource Management programme led by the Ministry of Water, Sanitation and Hygiene; ii) the national Agriculture, Livestock and Fisheries Investments Programme led by the Ministry of Agriculture and Livestock; and iii) the Analamanga Regional Land-Use Plan 2023–2043. The implementation of these policies and programmes in Antananarivo and its surrounding region has the potential to empower local communities while strengthening resilience to shocks, improving food distribution, creating employment opportunities and supporting food small and medium enterprises.

In **Kenya,** the Nairobi Food Systems Strategy was endorsed by Nairobi City County and integrated in the Nairobi City County Development Plan. Currently in the process of implementation, this food strategy aims to ensure affordable, accessible, nutritious and safe food for all, using a multisectoral approach and working across all levels of government. An Intergovernmental Relations Committee on Nairobi City Food Systems was established including representatives from Nairobi City County Government and representatives from various ministries (responsible for food, agriculture, health, environment, land, water, social protection, etc.). A multistakeholder food governance mechanism (food liaison advisory group), which includes non-state actors, was also established and aims to advise decision-makers at all levels on the implementation of the food strategy. Agrifood systems actions across the continuum will be ensured through the strong engagement of the intercounty coordination platform at the national level.

In **Ecuador,** the Municipality of the Metropolitan District of Quito endorsed the Quito Agri-food Strategy in 2019, allowing agrifood systems to be progressively integrated in city planning tools such as the Quito Resilience Strategy, Vision 2040, the Climate Action Plan and the Metropolitan Development and Land Management Plan (which recognizes food security as the strategic axis of the city's socioeconomic development). The strategy was developed in collaboration with multiple actors engaged in the agrifood systems governance platform. The platform includes local, provincial and national government representatives; social movements; international cooperation actors; United Nations Agencies; academia; and the private sector (mainly agribusinesses aiming to work in both urban and rural areas).

The priority areas identified at the local level to develop holistic food strategies and planning usually include urban and peri-urban agriculture; short supply chains; inclusive food markets; healthier food outlets and street food; public food procurement; sectoral planning and programming such as school feeding programmes; inspection of food outlets; planning and zoning rules on food outlets and/or marketing; and food waste prevention, reduction and management.[238, 240, 241] **Urban and peri-urban agriculture** initiatives have been one of the catalysing entry points to put food on the local political agenda. Urban and peri-urban agriculture has a close relationship with urban food governance, as it often goes beyond agroecological production and sustainable consumption to incorporate other aspects such as social cohesion, economic development and environmental issues. Another common entry point is **school feeding** whose potential for improving children's nutrition, dietary habits and educational attainment is inspiring many municipalities, even smaller ones, to action. School feeding programmes are also valued for their multiplier effects. They can

BOX 17 THE RAPID URBAN FOOD SYSTEMS APPRAISAL TOOL: ONE POSSIBLE TOOL TO ANALYSE AGRIFOOD SYSTEMS ACROSS THE RURAL–URBAN CONTINUUM

The Rapid Urban Food Systems Appraisal Tool (RUFSAT) aims to assist policymakers and other agrifood systems stakeholders to develop and prioritize evidence-based policies and strategies that address bottlenecks constraining the economic, social and environmental performance of agrifood systems. This is achieved through four interlinked components: i) stakeholder mapping; ii) value chain analysis; iii) mapping of the institutional and policy environment; and iv) a consumer survey that includes a mapping of the food retail environment.

These components are underpinned by geospatial information systems that bring all the information related to the agrifood systems and food consumption patterns within the urban setting onto a common base map. Maps and information in RUFSAT comprise the use of satellite imagery, mobile apps for field surveys, information available in the public domain, and data collected from local authorities. From these sources, RUFSAT identifies challenges and opportunities for planning and transformation of urban agrifood systems. It relies on feedback and technical advice from a food liaison advisory group – a working group of policymakers and subject matter experts created through a consultative process at the city level designed to provide input on the assessment findings as well as guidance on prioritization of challenges and opportunities at the city level.

RUFSAT assessments provide useful data and information for the development of local agrifood systems strategies, ordinances and regulations at the local level, and have been used in some of the case studies included in this chapter: the CONSIAL experience in Lima (Box 14), the Kisumu County initiative (Box 15) and the Nairobi Food Systems Strategy (Box 16).

BOX 18 STRENGTHENING MULTILEVEL INSTITUTIONAL AGREEMENTS THROUGH PUBLIC FOOD PROCUREMENT IN MANABÍ PROVINCE, ECUADOR

In the framework of the Ecuadorian Food Guidelines, the Provincial Government of Manabí together with the municipalities of Portoviejo, Chone and Santa Ana, and in coordination with the Ecuadorian Ministry of Education, established a food procurement scheme to distribute fruits to children as part of their school meal. This initiative aimed at providing access to healthy diets for Manabí students, while promoting income opportunities for farmers. The first deliveries to schools in Portoviejo, the provincial capital, started in October 2021 with local fresh fruits from family farmers located in the rural municipalities of Chone and Santa Ana. The provincial government financed the purchase and carried out the procurement through the public portal, EP Manabí Produce. Thanks to the initiative, nearly 43 000 children from 95 schools in Portoviejo received, on a daily basis, a kit comprising nine fresh fruit items (mandarins and oranges). This initiative has been crucial for fostering multilevel agrifood systems governance and interinstitutional coordination across national, provincial and municipal levels.

be designed to support local agriculture, strengthen and diversify local agrifood systems, and improve economic and social development through public procurement mechanisms focused on local smallholder farmers and sustainable production (Box 18). The same principles can be extended to food procurement and service policies for other locally run institutions or services.[247]

Food waste and circular economy initiatives are another common entry point for initiating food planning and policy processes. Food waste can be converted to compost or used to produce biogas, thereby avoiding harmful methane emissions while also creating employment opportunities; fish offal and waste can also be used to produce fish silage which serves as fishmeal in animal feed. However, this requires municipal organic waste to be properly managed not only at the household level, but also in food retailing outlets. Local institutions play a critical role in creating an enabling environment to reduce food waste and adopt waste management practices. For example, in Bangladesh, municipal food waste in Khulna city is being used to meet the high demand for organic compost fertilizer in the agroforestry sector; but the process has required support from local institutions to produce compost at a suitable level. In relation to food waste management, priority is also given to prevention, recovery and redistribution for human consumption – a process requiring a high level of engagement of local governments.[248] Furthermore, in Kigali, Rwanda, a thematic multistakeholder taskforce on food waste management has been created as part of the broader agrifood systems stakeholder advisory group addressing issues related to prevention, recovery, redistribution and the circular economy. The Kigali Municipality has assumed leadership of the platform to strengthen the spatial and functional agrifood systems linkages across the rural–urban continuum in Rwanda.

The degree of decentralization in different contexts and the level of technical capacity can limit the effectiveness of such local policies and strategies. For example, despite major decentralization efforts in recent decades, local African governments still have low administrative and fiscal capacity; consequently, in some cases strategic plans are not implemented due to lack of funding. Linking food policies and strategies to the fiscal decision-making process is therefore indispensable.[249]

Due to the multisectoral and multilevel nature of agrifood systems, funding to implement the key activities of a food strategy and/or action plan can come from a variety of sources: municipal, provincial, national, and even non-state actors such as non-governmental organizations and international partners. Mobilization of internal and external resources for effective public and private financing is crucial, both in terms of supporting the actions of authorities at all levels and creating incentives to attract private capital towards financially viable investment opportunities.[236, 238, 240]

Policy coherence at national and subnational levels remains a key challenge in establishing the appropriate enabling environment. National and regional governments usually have the mandate and resources to invest in infrastructure development for well-connected rural and urban areas, and have access to policy instruments dealing with the role of the private sector in agrifood systems transformation.[250] As mentioned earlier in this **Chapter 5**, investments in general services support in SICTs could scale up private investments and take advantage of the closer spatial and functional links that urbanization is creating across the rural–urban continuum. Therefore, these policies and investments will require strong multilevel governance across national and regional agrifood systems policies in order to promote the necessary structural transformation of agrifood systems. In order to address a specific issue systemically and encourage agrifood systems transformation, coordinated actions across horizontal and vertical dimensions of governance are needed. *Horizontal governance* refers to the coordination and/or integration among sectoral institutions (e.g. related to trade, agriculture, health and planning) and/or with non-governmental actors such as research institutions, civil society organizations, representatives of the private sector, and financial institutions.

BOX 19 THE MULTISTAKEHOLDER PARTICIPATORY PROCESS FOR ESTABLISHING MULTILEVEL INSTITUTIONAL AGREEMENTS FOR FOOD SECURITY AND NUTRITION IN WESTERN CAPE PROVINCE, SOUTH AFRICA

In 2016, the Western Cape Provincial Government of South Africa published a food security and nutrition strategy, Nourish to Flourish, which offers insights into integrated, transversal and multilevel agrifood systems governance. The strategy is co-led by the Department of the Provincial Premier and the Provincial Department of Agriculture. Informed by the mandates of these provincial co-leads, the scope of the strategy spans the rural–urban continuum including rural areas, small towns and large cities, as well as agrifood systems that flow into the provincial system. The development and implementation of the strategy was founded on a wide-ranging, innovative consultation and curation process, which brought together multiple actors including often unheard voices to improve agrifood systems. The strategy engages multiple government units, many of whom are assumed to hold no food or nutrition mandate (e.g. departments of spatial planning, education, economic development and environment), while supporting existing programmes within the food security realm. Avoiding traditional policy formulation processes, the strategy retains an open-ended governance approach, where the lead government officials continually innovate and adapt in response to evolving lessons learned and implementation feedback. Currently, as the post-2023 South Africa National Food and Nutrition Security Plan is being drafted, the Ministry of the President is exploring how the national government can support this strategy of the Western Cape Provincial Government, and also how such strategies can be applied in other regions and what kind of mechanisms can be created to bridge the national–local governance gap.

For example, as agrifood systems usually fall under the mandate of multiple agencies, to improve national coordination among them, countries are creating interministerial committees or similar mechanisms to manage decentralization processes and implement agroterritorial initiatives. On the other hand, *vertical or multilevel governance* concerns the distribution of power, policymaking capacity and responsibility across supranational, national, regional and local government levels.[243, 251] Multilevel governance means operating and coordinating between and across the two axes and creating cohesion across the rural–urban continuum, empowering all levels of government to take shared ownership[252, 253] (see Box 19).

Conducive policy frameworks for multilevel governance are still not common, although they do exist in a handful of countries. A regional perspective of agrifood systems governance can become an opportunity for initiating the process of establishing multilevel agrifood systems governance mechanisms, such as in the case of the Catalonia Region, Spain (Box 20). Moreover, processes of multilevel agrifood systems governance addressing specific entry points have been initiated in some countries. For example, Denmark has started the process of multilevel agrifood systems governance using public procurement as an entry point (Box 21). The establishment of national networks that engage various levels of government appears to be an important starting point to initiate such multilevel governance mechanisms.

Kenya has started the process of promoting multilevel agrifood systems governance using urban and peri-urban agriculture as an entry point. Since 2011, the Urban Areas and Cities Act in Kenya has required counties to regulate urban and peri-urban agriculture. However, although a small number of counties in Kenya have developed (or are in the process of developing) holistic food strategies, the shift from sectoral to systemic for the establishment of multilevel governance is still at the early stage with only initial discussions between national and local governments underway.

BOX 20 THE STRATEGIC FOOD PLAN FOR CATALONIA 2021–2026 AND THE CATALAN FOOD COUNCIL

The Strategic Food Plan for Catalonia 2021–2026 (Pla Estratègic de l'Alimentació de Catalunya – PEAC) has been promoted by the Ministry of Climate Action, Food and Rural Agenda of the Government of Catalonia. The PEAC is an interministerial and intersectoral tool that defines the vision, objectives and priority initiatives and establishes the bases of the Catalan National Agreement which will serve to guide future public agrifood systems policies. The PEAC is the result of a participatory process lasting more than a year and involving actors of the Catalan agrifood systems, including primary producers, the food industry, food distributors, restaurants and catering, research institutions and universities, and local and national agencies operating in the food-related sector.

The Catalan Food Council (Consell Català de l'Alimentació), attached to the Department of Agriculture, Livestock, Fisheries and Food, is the driving force of the PEAC and acts as a forum for analysis, debate and proposal on issues related to Catalonian agrifood policies. It also acts as an agrifood systems observatory for policy recommendations, and is made up of a broad representation of associations and entities related to agrifood systems in Catalonia.

BOX 21 MULTILEVEL PUBLIC FOOD PROCUREMENT NETWORK IN DENMARK: NATIONAL, REGIONAL AND LOCAL GOVERNMENTS WORKING TOGETHER TO INITIATE THE PROCESS OF ESTABLISHING MULTILEVEL AGRIFOOD SYSTEMS GOVERNANCE

Public food procurement is an important mechanism for strengthening agrifood systems linkages across the rural–urban continuum, thus catalysing noticeable changes in primary production, dietary patterns and food education. In 2018, during the preparation of green public procurement guidelines for food tenders in Denmark, the National Food Procurement Network (Nationale Udbudsjuridiske Fødevarenetværk) – a multilevel food procurement network for public sector officials – was formally established by the Danish Ministry of Environment, together with the chief procurement lawyer of the City of Copenhagen, to connect the different levels of government and strengthen the effectiveness of public food procurement. This formal collaboration engages the ministry, mayors and 44 national, regional and local officials, and is an important step towards the establishment of multilevel agrifood systems governance. The network has been created because of the need for closer and systemic collaboration between the state and the city level of government regarding the implementation of state-level rules and regulations. Without this collaboration, the decisions made at the state level may prove unfeasible at the local level. Building on the Danish procurement network, another public food procurement network has been established at the European and global levels to share experience and initiate the process of strengthening multilevel governance at all levels.

In Indonesia, after the United Nations Food Systems Summit, the national government committed to promoting the agrifood systems approach at all levels. Currently, the national, provincial and district/city levels are each required to develop a food security and nutrition action plan every five years. In Viet Nam on the other hand, cities have the mandate to develop the national agrifood systems action plan. The above frameworks undoubtedly stimulate policy development across the rural–urban continuum. However, there is a risk that the various localities feel obliged to address national priorities rather than respond to different local priorities.[254] Nonetheless, effective institutional mechanisms across government levels, in which the voice of subnational governments inform the national policy agenda, can create bridges across geographies and enhance accountability. ■

BANGLADESH
Harvesting tomatoes in a small urban garden in Dhaka.
©FAO/Saikat Mojumder

CHAPTER 6 CONCLUSION

This 2023 edition of *The State of Food Security and Nutrition in the World* has provided an update on global progress towards the targets of ending both hunger (SDG Target 2.1) and all forms of malnutrition (SDG Target 2.2). Hunger at the global level did not worsen between 2021 and 2022, but there are many places in the world where hunger is on the rise – where people are still struggling to recover income losses in the wake of the COVID-19 pandemic, or have been hit by rising prices of food, agricultural inputs and energy, or whose lives and livelihoods have been disrupted by conflicts or extreme weather events. Progress on important indicators of child nutrition is to be celebrated, and some regions are on track to achieve some of the nutrition targets by 2030. However, rising overweight among children under five years of age in many countries portends growing burdens of non-communicable diseases.

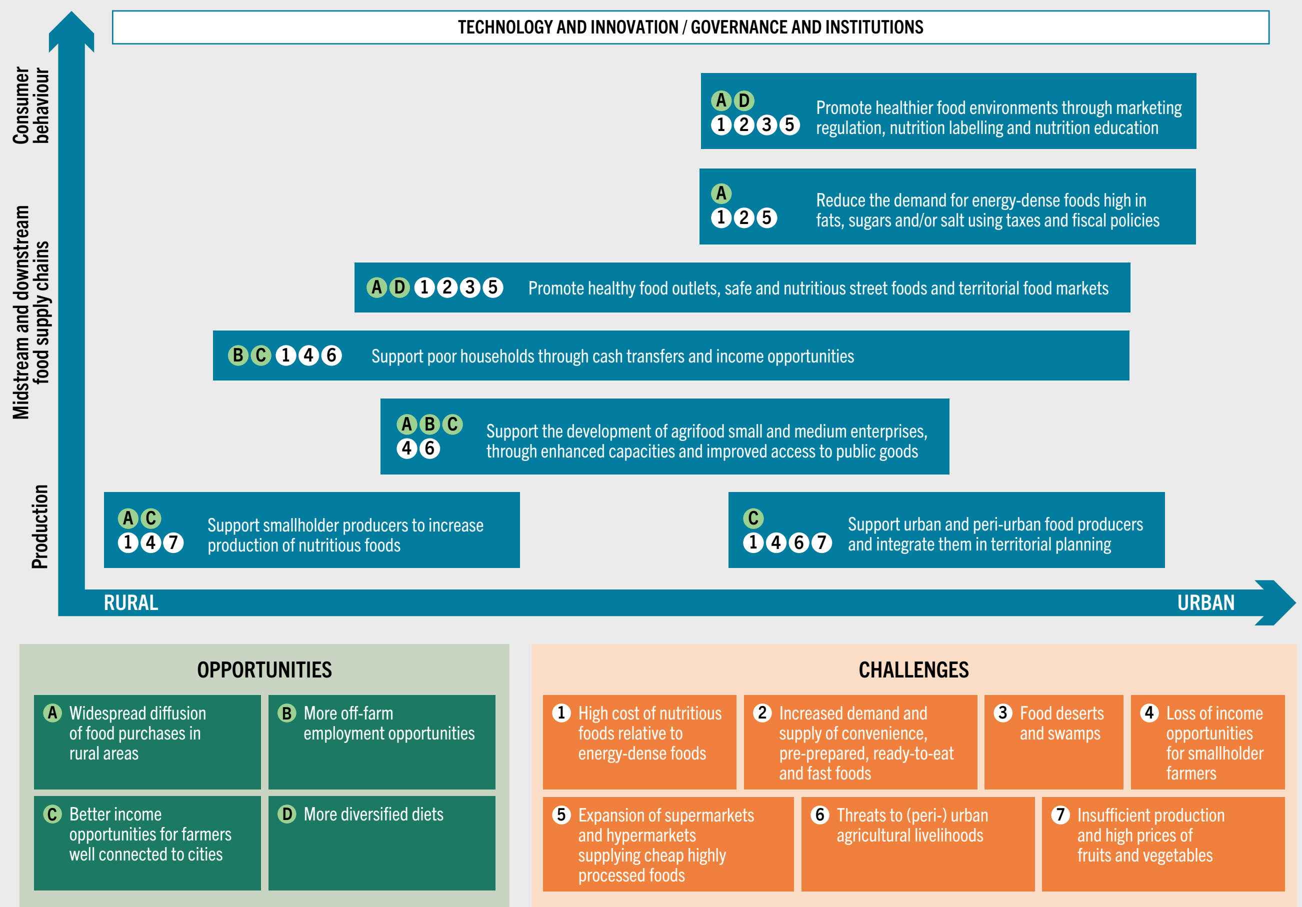
The 2030 Agenda for Sustainable Development is a vision of a healthier, more just and equal world – a world without poverty, hunger and malnutrition. While these goals may seem out of reach, the lack of an increase in hunger may signal the beginning of a turnaround, and any improvement in the nutrition of children bodes well for the future. Achieving food security and nutrition goals is not only good for those suffering from food insecurity and malnutrition, it is good for everyone. A healthier, more just and equal world is better for all.

Since its 2017 edition, this report has offered an in-depth thematic analysis of the underlying causes and drivers of observed food insecurity and malnutrition trends and how food security and nutrition SDG 2 targets are related to other SDG targets. The report has repeatedly highlighted that the intensification and interaction of conflict, climate extremes and economic slowdowns and downturns, combined with highly unaffordable nutritious foods and growing inequality, are pushing us off track to meet the SDG 2 targets. While policy recommendations have been offered to build resilience against these adversities, this year the report underscores the importance of also considering other important megatrends.

Urbanization has featured as the theme of this year's report. With almost seven in ten people projected to live in cities by 2050, this megatrend is shaping agrifood systems and, as a consequence, their capacity to deliver affordable healthy diets for all and to help eradicate hunger, food insecurity and malnutrition. Urbanization also has relevance for SDG 11 (Sustainable Cities and Communities), SDG 1 (No Poverty), SDG 2 (Good Health and Well-Being), SDG 10 (Reduced Inequalities) and SDG 12 (Responsible Consumption and Production). Therefore, the findings and policy recommendations from analysing urbanization in this report can inform efforts of the 2030 Agenda for Sustainable Development, as well as other ongoing efforts, including those in the framework of the United Nations General Assembly-endorsed New Urban Agenda and the coalitions of action established after the United Nations Food Systems Summit.

A key conclusion is that the ways in which urbanization is shaping agrifood systems can only be understood with a rural–urban continuum lens; the simple concept of a rural–urban divide is no longer useful to understand the growing links across urban, peri-urban and rural areas. This growing connectivity across the rural–urban

FIGURE 37 CHALLENGES AND OPPORTUNITIES FOR AGRIFOOD SYSTEMS ARISING FROM URBANIZATION, MAPPED ONTO POLICIES ACROSS THE RURAL–URBAN CONTINUUM



NOTES: The blue boxes indicate policies to leverage agrifood systems transformation for healthy diets across the rural–urban continuum, discussed in **Chapter 5**. The green and orange boxes indicate opportunities and challenges to access affordable healthy diets identified in **Chapter 3**. Policy adequacy for leveraging and addressing specific opportunities and challenges is indicated with letters and numbers, respectively.
SOURCE: Authors' (FAO) own elaboration.

continuum is a key aspect today to understand the functioning of value chains. Only then can the challenges and the opportunities that urbanization creates for agrifood systems be clearly mapped onto appropriate policy, technology and investment solutions, as shown in Figure 37. Implementing these solutions requires that agrifood systems governance mechanisms and institutions cross sectoral and administrative boundaries and rely on subnational and local governments. Local governments in particular are fundamental actors in leveraging multilevel and multistakeholder mechanisms that, as shown with concrete examples in this report, have proved effective in implementing essential policies and solutions for making healthy diets available and affordable for all.

New empirical evidence presented in this report for 11 Western, Eastern and Southern African countries also challenges traditional thinking and reveals important food consumption patterns, including dietary convergence across the rural–urban continuum. For example, it calls into question the traditional notion that Africa's rural farmers largely produce their own food. The affordability of a healthy diet is actually found to be a critical issue for rural households in these countries because they are more – not to say the most – reliant on food purchases. The new evidence also runs counter to conventional thinking that purchase patterns between urban and rural areas differ markedly, at least for some food groups.

In these countries, the diffusion of processed foods, including highly processed foods, associated with urban areas is now seen in rural areas as well. Unfortunately, low-income households living in peri-urban and rural areas in these countries would need to more than double what they spend on food to secure a healthy diet. Moreover, food insecurity is no longer a predominantly rural problem, as levels of both severe and moderate or severe food insecurity across urban areas (large, intermediate and small cities and towns) and peri-urban areas (less than 1 hour travel to large, intermediate and small cities) were found to be similar to or even higher than those in rural areas in some of the countries analysed. The prevalence of stunting, wasting and overweight in children under five years of age can also show important variations across the rural–urban continuum.

Unfortunately, we have learned through this report that such valuable granular analysis of food consumption patterns, affordability of healthy diets, and food insecurity and malnutrition across the rural–urban continuum cannot currently be replicated for more countries and regions of the world, and that renewed efforts in food security and nutrition data collection and analysis are needed. The analysis has relied on the newly available URCA global dataset, which provides a georeferenced mapping of the spatial and functional connectivity across urban, peri-urban and rural areas, using latitudinal and longitudinal data of households from the most recent household surveys. This combination has made it possible to work with different categories of catchment areas defined across the rural–urban continuum for the said 11 African countries. Unfortunately, georeferenced nationally representative household survey data are currently only available for a handful of datasets which have latitude and longitude information that is publicly available, and all of them are for Africa. It is then in the best interest of governments of other countries and regions that such data become available for public use, or, if the data are lacking, that governments invest in data development to bridge this important gap. Only then will decision-makers of those countries and regions be able to rely on an analysis, similar to that presented in this report, to inform their policies and investments in ways that leverage urbanization to accelerate agrifood systems transformation in the quest to secure affordable healthy diets, food security and adequate nutrition for all across the rural–urban continuum. ■

MEXICO
A woman makes tortillas in her home in the village of San Lorenzo.
©Alex Webb/Magnum Photos for FAO

ANNEXES

ANNEX 1A
STATISTICAL TABLES TO CHAPTER 2

TABLE A1.1 PROGRESS TOWARDS THE SUSTAINABLE DEVELOPMENT GOALS AND GLOBAL NUTRITION TARGETS: PREVALENCE OF UNDERNOURISHMENT, MODERATE OR SEVERE FOOD INSECURITY, SELECTED FORMS OF MALNUTRITION, EXCLUSIVE BREASTFEEDING AND LOW BIRTHWEIGHT

REGIONS/ SUBREGIONS/ COUNTRIES/ TERRITORIES	PREVALENCE OF UNDERNOURISHMENT IN THE TOTAL POPULATION[1]		PREVALENCE OF SEVERE FOOD INSECURITY IN THE TOTAL POPULATION[1,2,3]		PREVALENCE OF MODERATE OR SEVERE FOOD INSECURITY IN THE TOTAL POPULATION[1,2,3]		PREVALENCE OF WASTING IN CHILDREN (<5 YEARS)	PREVALENCE OF STUNTING IN CHILDREN (<5 YEARS)		PREVALENCE OF OVERWEIGHT IN CHILDREN (<5 YEARS)		PREVALENCE OF OBESITY IN THE ADULT POPULATION (≥18 YEARS)		PREVALENCE OF ANAEMIA IN WOMEN (15–49 YEARS)		PREVALENCE OF EXCLUSIVE BREASTFEEDING AMONG INFANTS (0–5 MONTHS)		PREVALENCE OF LOW BIRTHWEIGHT	
	2004–06 (%)	2020–22[4] (%)	2014–16 (%)	2020–22 (%)	2014–16 (%)	2020–22 (%)	2022[5] (%)	2012 (%)	2022 (%)	2012 (%)	2022 (%)	2012 (%)	2016 (%)	2012 (%)	2019 (%)	2012[6] (%)	2021[7] (%)	2012 (%)	2020 (%)
WORLD	12.0	9.2	7.8	11.3	21.9	29.5	6.8	26.3	22.3	5.5	5.6	11.8	13.1	28.5	29.9	37.0	47.7	15.0	14.7
Least developed countries	25.3	21.7	19.8	24.2	50.4	59.3	7.0	38.7	32.3	3.1	3.2	4.9	6.0	39.1	39.4	45.5	53.5	16.1	15.3
Landlocked developing countries	24.6	19.3	16.4	23.0	44.8	56.2	4.1	35.8	28.3	4.2	3.7	8.3	9.4	32.0	32.9	45.3	53.3	15.2	14.7
Small Island Developing States	17.5	15.3	21.5	20.4	45.5	46.8	4.1	21.3	21.1	6.8	8.0	18.8	20.9	28.2	29.2	37.0	42.9	14.0	14.4
Low-income countries	26.9	27.9	22.5	28.0	55.6	65.7	6.6	39.6	33.5	3.8	3.4	6.0	6.9	38.3	38.5	43.0	53.3	15.3	14.8
Lower-middle-income countries	18.2	13.5	10.9	16.2	27.6	39.6	9.7	35.5	28.1	4.3	4.5	7.0	8.2	41.7	42.1	39.9	51.8	20.0	18.5
Upper-middle-income countries	6.9	<2.5	3.0	4.6	12.7	16.2	1.7	10.1	8.3	8.0	8.8	11.5	13.2	17.6	18.1	28.8	35.8	7.6	8.1
High-income countries	<2.5	<2.5	1.5	1.6	8.3	7.6	0.4	4.0	4.0	7.4	7.6	22.3	24.3	13.1	14.4	n.a.	n.a.	8.0	8.1
Low-income food-deficit countries	27.0	24.9	20.6	26.1	51.8	62.7	n.a.	36.8	30.5	4.0	3.7	7.1	8.2	37.8	37.7	41.0	51.8	14.6	14.0

TABLE A1.1 (Continued)

REGIONS/ SUBREGIONS/ COUNTRIES/ TERRITORIES	PREVALENCE OF UNDERNOURISHMENT IN THE TOTAL POPULATION[1]		PREVALENCE OF SEVERE FOOD INSECURITY IN THE TOTAL POPULATION[1, 2, 3]		PREVALENCE OF MODERATE OR SEVERE FOOD INSECURITY IN THE TOTAL POPULATION[1, 2, 3]		PREVALENCE OF WASTING IN CHILDREN (<5 YEARS)	PREVALENCE OF STUNTING IN CHILDREN (<5 YEARS)		PREVALENCE OF OVERWEIGHT IN CHILDREN (<5 YEARS)		PREVALENCE OF OBESITY IN THE ADULT POPULATION (≥18 YEARS)		PREVALENCE OF ANAEMIA IN WOMEN (15–49 YEARS)		PREVALENCE OF EXCLUSIVE BREASTFEEDING AMONG INFANTS (0–5 MONTHS)		PREVALENCE OF LOW BIRTHWEIGHT	
	2004–06 (%)	2020–22[4] (%)	2014–16 (%)	2020–22 (%)	2014–16 (%)	2020–22 (%)	2022[5] (%)	2012 (%)	2022 (%)	2012 (%)	2022 (%)	2012 (%)	2016 (%)	2012 (%)	2019 (%)	2012[6] (%)	2021[7] (%)	2012 (%)	2020 (%)
AFRICA	**19.5**	**19.3**	**17.8**	**23.4**	**46.6**	**58.9**	**5.8**	**34.4**	**30.0**	**5.0**	**4.9**	**11.5**	**12.8**	**39.2**	**38.9**	**35.4**	**44.3**	**14.5**	**13.9**
Northern Africa	**6.1**	**6.8**	**9.8**	**10.9**	**28.6**	**32.2**	**6.3**	**23.5**	**21.7**	**11.8**	**12.3**	**23.0**	**25.2**	**31.9**	**31.1**	**40.8**	**n.a.**	**14.0**	**14.1**
Algeria	6.7	<2.5	13.0	5.6	22.9	19.4	2.7	12.1	8.6	13.5	11.9	24.7	27.4	32.9	33.3	25.4	28.6	6.9	7.2
Egypt	6.4	7.2	8.4	8.8	27.8	28.5	n.a.	24.6	20.4	15.7	18.8	29.3	32.0	31.0	28.3	52.8	n.a.	n.a.	n.a.
Libya	4.7	8.4	11.2	21.2	29.1	39.8	n.a.	30.0	52.2	26.4	28.7	30.0	32.5	28.6	29.9	n.a.	n.a.	n.a.	n.a.
Morocco	5.5	6.3	n.r.	n.r.	n.r.	n.r.	2.3[h]	15.8	12.8	9.5	4.9	23.4	26.1	29.8	29.9	27.8	35.0	16.1	14.8
Sudan	–	11.9	13.4[b]	18.1[c]	41.4[b]	51.8[c]	n.a.	36.0	36.0	2.4	2.7	n.a.	n.a.	36.8	36.5	41.0	n.a.	n.a.	n.a.
Tunisia	4.3	3.0	9.1	12.6	18.2	28.5	2.1	8.8	8.6	12.7	19.0	24.6	26.9	30.4	32.1	8.5	13.5	8.1	8.2
Northern Africa (excluding Sudan)	**6.1**	**5.7**	**9.1**	**9.3**	**26.1**	**28.0**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**26.8**	**29.5**	**n.a.**	**n.a.**	**40.7**	**n.a.**	**n.a.**	**n.a.**
Sub-Saharan Africa	**22.9**	**22.1**	**19.6**	**26.2**	**50.8**	**64.9**	**5.7**	**36.2**	**31.3**	**3.8**	**3.7**	**8.0**	**9.2**	**41.2**	**40.7**	**34.4**	**45.1**	**14.5**	**13.9**
Eastern Africa	**32.7**	**28.4**	**23.2**	**28.1**	**59.0**	**67.5**	**5.0**	**38.6**	**30.6**	**3.9**	**3.6**	**5.3**	**6.4**	**31.4**	**31.9**	**48.6**	**59.1**	**14.7**	**14.0**
Burundi	n.a.	n.a.	n.r.	n.r.	n.r.	n.r.	4.9[h]	56.5	56.5	2.2	3.6	4.4	5.4	31.1	38.5	69.3	71.9	15.1	14.8
Comoros	16.8	13.5	n.a.	27.4	n.a.	79.7	n.a.	31.9	18.8	11.5	7.7	6.7	7.8	32.8	33.8	11.4	n.a.	24.1	23.0
Djibouti	30.2	16.8	n.a.	16.5	n.a.	49.2	10.6[h]	29.6	18.7	1.3	3.2	12.3	13.5	31.0	32.3	12.4	n.a.	n.a.	n.a.
Eritrea	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	51.6	50.2	1.9	3.0	4.1	5.0	36.2	37.0	68.7	n.a.	15.4	15.2
Ethiopia	37.1	21.9	14.5	21.1	56.2	58.1	6.8	42.1	34.4	2.5	2.7	3.6	4.5	22.4	23.9	52.0	58.8	n.a.	n.a.
Kenya	28.4	27.8	15.0[b, c]	28.0[c]	50.7[b, c]	72.3[c]	4.9	28.6	18.4	4.6	3.8	5.9	7.1	28.4	28.7	31.9	n.a.	10.8	10.0
Madagascar	33.7	51.0	n.a.	12.2	n.a.	64.9	7.2	47.3	38.6	1.8	1.5	4.3	5.3	37.5	37.8	41.9	54.4	19.5	18.7
Malawi	21.9	17.8	47.7[b, c]	52.2[b, c]	78.1[b, c]	82.4[b, c]	2.6	43.6	34.0	4.9	3.9	4.8	5.8	30.6	31.4	70.8	64.1	15.8	15.6
Mauritius	5.1	6.8	5.2	10.5	13.0	32.0	n.a.	9.0[f]	8.6[f]	7.8[f]	6.8[f]	9.6	10.8	19.2	23.5	n.a.	n.a.	19.1	18.7
Mozambique	33.8	30.5	n.a.	39.6	n.a.	75.4	3.9	42.6	36.4	5.5	5.5	6.1	7.2	48.8	47.9	40.0	n.a.	18.1	17.8

TABLE A1.1 (Continued)

REGIONS/ SUBREGIONS/ COUNTRIES/ TERRITORIES	PREVALENCE OF UNDERNOURISHMENT IN THE TOTAL POPULATION[1]		PREVALENCE OF SEVERE FOOD INSECURITY IN THE TOTAL POPULATION[1,2,3]		PREVALENCE OF MODERATE OR SEVERE FOOD INSECURITY IN THE TOTAL POPULATION[1,2,3]		PREVALENCE OF WASTING IN CHILDREN (<5 YEARS)	PREVALENCE OF STUNTING IN CHILDREN (<5 YEARS)		PREVALENCE OF OVERWEIGHT IN CHILDREN (<5 YEARS)		PREVALENCE OF OBESITY IN THE ADULT POPULATION (≥18 YEARS)		PREVALENCE OF ANAEMIA IN WOMEN (15–49 YEARS)		PREVALENCE OF EXCLUSIVE BREASTFEEDING AMONG INFANTS (0–5 MONTHS)		PREVALENCE OF LOW BIRTHWEIGHT	
	2004–06 (%)	2020–22[4] (%)	2014–16 (%)	2020–22 (%)	2014–16 (%)	2020–22 (%)	2022[5] (%)	2012 (%)	2022 (%)	2012 (%)	2022 (%)	2012 (%)	2016 (%)	2012 (%)	2019 (%)	2012[6] (%)	2021[7] (%)	2012 (%)	2020 (%)
Rwanda	34.3	31.6	n.r.	n.r.	n.r.	n.r.	1.1	41.2	29.8	6.3	4.7	4.7	5.8	18.3	17.2	83.8	80.9	9.3	9.4
Seychelles	2.6	4.3	3.2[b]	3.3[c]	14.3[b]	14.7[c]	n.a.	7.9	7.2	9.9	9.1	12.4	14.0	23.5	25.1	n.a.	n.a.	12.3	12.5
Somalia	70.4	48.7	n.a.	43.4	n.a.	79.5	n.a.	27.6	18.0	3.0	2.7	7.0	8.3	44.0	43.1	5.3	33.7	n.a.	n.a.
South Sudan	–	21.4	n.a.	63.2[b]	n.a.	87.3[b]	n.a.	30.8	27.9	6.3	4.7	n.a.	n.a.	34.7	35.6	44.5	n.a.	n.a.	n.a.
Uganda	16.9	31.6	21.5[c]	24.9[c]	66.3[c]	74.2[c]	3.6	33.3	23.4	3.9	3.5	4.3	5.3	31.3	32.8	62.2	65.5	n.a.	n.a.
United Republic of Tanzania	28.1	23.5	20.6[c]	26.3[c]	48.9[c]	58.7[c]	3.3	38.1	30.6	4.5	4.6	6.9	8.4	40.3	38.9	48.7	57.8	10.5	9.7
Zambia	51.4	29.8	22.4[c]	32.1[c]	51.2[c]	73.1[c]	4.2	40.8	31.4	6.0	5.4	6.8	8.1	30.5	31.5	59.9	69.9	12.0	11.2
Zimbabwe	30.0	38.4	35.5	28.6	64.7	73.6	2.9	31.1	21.6	4.6	2.7	14.3	15.5	30.0	28.9	31.3	41.9	12.2	11.8
Middle Africa	**31.9**	**28.4**	**n.a.**	**37.7**	**n.a.**	**74.7**	**5.6**	**37.9**	**37.4**	**4.5**	**4.6**	**6.7**	**7.9**	**46.1**	**43.2**	**28.4**	**44.4**	**12.8**	**12.2**
Angola	52.6	21.6	21.0	31.2[b, c]	66.5	78.5[b, c]	n.a.	31.8	43.6	3.0	3.9	6.8	8.2	45.9	44.5	n.a.	37.4	15.7	15.5
Cameroon	15.8	6.4	22.3	26.7	49.9	58.5	4.3	32.1	26.9	7.1	10.5	9.8	11.4	41.2	40.6	19.9	39.4	12.9	12.5
Central African Republic	38.9	48.7	n.a.	61.8	n.a.	81.3	5.4	40.6	39.8	3.5	2.6	6.4	7.5	47.9	46.8	33.0	36.2	15.9	16.4
Chad	38.1	31.4	n.r.	n.r.	n.r.	n.r.	8.3[h]	38.9	32.3	2.5	3.2	5.1	6.1	49.2	45.4	3.2	16.2	n.a.	n.a.
Congo	34.5	33.3	42.6	58.8	82.0	88.2	n.a.	23.1	16.5	5.1	4.5	8.3	9.6	53.1	48.8	20.2	n.a.	11.6	11.9
Democratic Republic of the Congo	28.4	35.3	n.a.	40.7	n.a.	76.6	6.4	42.7	40.3	4.6	3.7	5.6	6.7	46.4	42.4	36.4	53.6	11.0	10.2
Equatorial Guinea	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	25.0	16.1	8.5	8.2	6.8	8.0	47.4	44.5	7.4	n.a.	n.a.	n.a.
Gabon	14.4	23.0	n.r.	n.r.	n.r.	n.r.	3.4	17.2	13.4	6.2	5.4	13.5	15.0	55.3	52.4	5.1	n.a.	14.9	14.6
Sao Tome and Principe	10.3	13.1	n.a.	14.1	n.a.	54.6	4.1	18.8	10.0	2.5	4.7	10.7	12.4	45.7	44.2	50.3	63.1	10.6	11.1

TABLE A1.1 (Continued)

REGIONS/ SUBREGIONS/ COUNTRIES/ TERRITORIES	PREVALENCE OF UNDERNOURISHMENT IN THE TOTAL POPULATION[1]		PREVALENCE OF SEVERE FOOD INSECURITY IN THE TOTAL POPULATION[1, 2, 3]		PREVALENCE OF MODERATE OR SEVERE FOOD INSECURITY IN THE TOTAL POPULATION[1, 2, 3]		PREVALENCE OF WASTING IN CHILDREN (<5 YEARS)	PREVALENCE OF STUNTING IN CHILDREN (<5 YEARS)		PREVALENCE OF OVERWEIGHT IN CHILDREN (<5 YEARS)		PREVALENCE OF OBESITY IN THE ADULT POPULATION (≥18 YEARS)		PREVALENCE OF ANAEMIA IN WOMEN (15–49 YEARS)		PREVALENCE OF EXCLUSIVE BREASTFEEDING AMONG INFANTS (0–5 MONTHS)		PREVALENCE OF LOW BIRTHWEIGHT	
	2004–06 (%)	2020–22[4] (%)	2014–16 (%)	2020–22 (%)	2014–16 (%)	2020–22 (%)	2022[5] (%)	2012 (%)	2022 (%)	2012 (%)	2022 (%)	2012 (%)	2016 (%)	2012 (%)	2019 (%)	2012[6] (%)	2021[7] (%)	2012 (%)	2020 (%)
Southern Africa	**5.2**	**10.2**	**9.0**	**11.5**	**21.7**	**25.1**	**3.5**	**23.4**	**22.8**	**12.3**	**11.4**	**25.0**	**27.1**	**28.5**	**30.3**	**n.a.**	**32.8**	**16.4**	**16.4**
Botswana	22.9	22.9	18.4[c]	26.7[b, c]	46.5[c]	56.3[b, c]	n.a.	24.6	21.6	10.4	10.1	17.5	18.9	31.3	32.5	20.3	30.0	17.3	16.8
Eswatini	9.6	11.6	n.a.	18.3	n.a.	67.0	n.a.	28.0	21.2	10.1	7.9	14.9	16.5	30.0	30.7	43.8	n.a.	10.6	10.2
Lesotho	13.9	46.0	n.a.	32.9[c]	n.a.	56.7[c]	2.1	37.5	31.8	7.0	6.9	14.9	16.6	28.3	27.9	52.9	59.0	14.8	14.4
Namibia	20.3	17.1	28.8[c]	33.0[c]	53.2[c]	57.7[c]	n.a.	24.0	16.8	4.2	5.3	15.1	17.2	24.7	25.2	22.1	n.a.	15.9	15.6
South Africa	3.4	7.9	n.a.	9.0[c]	n.a.	20.3[c]	3.8[h]	22.5	22.8	13.1	12.1	26.1	28.3	28.6	30.5	n.a.	31.6	16.6	16.6
Western Africa	**12.1**	**14.3**	**11.6**	**21.2**	**40.1**	**64.1**	**6.7**	**34.5**	**30.0**	**2.3**	**2.4**	**7.4**	**8.9**	**52.9**	**51.8**	**22.1**	**35.1**	**14.9**	**14.3**
Benin	12.0	9.9	10.4[c]	15.3[c]	55.0[c]	73.6[c]	5.0	33.9	30.4	1.6	2.2	8.2	9.6	55.5	55.2	32.5	41.4	17.5	16.4
Burkina Faso	17.8	16.2	10.0[b, c]	21.2	41.8[b, c]	56.9	10.6	33.3	21.8	1.8	2.0	4.5	5.6	53.3	52.5	38.2	57.9	19.1	18.5
Cabo Verde	11.2	18.2	n.a.	6.3[b]	n.a.	37.0[b]	n.a.	12.6[f]	9.4[f]	n.a.	n.a.	10.3	11.8	26.9	24.3	59.6	41.8	n.a.	n.a.
Côte d'Ivoire	16.9	7.7	6.2[c]	9.7[c]	34.1[c]	44.2[c]	8.4	29.6	20.2	2.6	2.6	8.7	10.3	52.2	50.9	11.8	34.0	19.1	18.3
Gambia	21.5	19.6	n.a.	27.0	n.a.	60.7	5.1	22.3	13.6	1.9	1.8	8.7	10.3	56.4	49.5	33.2	53.6	13.7	13.2
Ghana	11.1	4.9	5.1[b, c]	6.2[c]	38.3[b, c]	39.4[c]	6.8	22.0	12.7	2.3	1.9	9.4	10.9	44.2	35.4	45.7	42.9	14.9	14.4
Guinea	14.9	12.9	44.3	49.5	72.5	73.1	9.2	33.7	27.9	4.4	5.6	6.4	7.7	50.9	48.0	20.4	33.4	n.a.	n.a.
Guinea-Bissau	16.4	37.9	n.a.	32.0[c]	n.a.	77.8[c]	5.1	29.3	27.7	2.8	3.3	7.9	9.5	49.9	48.1	38.3	59.3	21.8	19.5
Liberia	33.5	38.4	38.6	37.5	79.7	81.2	3.4	35.0	26.6	3.3	5.3	8.6	9.9	43.6	42.6	27.8	55.2	19.7	19.9
Mali	13.6	12.8	n.r.	n.r.	n.r.	n.r.	10.6	30.7	23.8	1.6	2.0	7.2	8.6	58.2	59.0	20.2	47.7	n.a.	n.a.
Mauritania	9.1	8.7	4.6[c]	9.5[b, c]	26.3[c]	53.7[b, c]	13.6[h]	26.0	22.1	1.9	2.0	11.0	12.7	45.1	43.3	26.7	40.9	n.a.	n.a.
Niger	19.1	16.1	n.a.	30.5[c]	n.a.	71.4[c]	10.9	46.6	47.4	1.1	2.7	4.5	5.5	49.1	49.5	23.3	25.6	n.a.	n.a.
Nigeria	7.0	15.9	11.0[b, c]	21.3[b, c]	34.7[b, c]	69.7[b, c]	6.5	37.7	34.2	2.5	2.2	7.4	8.9	54.9	55.1	14.7	28.7	n.a.	n.a.
Senegal	18.1	5.7	7.5[c]	11.1[c]	39.0[c]	49.8[c]	8.1	18.5	17.0	1.5	3.4	7.6	8.8	55.9	52.7	39.0	40.8	19.1	17.2
Sierra Leone	46.5	27.8	26.7[b, c]	31.9	75.8[b, c]	89.2	6.3	34.9	26.0	3.3	5.2	7.4	8.7	47.9	48.4	31.2	50.9	11.4	10.3
Togo	28.3	17.4	16.1[c]	19.4[c]	60.4[c]	62.9[c]	5.7	27.3	22.3	1.6	2.2	7.1	8.4	47.4	45.7	62.1	64.3	15.1	14.3

TABLE A1.1 (Continued)

REGIONS/ SUBREGIONS/ COUNTRIES/ TERRITORIES	PREVALENCE OF UNDERNOURISHMENT IN THE TOTAL POPULATION[1]		PREVALENCE OF SEVERE FOOD INSECURITY IN THE TOTAL POPULATION[1,2,3]		PREVALENCE OF MODERATE OR SEVERE FOOD INSECURITY IN THE TOTAL POPULATION[1,2,3]		PREVALENCE OF WASTING IN CHILDREN (<5 YEARS)	PREVALENCE OF STUNTING IN CHILDREN (<5 YEARS)		PREVALENCE OF OVERWEIGHT IN CHILDREN (<5 YEARS)		PREVALENCE OF OBESITY IN THE ADULT POPULATION (≥18 YEARS)		PREVALENCE OF ANAEMIA IN WOMEN (15–49 YEARS)		PREVALENCE OF EXCLUSIVE BREASTFEEDING AMONG INFANTS (0–5 MONTHS)		PREVALENCE OF LOW BIRTHWEIGHT	
	2004–06 (%)	2020–22[4] (%)	2014–16 (%)	2020–22 (%)	2014–16 (%)	2020–22 (%)	2022[5] (%)	2012 (%)	2022 (%)	2012 (%)	2022 (%)	2012 (%)	2016 (%)	2012 (%)	2019 (%)	2012[6] (%)	2021[7] (%)	2012 (%)	2020 (%)
Sub-Saharan Africa (including Sudan)	**22.0**	**21.7**	**19.4**	**25.9**	**50.5**	**64.4**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**7.7**	**8.9**	**n.a.**	**n.a.**	**34.6**	**45.1**	**n.a.**	**n.a.**
ASIA*	**13.6**	**8.6**	**6.7**	**9.9**	**17.7**	**24.8**	**9.3**	**28.2**	**22.3**	**4.8**	**5.1**	**6.1**	**7.3**	**31.1**	**32.7**	**39.0**	**51.5**	**17.2**	**17.2**
Central Asia	**14.0**	**3.2**	**1.7**	**4.8**	**9.2**	**18.4**	**2.1**	**14.7**	**7.7**	**8.2**	**5.0**	**15.6**	**17.7**	**28.8**	**28.1**	**29.2**	**44.9**	**6.3**	**6.0**
Kazakhstan	7.2	<2.5	n.a.	0.5[b]	n.a.	2.4[b]	n.a.	11.0	4.9	12.1	7.7	19.0	21.0	27.3	28.7	31.8	37.8	5.7	5.3
Kyrgyzstan	8.0	4.8	n.a.	1.1[c]	n.a.	6.9[c]	2.0	16.0	10.3	7.9	6.4	14.4	16.6	34.1	35.8	56.0	45.6	6.4	6.0
Tajikistan	37.6	9.3	n.r.	n.r.	n.r.	n.r.	5.6	25.7	13.1	5.4	3.0	12.2	14.2	31.0	35.2	32.6	35.8	9.3	8.7
Turkmenistan	4.2	5.7	n.a.	n.a.	n.a.	n.a.	4.1	12.5	6.7	5.4	3.6	16.3	18.6	25.3	26.6	10.9	56.5	4.9	4.3
Uzbekistan	14.8	<2.5	1.9	6.8	11.2	26.1	2.4	13.2	6.9	7.7	4.2	14.4	16.6	28.7	24.8	23.8	49.5	5.8	5.8
Eastern Asia*	**6.9**	**<2.5**	**1.0**	**1.3**	**6.0**	**6.7**	**1.5**	**7.7**	**4.9**	**6.6**	**8.3**	**4.9**	**6.0**	**15.5**	**16.1**	**28.4**	**35.3**	**5.5**	**5.5**
China	7.0	<2.5	n.r.	n.r.	n.r.	n.r.	1.9	7.6	4.6	7.0	8.9	5.0	6.2	14.8	15.5	27.6	34.1	5.1	5.0
China, mainland	7.1	<2.5	n.r.	n.r.	n.r.	n.r.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Taiwan Province of China	4.3	3.0	n.r.	n.r.	n.r.	n.r.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	27.0	28.4	n.a.	n.a.	n.a.	n.a.
China, Hong Kong SAR	<2.5	<2.5	n.r.	n.r.	n.r.	n.r.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
China, Macao SAR	15.9	8.0	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Democratic People's Republic of Korea	34.3	45.5	n.a.	n.a.	n.a.	n.a.	2.5	25.7	16.8	1.6	2.8	5.9	6.8	31.7	33.9	68.9	71.4	n.a.	n.a.
Japan	<2.5	3.2	<0.5	0.9	2.6	4.4	n.a.	6.5	5.0	1.7	2.1	3.6	4.3	19.7	19.0	n.a.	n.a.	11.1	11.3
Mongolia	28.8	8.0	<0.5	<0.5[b, c]	6.8	5.7[b, c]	0.9	12.2	6.1	9.8	10.7	17.9	20.6	14.3	14.5	65.7	58.0	5.7	4.9
Republic of Korea	<2.5	<2.5	<0.5[b]	0.8	4.8[b]	5.6	0.2[h]	1.9	1.7	6.8	5.4	4.1	4.7	13.7	13.5	n.a.	n.a.	6.3	7.5

TABLE A1.1 (Continued)

REGIONS/ SUBREGIONS/ COUNTRIES/ TERRITORIES	PREVALENCE OF UNDERNOURISHMENT IN THE TOTAL POPULATION[1]		PREVALENCE OF SEVERE FOOD INSECURITY IN THE TOTAL POPULATION[1, 2, 3]		PREVALENCE OF MODERATE OR SEVERE FOOD INSECURITY IN THE TOTAL POPULATION[1, 2, 3]		PREVALENCE OF WASTING IN CHILDREN (<5 YEARS)	PREVALENCE OF STUNTING IN CHILDREN (<5 YEARS)		PREVALENCE OF OVERWEIGHT IN CHILDREN (<5 YEARS)		PREVALENCE OF OBESITY IN THE ADULT POPULATION (≥18 YEARS)		PREVALENCE OF ANAEMIA IN WOMEN (15–49 YEARS)		PREVALENCE OF EXCLUSIVE BREASTFEEDING AMONG INFANTS (0–5 MONTHS)		PREVALENCE OF LOW BIRTHWEIGHT	
	2004–06 (%)	2020–22[4] (%)	2014–16 (%)	2020–22 (%)	2014–16 (%)	2020–22 (%)	2022[5] (%)	2012 (%)	2022 (%)	2012 (%)	2022 (%)	2012 (%)	2016 (%)	2012 (%)	2019 (%)	2012[6] (%)	2021[7] (%)	2012 (%)	2020 (%)
Eastern Asia (excluding China and Japan)	**9.2**	**11.8**	**<0.5**	**0.9**	**3.7**	**4.9**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**
South-eastern Asia	**17.1**	**5.2**	**2.0**	**2.4**	**14.7**	**16.4**	**7.8**	**30.4**	**26.4**	**6.4**	**7.4**	**5.4**	**6.7**	**25.0**	**27.2**	**33.4**	**48.3**	**12.8**	**12.5**
Brunei Darussalam	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	17.0	10.9	8.6	9.1	12.1	14.1	14.8	16.7	n.a.	n.a.	13.2	13.6
Cambodia	17.8	4.8	16.9	14.8	48.9	51.1	9.6	33.8	22.3	2.2	3.8	3.1	3.9	46.1	47.1	72.8	51.2	12.7	11.4
Indonesia	19.3	5.9	0.7[b]	<0.5[b]	6.0[b]	4.9[b]	10.2	34.6	31.0	9.2	10.6	5.5	6.9	27.0	31.2	40.9	50.7	10.5	9.9
Lao People's Democratic Republic	22.7	4.7	n.a.	7.2	n.a.	34.1	9.0	40.4	27.7	2.2	4.0	4.1	5.3	36.3	39.5	39.7	44.4	17.2	16.7
Malaysia	3.1	2.7	7.8	6.0	17.4	16.0	9.7	17.6	21.9	6.2	5.7	13.1	15.6	30.1	32.0	n.a.	40.3	13.0	13.8
Myanmar	29.0	3.8	n.a.	5.0	n.a.	29.3	7.4[h]	31.1	24.1	1.8	0.8	4.6	5.8	39.4	42.1	23.6	51.2	12.7	12.5
Philippines	14.6	5.2	n.a.	5.7[b, c]	n.a.	44.7[b, c]	n.a.	31.9	28.8	3.5	4.6	5.4	6.4	16.9	12.3	33.0	54.9	21.2	21.1
Singapore	n.a.	n.a.	1.0	1.7	2.8	6.6	n.a.	3.4	3.0	3.0	3.8	5.6	6.1	11.5	13.0	n.a.	n.a.	10.6	11.0
Thailand	11.9	5.2	0.7[c]	1.3[b, c]	4.7[c]	7.1[b, c]	7.7	14.0	11.8	9.1	8.6	7.9	10.0	22.1	24.0	12.3	14.0	10.5	10.3
Timor-Leste	33.1	22.3	n.a.	n.a.	n.a.	n.a.	8.3	52.5	45.1	2.4	1.3	2.9	3.8	26.8	29.9	50.8	65.0	16.8	18.2
Viet Nam	15.2	5.0	n.a.	1.2[c]	n.a.	9.0[c]	4.7	25.4	19.3	4.3	8.1	1.6	2.1	17.0	20.6	17.0	45.4	7.6	6.3
Southern Asia	**19.6**	**15.9**	**13.1**	**19.7**	**27.6**	**41.3**	**14.3**	**40.3**	**30.5**	**2.7**	**2.8**	**4.5**	**5.4**	**48.3**	**48.2**	**47.2**	**60.2**	**26.1**	**24.4**
Afghanistan	34.5	30.1	14.8	28.4	45.1	79.1	5.1	44.3	33.1	5.0	3.7	4.4	5.5	37.5	42.6	n.a.	57.5	n.a.	n.a.
Bangladesh	13.7	11.2	13.3	11.0	32.2	31.1	9.8	39.2	26.4	1.8	2.1	2.8	3.6	35.7	36.7	64.1	62.6	24.3	23.0
Bhutan	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	30.2	22.7	6.9	6.5	5.2	6.4	39.8	38.6	48.7	53.2	11.7	11.4
India	21.4	16.6	n.r.	n.r.	n.r.	n.r.	18.7	41.6	31.7	2.2	2.8	3.1	3.9	53.2	53.0	46.4	63.7	29.5	27.4[g]
Iran (Islamic Republic of)	5.4	6.1	9.5	7.4	48.0	40.8	4.3	5.9	4.7	4.8	3.8	23.3	25.8	22.8	24.1	53.1	47.4	n.a.	n.a.

TABLE A1.1 (Continued)

REGIONS/ SUBREGIONS/ COUNTRIES/ TERRITORIES	PREVALENCE OF UNDERNOURISHMENT IN THE TOTAL POPULATION[1]		PREVALENCE OF SEVERE FOOD INSECURITY IN THE TOTAL POPULATION[1, 2, 3]		PREVALENCE OF MODERATE OR SEVERE FOOD INSECURITY IN THE TOTAL POPULATION[1, 2, 3]		PREVALENCE OF WASTING IN CHILDREN (<5 YEARS)	PREVALENCE OF STUNTING IN CHILDREN (<5 YEARS)		PREVALENCE OF OVERWEIGHT IN CHILDREN (<5 YEARS)		PREVALENCE OF OBESITY IN THE ADULT POPULATION (≥18 YEARS)		PREVALENCE OF ANAEMIA IN WOMEN (15–49 YEARS)		PREVALENCE OF EXCLUSIVE BREASTFEEDING AMONG INFANTS (0–5 MONTHS)		PREVALENCE OF LOW BIRTHWEIGHT	
	2004–06 (%)	2020–22[4] (%)	2014–16 (%)	2020–22 (%)	2014–16 (%)	2020–22 (%)	2022[5] (%)	2012 (%)	2022 (%)	2012 (%)	2022 (%)	2012 (%)	2016 (%)	2012 (%)	2019 (%)	2012[6] (%)	2021[7] (%)	2012 (%)	2020 (%)
Maldives	n.a.	n.a.	n.a.	2.2	n.a.	13.4	9.1	16.4	13.9	6.0	3.3	6.7	8.6	45.6	52.2	45.3	63.0	13.8	13.7
Nepal	17.0	5.4	10.4	13.2	29.5	37.4	7.7	40.3	26.7	1.2	1.7	3.3	4.1	35.9	35.7	69.6	62.1	20.9	19.7
Pakistan	17.1	18.5	0.9[c]	12.9[b, c, d]	14.1[c]	42.3[b, c, d]	7.1	43.8	34.0	4.6	2.7	7.1	8.6	42.7	41.3	37.0	47.8	n.a.	n.a.
Sri Lanka	13.9	5.3	0.7[c]	1.2[c]	5.9[c]	10.9[c]	15.1	16.7	15.9	1.2	1.3	4.1	5.2	33.5	34.6	75.8	80.9	18.5	18.0
Southern Asia (excluding India)	**15.0**	**14.1**	**7.3**	**12.2**	**27.1**	**39.9**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**8.2**	**9.5**	**n.a.**	**n.a.**	**49.0**	**53.8**	**n.a.**	**n.a.**
Western Asia	**7.8**	**10.5**	**8.9**	**10.1**	**29.4**	**36.5**	**3.5**	**19.1**	**14.0**	**9.1**	**7.2**	**27.2**	**29.8**	**31.7**	**32.5**	**31.9**	**31.7**	**12.2**	**12.2**
Armenia	12.3	<2.5	n.a.	<0.5[b]	n.a.	7.1[b]	4.4	13.9	7.2	15.0	11.5	18.3	20.2	17.6	17.3	34.1	44.5	8.3	8.3
Azerbaijan	4.7	<2.5	<0.5	<0.5	5.9	10.1	n.a.	17.4	13.3	12.2	10.1	17.7	19.9	34.7	35.1	10.8	n.a.	11.0	11.0
Bahrain	n.a.	n.a.	n.r.	n.r.	n.r.	n.r.	n.a.	6.8[f]	5.0[f]	n.a.	n.a.	27.6	29.8	36.3	35.4	n.a.	n.a.	11.6	12.4
Cyprus	7.7	<2.5	n.r.	n.r.	n.r.	n.r.	n.a.	n.a.	n.a.	n.a.	n.a.	20.4	21.8	12.0	13.6	n.a.	n.a.	n.a.	n.a.
Georgia	3.9	2.9	7.0	9.7	31.8	36.5	0.6	8.8	4.8	13.9	5.0	19.3	21.7	26.9	27.5	54.8	20.4	6.9	7.4
Iraq	17.8	16.3	n.r.	n.r.	n.r.	n.r.	3.0	19.6	9.9	9.5	6.4	28.0	30.4	29.8	28.6	19.4	25.8	10.8	10.9
Israel	<2.5	<2.5	1.3[b]	3.1[c]	11.0[b]	13.2[c]	n.a.	n.a.	n.a.	n.a.	n.a.	24.8	26.1	11.5	12.9	n.a.	n.a.	9.4	9.0
Jordan	n.a.	n.a.	n.r.	n.r.	n.r.	n.r.	0.6	7.7	6.6	5.9	9.5	33.1	35.5	30.5	37.7	22.7	17.8	17.0	18.9
Kuwait	<2.5	<2.5	4.9	4.5	12.6	10.9	2.3	4.8	6.9	9.0	11.7	35.6	37.9	21.1	23.7	n.a.	n.a.	12.4	14.4
Lebanon	n.a.	n.a.	n.a.	12.6	n.a.	36.5	1.4	11.7	7.4	8.5	8.3	29.7	32.0	25.4	28.3	n.a.	n.a.	12.2	12.6
Oman	9.4	2.8	n.a.	n.a.	n.a.	n.a.	9.3	11.1	12.7	2.9	6.5	24.3	27.0	29.0	29.1	n.a.	23.2	13.3	13.2
Palestine	n.a.	n.a.	n.a.	4.0[b]	n.a.	28.1[b]	1.3	10.3	7.5	7.6	8.3	n.a.	n.a.	30.5	31.0	28.7	38.9	9.8	10.4
Qatar	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	6.2[f]	4.4[f]	12.2[f]	11.7[f]	32.4	35.1	27.1	28.1	29.3	n.a.	9.9	10.0
Saudi Arabia	4.9	3.8	n.r.	n.r.	n.r.	n.r.	4.4[h]	11.8	12.4	9.3	10.1	32.8	35.4	25.8	27.5	n.a.	n.a.	n.a.	n.a.
Syrian Arab Republic	4.9	27.8	n.a.	n.a.	n.a.	n.a.	n.a.	26.4	25.4	16.6	11.7	25.1	27.8	31.7	32.8	42.6	28.5	n.a.	n.a.
Türkiye	<2.5	<2.5	n.r.	n.r.	n.r.	n.r.	1.7	9.1	5.5	10.2	8.1	29.5	32.1	n.a.	n.a.	41.6	40.7	14.0	12.9

REGIONS/ SUBREGIONS/ COUNTRIES/ TERRITORIES	PREVALENCE OF UNDERNOURISHMENT IN THE TOTAL POPULATION[1]		PREVALENCE OF SEVERE FOOD INSECURITY IN THE TOTAL POPULATION[1, 2, 3]		PREVALENCE OF MODERATE OR SEVERE FOOD INSECURITY IN THE TOTAL POPULATION[1, 2, 3]		PREVALENCE OF WASTING IN CHILDREN (<5 YEARS)	PREVALENCE OF STUNTING IN CHILDREN (<5 YEARS)		PREVALENCE OF OVERWEIGHT IN CHILDREN (<5 YEARS)		PREVALENCE OF OBESITY IN THE ADULT POPULATION (≥18 YEARS)		PREVALENCE OF ANAEMIA IN WOMEN (15–49 YEARS)		PREVALENCE OF EXCLUSIVE BREASTFEEDING AMONG INFANTS (0–5 MONTHS)		PREVALENCE OF LOW BIRTHWEIGHT	
	2004–06 (%)	2020–22[4] (%)	2014–16 (%)	2020–22 (%)	2014–16 (%)	2020–22 (%)	2022[5] (%)	2012 (%)	2022 (%)	2012 (%)	2022 (%)	2012 (%)	2016 (%)	2012 (%)	2019 (%)	2012[6] (%)	2021[7] (%)	2012 (%)	2020 (%)
United Arab Emirates	7.6	<2.5	n.a.	1.2[b, c]	n.a.	9.8[b, c]	n.a.	n.a.	n.a.	n.a.	n.a.	29.0	31.7	24.0	24.3	n.a.	n.a.	13.9	13.9
Yemen	27.3	34.5	12.3	12.8	45.7	67.2	n.a.	46.9	35.1	2.4	1.7	14.6	17.1	61.5	61.5	n.a.	n.a.	n.a.	n.a.
Central Asia and Southern Asia	**19.4**	**15.4**	**12.7**	**19.2**	**26.9**	**40.5**	**13.7**	**39.3**	**29.4**	**2.9**	**2.9**	**4.9**	**5.9**	**47.5**	**47.5**	**46.5**	**59.4**	**25.4**	**23.5**
Eastern Asia and South-eastern Asia*	**9.6**	**<2.5**	**1.3**	**1.7**	**8.5**	**9.5**	**4.2**	**16.0**	**13.9**	**6.5**	**8.0**	**5.0**	**6.2**	**18.2**	**19.5**	**30.3**	**41.5**	**8.1**	**8.7**
Western Asia and Northern Africa	**7.0**	**8.8**	**9.3**	**10.5**	**29.1**	**34.5**	**4.9**	**21.2**	**17.9**	**10.4**	**9.8**	**25.3**	**27.7**	**31.8**	**31.8**	**37.2**	**n.a.**	**13.1**	**13.1**
LATIN AMERICA AND THE CARIBBEAN	**9.3**	**6.7**	**7.9**	**13.0**	**27.6**	**39.0**	**1.4**	**12.7**	**11.5**	**7.4**	**8.6**	**22.2**	**24.2**	**18.2**	**17.2**	**34.3**	**42.6**	**9.5**	**9.6**
Caribbean	**18.4**	**15.4**	**n.a.**	**28.8**	**n.a.**	**61.8**	**2.9**	**13.0**	**11.3**	**6.5**	**6.6**	**22.0**	**24.7**	**28.7**	**29.2**	**29.4**	**31.4**	**11.4**	**11.7**
Antigua and Barbuda	n.a.	n.a.	n.a.	7.1	n.a.	33.0	n.a.	n.a.	n.a.	n.a.	n.a.	17.1	18.9	16.7	17.2	n.a.	n.a.	15.1	15.4
Bahamas	n.a.	n.a.	n.a.	3.4	n.a.	17.2	n.a.	n.a.	n.a.	n.a.	n.a.	29.5	31.6	13.3	14.5	n.a.	n.a.	15.3	15.4
Barbados	5.9	<2.5	n.a.	7.4	n.a.	31.1	n.a.	7.5	6.0	11.8	12.5	20.9	23.1	16.9	17.0	19.7	n.a.	n.a.	n.a.
Cuba	<2.5	<2.5	n.a.	n.a.	n.a.	n.a.	2.0	7.0	7.0	9.7	10.2	22.6	24.6	20.2	19.3	48.6	40.6	7.2	7.1
Dominica	5.2	6.7	n.r.	n.r.	n.r.	n.r.	n.a.	n.a.	n.a.	n.a.	n.a.	25.6	27.9	20.1	20.8	n.a.	n.a.	n.a.	n.a.
Dominican Republic	19.4	6.3	24.3[b]	22.0[b, c]	54.2[b]	52.1[b, c]	2.2	7.9	5.6	7.5	7.6	24.5	27.6	28.0	26.4	8.0	15.8	12.1	13.4
Grenada	n.a.	n.a.	n.a.	6.6[b]	n.a.	21.1[b]	n.a.	n.a.	n.a.	n.a.	n.a.	19.1	21.3	18.9	19.2	n.a.	n.a.	n.a.	n.a.
Haiti	51.8	45.0	n.a.	42.9	n.a.	82.6	3.7	23.8	19.5	3.4	3.7	19.4	22.7	47.6	47.7	39.3	39.9	n.a.	n.a.
Jamaica	7.9	8.3	25.3	25.6	48.3	54.4	3.2	6.1	6.5	6.9	5.7	22.3	24.7	19.5	19.9	23.8	n.a.	14.3	13.7
Puerto Rico	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	18.4	18.8	n.a.	n.a.	n.a.	n.a.

TABLE A1.1 (Continued)

REGIONS/ SUBREGIONS/ COUNTRIES/ TERRITORIES	PREVALENCE OF UNDERNOURISHMENT IN THE TOTAL POPULATION[1]		PREVALENCE OF SEVERE FOOD INSECURITY IN THE TOTAL POPULATION[1,2,3]		PREVALENCE OF MODERATE OR SEVERE FOOD INSECURITY IN THE TOTAL POPULATION[1,2,3]		PREVALENCE OF WASTING IN CHILDREN (<5 YEARS)	PREVALENCE OF STUNTING IN CHILDREN (<5 YEARS)		PREVALENCE OF OVERWEIGHT IN CHILDREN (<5 YEARS)		PREVALENCE OF OBESITY IN THE ADULT POPULATION (≥18 YEARS)		PREVALENCE OF ANAEMIA IN WOMEN (15–49 YEARS)		PREVALENCE OF EXCLUSIVE BREASTFEEDING AMONG INFANTS (0–5 MONTHS)		PREVALENCE OF LOW BIRTHWEIGHT	
	2004–06 (%)	2020–22[4] (%)	2014–16 (%)	2020–22 (%)	2014–16 (%)	2020–22 (%)	2022[5] (%)	2012 (%)	2022 (%)	2012 (%)	2022 (%)	2012 (%)	2016 (%)	2012 (%)	2019 (%)	2012[6] (%)	2021[7] (%)	2012 (%)	2020 (%)
Saint Kitts and Nevis	n.a.	n.a.	8.1	5.6	21.1	29.9	n.a.	n.a.	n.a.	n.a.	n.a.	20.4	22.9	16.0	15.4	n.a.	n.a.	n.a.	n.a.
Saint Lucia	n.a.	n.a.	4.5[b]	4.5	22.2[b]	22.2	n.a.	2.3	2.5	6.0	6.0	17.4	19.7	14.1	14.3	3.5	n.a.	15.9	16.3
Saint Vincent and the Grenadines	8.5	3.1	n.a.	10.3	n.a.	33.3	n.a.	n.a.	n.a.	n.a.	n.a.	21.2	23.7	17.3	17.0	n.a.	n.a.	n.a.	n.a.
Trinidad and Tobago	11.2	12.2	n.a.	10.2	n.a.	43.3	n.a.	8.6	8.8	10.5	13.9	16.3	18.6	17.8	17.7	21.5	n.a.	15.9	16.3
Central America	**8.0**	**5.0**	**6.5**	**8.0**	**29.3**	**34.3**	**1.0**	**18.2**	**16.9**	**6.6**	**6.7**	**25.1**	**27.3**	**15.2**	**14.6**	**21.7**	**37.7**	**10.9**	**10.9**
Belize	5.5	4.9	n.a.	5.9[b]	n.a.	45.5[b]	n.a.	17.5	12.0	8.7	5.9	22.0	24.1	21.2	20.5	14.7	33.2	11.3	11.6
Costa Rica	4.3	3.0	1.8[c]	2.9[b]	12.2[c]	16.2[b]	1.8	6.4	9.5	7.6	7.6	22.9	25.7	12.3	13.7	32.5	25.3	8.5	8.7
El Salvador	9.2	7.7	13.8	16.2	42.2	48.4	n.a.	15.5	10.0	6.2	6.8	22.2	24.6	9.9	10.6	31.4	n.a.	10.4	10.2
Guatemala	19.4	13.3	16.1	21.1	42.7	59.8	0.8	47.1	43.5	5.1	4.8	18.9	21.2	11.0	7.4	49.6	53.2	14.4	14.5
Honduras	22.6	18.7	14.2[c]	23.5[b]	41.6[c]	56.1[b]	1.9	22.0	17.5	5.0	4.7	19.0	21.4	16.6	18.0	30.7	30.2	12.5	13.1
Mexico	4.4	<2.5	3.6[b]	3.6[b]	25.6[b]	27.6[b]	1.7	13.3	12.6	6.8	6.9	26.8	28.9	15.9	15.3	14.4	35.9	10.2	10.2
Nicaragua	22.9	17.8	n.r.	n.r.	n.r.	n.r.	n.a.	17.3	14.9	7.3	8.7	21.5	23.7	13.3	15.7	31.7	n.a.	10.7	10.1
Panama	21.6	5.3	n.r.	n.r.	n.r.	n.r.	1.1	19.9	13.8	10.5	11.4	20.6	22.7	22.1	21.2	n.a.	n.a.	10.7	10.3
South America	**8.8**	**6.5**	**6.0**	**13.5**	**23.4**	**38.7**	**1.4**	**10.1**	**9.0**	**7.9**	**9.7**	**21.1**	**23.0**	**18.4**	**17.3**	**42.2**	**46.8**	**8.6**	**8.8**
Argentina	3.8	3.2	5.8	13.1	19.2	36.9	1.7	7.1	9.5	11.0	12.6	26.3	28.3	12.7	11.9	32.0	n.a.	7.2	7.4
Bolivia (Plurinational State of)	27.1	19.4	n.r.	n.r.	n.r.	n.r.	2.0	19.9	11.1	8.9	9.0	18.3	20.2	28.6	24.4	64.3	55.7	8.3	7.9
Brazil	6.5	4.7	1.9	9.9	18.3	32.8	3.1[h]	6.3	7.2	7.9	10.3	20.1	22.1	18.3	16.1	38.6	45.8	8.3	8.7
Chile	3.2	2.5	2.9[c]	4.1[b]	10.8[c]	18.1[b]	n.a.	1.9	1.6	9.8	8.8	26.1	28.0	7.9	8.7	n.a.	n.a.	6.1	6.8
Colombia	11.5	6.6	n.r.	n.r.	n.r.	n.r.	1.6	12.7	11.2	5.0	6.2	20.4	22.3	22.1	21.2	42.9	36.7	10.5	11.0

TABLE A1.1 (Continued)

REGIONS/ SUBREGIONS/ COUNTRIES/ TERRITORIES	PREVALENCE OF UNDERNOURISHMENT IN THE TOTAL POPULATION[1]		PREVALENCE OF SEVERE FOOD INSECURITY IN THE TOTAL POPULATION[1, 2, 3]		PREVALENCE OF MODERATE OR SEVERE FOOD INSECURITY IN THE TOTAL POPULATION[1, 2, 3]		PREVALENCE OF WASTING IN CHILDREN (<5 YEARS)	PREVALENCE OF STUNTING IN CHILDREN (<5 YEARS)		PREVALENCE OF OVERWEIGHT IN CHILDREN (<5 YEARS)		PREVALENCE OF OBESITY IN THE ADULT POPULATION (≥18 YEARS)		PREVALENCE OF ANAEMIA IN WOMEN (15–49 YEARS)		PREVALENCE OF EXCLUSIVE BREASTFEEDING AMONG INFANTS (0–5 MONTHS)		PREVALENCE OF LOW BIRTHWEIGHT	
	2004–06 (%)	2020–22[4] (%)	2014–16 (%)	2020–22 (%)	2014–16 (%)	2020–22 (%)	2022[5] (%)	2012 (%)	2022 (%)	2012 (%)	2022 (%)	2012 (%)	2016 (%)	2012 (%)	2019 (%)	2012[6] (%)	2021[7] (%)	2012 (%)	2020 (%)
Ecuador	22.3	13.9	6.0[b, c]	13.0[c]	20.7[b, c]	37.3[c]	3.7	24.4	22.7	7.5	11.9	18.1	19.9	17.3	17.2	n.a.	n.a.	10.9	10.6
Guyana	7.1	<2.5	n.a.	n.a.	n.a.	n.a.	6.5	14.5	7.6	6.2	5.7	17.9	20.2	34.4	31.7	31.3	n.a.	17.0	17.2
Paraguay	9.3	4.2	1.2[c]	6.1[b, c]	8.3[c]	25.9[b, c]	1.0	9.4	3.4	10.4	14.6	18.2	20.3	22.2	23.0	24.4	29.6	10.0	10.0
Peru	18.7	7.0	n.r.	n.r.	n.r.	n.r.	0.4	18.6	10.1	8.1	9.4	18.1	19.7	20.6	20.6	67.4	63.9	8.3	7.5
Suriname	9.8	9.0	n.a.	7.2	n.a.	35.9	5.5	8.3	7.6	3.7	3.8	24.4	26.4	20.3	21.0	2.8	8.9	15.7	16.5
Uruguay	2.9	<2.5	1.7[c]	2.9[b, c]	13.3[c]	15.2[b, c]	1.4	9.1	6.1	9.3	11.5	26.0	27.9	13.2	15.0	n.a.	57.7	8.0	7.8
Venezuela (Bolivarian Republic of)	8.3	17.9	n.r.	n.r.	n.r.	n.r.	n.a.	12.1	10.5	6.2	6.9	24.0	25.6	20.9	24.2	n.a.	n.a.	9.0	9.3
OCEANIA	**6.8**	**6.6**	**2.8**	**3.5**	**11.1**	**12.7**	**n.a.**	**20.0**	**22.0**	**11.0**	**16.8**	**25.8**	**28.1**	**14.4**	**16.0**	**n.a.**	**n.a.**	**11.3**	**11.8**
Australia and New Zealand	**<2.5**	**<2.5**	**2.8**	**3.4**	**10.6**	**12.0**	**n.a.**	**3.4**	**3.4**	**12.4**	**19.3**	**27.0**	**29.3**	**7.6**	**8.8**	**n.a.**	**n.a.**	**6.4**	**6.4**
Australia	<2.5	<2.5	2.8	3.4	10.8	11.4	n.a.	3.2	3.4	13.7	21.8	26.7	29.0	7.4	8.5	n.a.	n.a.	6.4	6.6
New Zealand	<2.5	<2.5	2.8	3.3	10.0	15.1	n.a.	n.a.	n.a.	n.a.	n.a.	28.4	30.8	8.8	10.4	n.a.	n.a.	6.0	5.9
Oceania excluding Australia and New Zealand	**21.1**	**19.8**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**8.3[a]**	**40.9**	**44.0**	**9.3**	**13.9**	**21.3**	**23.6**	**32.9**	**33.9**	**56.6**	**59.5**	**17.4**	**17.9**
Melanesia	**23.4**	**21.1**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**43.3**	**46.4**	**9.6**	**14.4**	**20.1**	**22.3**	**33.3**	**34.2**	**56.8**	**59.8**	**17.6**	**18.0**
Fiji	3.5	6.6	n.a.	6.3	n.a.	24.2	4.6	8.5	7.1	6.3	7.4	27.7	30.2	31.5	32.0	n.a.	42.9	7.4	7.4
New Caledonia	10.1	4.8	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Papua New Guinea	28.0	23.4	n.a.	n.a.	n.a.	n.a.	n.a.	48.0	51.2	10.5	16.0	19.0	21.3	33.4	34.4	56.1	59.7	19.0	19.4
Solomon Islands	12.0	19.0	n.a.	n.a.	n.a.	n.a.	n.a.	31.8	29.8	3.5	5.5	19.9	22.5	38.4	37.7	73.7	76.2	13.2	13.2
Vanuatu	6.9	9.5	n.a.	2.4	n.a.	23.3	n.a.	27.0	31.4	4.8	5.1	22.6	25.2	24.1	28.5	39.5	n.a.	12.7	13.1

TABLE A1.1 (Continued)

REGIONS/ SUBREGIONS/ COUNTRIES/ TERRITORIES	PREVALENCE OF UNDERNOURISHMENT IN THE TOTAL POPULATION[1]		PREVALENCE OF SEVERE FOOD INSECURITY IN THE TOTAL POPULATION[1, 2, 3]		PREVALENCE OF MODERATE OR SEVERE FOOD INSECURITY IN THE TOTAL POPULATION[1, 2, 3]		PREVALENCE OF WASTING IN CHILDREN (<5 YEARS)	PREVALENCE OF STUNTING IN CHILDREN (<5 YEARS)		PREVALENCE OF OVERWEIGHT IN CHILDREN (<5 YEARS)		PREVALENCE OF OBESITY IN THE ADULT POPULATION (≥18 YEARS)		PREVALENCE OF ANAEMIA IN WOMEN (15–49 YEARS)		PREVALENCE OF EXCLUSIVE BREASTFEEDING AMONG INFANTS (0–5 MONTHS)		PREVALENCE OF LOW BIRTHWEIGHT	
	2004–06 (%)	2020–22[4] (%)	2014–16 (%)	2020–22 (%)	2014–16 (%)	2020–22 (%)	2022[5] (%)	2012 (%)	2022 (%)	2012 (%)	2022 (%)	2012 (%)	2016 (%)	2012 (%)	2019 (%)	2012[6] (%)	2021[7] (%)	2012 (%)	2020 (%)
Micronesia	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**16.3**	**13.5**	**4.4**	**4.4**	**43.2**	**45.9**	**27.9**	**29.1**	**55.3**	**59.6**	**12.4**	**12.3**
Kiribati	6.1	12.1	n.a.	8.0	n.a.	41.0	3.5	16.2	14.2	2.1	2.0	43.5	46.0	31.8	32.6	66.4	63.6	9.3	9.0
Marshall Islands	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	3.5	37.0	30.5	4.1	4.4	50.7	52.9	29.7	30.6	27.3	43.1	n.a.	n.a.
Micronesia (Federated States of)	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	42.9	45.8	22.7	25.0	n.a.	n.a.	n.a.	n.a.
Nauru	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	21.0	14.8	4.0	4.5	59.6	61.0	29.5	29.6	67.2	n.a.	n.a.	n.a.
Palau	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	53.1	55.3	27.3	28.5	n.a.	n.a.	13.7	13.5
Polynesia	**3.5**	**4.9**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**7.3**	**6.5**	**8.2**	**8.2**	**44.9**	**47.6**	**25.6**	**27.4**	**51.1**	**48.1**	**16.3**	**16.8**
American Samoa	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Cook Islands	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	53.8	55.9	25.8	27.1	n.a.	n.a.	10.1	10.3
French Polynesia	3.9	5.1	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Niue	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	46.8	50.0	25.9	27.3	n.a.	n.a.	n.a.	n.a.
Samoa	2.8	4.6	n.a.	3.4	n.a.	23.6	3.1	5.0	7.4	6.0	7.9	44.7	47.3	24.5	26.8	51.3	51.7	n.a.	n.a.
Tokelau (Associate Member)	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Tonga	n.a.	n.a.	n.a.	3.7[b]	n.a.	17.6[b]	1.1	7.2	1.8	15.0	10.9	45.4	48.2	27.2	28.5	52.2	39.6	n.a.	n.a.
Tuvalu	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	2.8	7.8	5.2	5.2	4.2	48.6	51.6	26.0	27.5	34.7	43.8	n.a.	n.a.
NORTHERN AMERICA AND EUROPE	**<2.5**	**<2.5**	**1.3**	**1.4**	**9.1**	**7.8**	**n.a.**	**4.2**	**3.8**	**9.0**	**7.6**	**25.0**	**26.9**	**13.1**	**14.6**	**n.a.**	**n.a.**	**7.4**	**7.4**
Northern America**	**<2.5**	**<2.5**	**1.0**	**0.7**	**9.9**	**7.8**	**0.2**	**2.6**	**3.6**	**8.6**	**8.2**	**32.9**	**35.5**	**9.9**	**11.7**	**25.5**	**25.8**	**8.0**	**8.1**
Bermuda	19.4	<2.5	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Canada	<2.5	<2.5	n.a.	1.2[c]	n.a.	7.7[c]	n.a.	n.a.	n.a.	11.4	11.1	27.1	29.4	8.8	10.4	n.a.	n.a.	6.2	6.6

TABLE A1.1 (Continued)

REGIONS/ SUBREGIONS/ COUNTRIES/ TERRITORIES	PREVALENCE OF UNDERNOURISHMENT IN THE TOTAL POPULATION[1]		PREVALENCE OF SEVERE FOOD INSECURITY IN THE TOTAL POPULATION[1,2,3]		PREVALENCE OF MODERATE OR SEVERE FOOD INSECURITY IN THE TOTAL POPULATION[1,2,3]		PREVALENCE OF WASTING IN CHILDREN (<5 YEARS)	PREVALENCE OF STUNTING IN CHILDREN (<5 YEARS)		PREVALENCE OF OVERWEIGHT IN CHILDREN (<5 YEARS)		PREVALENCE OF OBESITY IN THE ADULT POPULATION (≥18 YEARS)		PREVALENCE OF ANAEMIA IN WOMEN (15–49 YEARS)		PREVALENCE OF EXCLUSIVE BREASTFEEDING AMONG INFANTS (0–5 MONTHS)		PREVALENCE OF LOW BIRTHWEIGHT	
	2004–06 (%)	2020–22[4] (%)	2014–16 (%)	2020–22 (%)	2014–16 (%)	2020–22 (%)	2022[5] (%)	2012 (%)	2022 (%)	2012 (%)	2022 (%)	2012 (%)	2016 (%)	2012 (%)	2019 (%)	2012[6] (%)	2021[7] (%)	2012 (%)	2020 (%)
Greenland	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
United States of America	<2.5	<2.5	1.1[b]	0.7[b]	10.5[b]	7.8[b]	0.1	2.5	3.6	8.4	7.9	33.6	36.2	10.0	11.8	25.5	25.8	8.2	8.3
Europe	**<2.5**	**<2.5**	**1.5**	**1.7**	**8.7**	**7.8**	**n.a.**	**5.1**	**4.0**	**9.2**	**7.3**	**21.4**	**22.9**	**14.5**	**16.0**	**n.a.**	**n.a.**	**7.1**	**7.0**
Eastern Europe	**<2.5**	**<2.5**	**1.5**	**1.7**	**11.2**	**10.5**	**n.a.**	**7.2**	**5.3**	**12.1**	**7.4**	**22.0**	**23.4**	**19.2**	**20.5**	**n.a.**	**n.a.**	**7.1**	**7.0**
Belarus	<2.5	<2.5	n.r.	n.r.	n.r.	n.r.	n.a.	3.9	3.6	8.0	5.3	23.0	24.5	19.1	20.6	19.0	21.7	5.0	5.1
Bulgaria	4.8	<2.5	1.9	3.5	14.9	15.8	n.a.	7.1	5.6	7.0	3.8	23.2	25.0	22.5	23.6	n.a.	n.a.	11.0	11.4
Czechia	<2.5	<2.5	0.7	2.3	5.8	8.5	n.a.	2.5	2.5	5.3	6.1	24.5	26.0	20.0	21.1	n.a.	n.a.	7.3	7.6
Hungary	<2.5	<2.5	1.4	3.0	11.3	12.6	n.a.	n.a.	n.a.	n.a.	n.a.	24.5	26.4	19.6	19.7	n.a.	n.a.	8.4	8.3
Poland	<2.5	<2.5	1.8	1.0	8.9	7.5	n.a.	2.1	2.3	5.6	6.0	21.5	23.1	n.a.	n.a.	n.a.	n.a.	5.8	5.6
Republic of Moldova	33.4	<2.5	1.6	4.8	19.3	23.5	n.a.	6.8	3.9	5.4	2.9	17.5	18.9	26.0	26.1	36.4	n.a.	6.5	6.5
Romania	<2.5	<2.5	5.6	5.7	19.3	16.3	n.a.	9.3	7.7	7.9	4.5	20.7	22.5	22.1	22.7	n.a.	n.a.	9.5	8.8
Russian Federation	<2.5	<2.5	0.7	<0.5[b]	8.2	5.0[b]	n.a.	n.a.	n.a.	12.2	7.4	21.9	23.1	20.0	21.1	n.a.	n.a.	7.3	7.3
Slovakia	5.5	2.8	1.1	1.8	6.2	8.3	n.a.	n.a.	n.a.	n.a.	n.a.	19.1	20.5	22.3	23.5	n.a.	n.a.	7.5	7.8
Ukraine	<2.5	4.8	2.0	4.3	19.8	28.2	n.a.	18.2	12.3	23.6	13.6	22.7	24.1	14.4	17.7	19.7	n.a.	6.0	5.7
Northern Europe	**<2.5**	**<2.5**	**1.8**	**1.7**	**6.7**	**5.1**	**n.a.**	**3.7**	**3.0**	**8.7**	**9.7**	**23.7**	**25.8**	**10.6**	**12.0**	**n.a.**	**n.a.**	**6.3**	**6.0**
Denmark	<2.5	<2.5	1.0	1.8	5.9	6.8	n.a.	n.a.	n.a.	n.a.	n.a.	18.1	19.7	11.5	12.2	n.a.	n.a.	5.1	4.8
Estonia	<2.5	<2.5	0.9	0.7	9.5	8.5	n.a.	1.3	1.2	4.8	5.1	20.1	21.2	20.7	21.7	n.a.	n.a.	4.5	4.2
Finland	<2.5	<2.5	2.4	2.6	9.3	10.5	n.a.	n.a.	n.a.	n.a.	n.a.	20.7	22.2	9.7	10.9	n.a.	n.a.	4.1	4.1
Iceland	<2.5	<2.5	1.7	1.6	6.4	6.1	n.a.	n.a.	n.a.	n.a.	n.a.	20.3	21.9	9.4	10.3	n.a.	n.a.	3.8	4.0
Ireland	<2.5	<2.5	3.4	2.4	8.9	5.4	n.a.	n.a.	n.a.	n.a.	n.a.	22.8	25.3	10.9	12.1	n.a.	n.a.	5.5	5.6
Latvia	<2.5	<2.5	0.6	1.0	9.9	9.4	1.6[h]	2.4	1.8	10.3	6.4	22.4	23.6	20.9	21.6	n.a.	n.a.	4.5	4.2

TABLE A1.1 (Continued)

REGIONS/ SUBREGIONS/ COUNTRIES/ TERRITORIES	PREVALENCE OF UNDERNOURISHMENT IN THE TOTAL POPULATION[1]		PREVALENCE OF SEVERE FOOD INSECURITY IN THE TOTAL POPULATION[1, 2, 3]		PREVALENCE OF MODERATE OR SEVERE FOOD INSECURITY IN THE TOTAL POPULATION[1, 2, 3]		PREVALENCE OF WASTING IN CHILDREN (<5 YEARS)	PREVALENCE OF STUNTING IN CHILDREN (<5 YEARS)		PREVALENCE OF OVERWEIGHT IN CHILDREN (<5 YEARS)		PREVALENCE OF OBESITY IN THE ADULT POPULATION (≥18 YEARS)		PREVALENCE OF ANAEMIA IN WOMEN (15–49 YEARS)		PREVALENCE OF EXCLUSIVE BREASTFEEDING AMONG INFANTS (0–5 MONTHS)		PREVALENCE OF LOW BIRTHWEIGHT	
	2004–06 (%)	2020–22[4] (%)	2014–16 (%)	2020–22 (%)	2014–16 (%)	2020–22 (%)	2022[5] (%)	2012 (%)	2022 (%)	2012 (%)	2022 (%)	2012 (%)	2016 (%)	2012 (%)	2019 (%)	2012[6] (%)	2021[7] (%)	2012 (%)	2020 (%)
Lithuania	<2.5	<2.5	2.5	2.1	15.3	8.5	4.8[h]	5.4	4.5	8.0	4.7	25.0	26.3	18.8	19.9	n.a.	n.a.	4.7	4.4
Norway	<2.5	<2.5	1.1	1.2	4.8	5.2	n.a.	n.a.	n.a.	n.a.	n.a.	21.3	23.1	10.7	12.0	n.a.	n.a.	4.7	4.4
Sweden	<2.5	<2.5	0.8	1.4	4.5	5.4	n.a.	n.a.	n.a.	n.a.	n.a.	19.0	20.6	11.7	13.6	n.a.	n.a.	4.2	4.1
United Kingdom of Great Britain and Northern Ireland	<2.5	<2.5	1.9	1.6	6.3	4.1	0.3[h]	n.a.	n.a.	9.7	11.3	25.4	27.8	9.4	11.1	n.a.	n.a.	7.1	6.8
Southern Europe	**<2.5**	**<2.5**	**1.7**	**2.3**	**9.9**	**8.5**	**n.a.**	**4.6**	**3.9**	**8.7**	**8.3**	**20.4**	**21.8**	**13.5**	**15.1**	**n.a.**	**n.a.**	**8.0**	**8.2**
Albania	8.9	4.1	10.0	7.5	38.8	30.2	1.6	16.4	8.3	22.4	13.4	19.3	21.7	21.6	24.8	37.1	36.5	6.0	6.0
Andorra	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	24.8	25.6	10.6	12.1	n.a.	n.a.	9.1	9.4
Bosnia and Herzegovina	<2.5	<2.5	1.5	3.1	9.6	13.4	n.a.	9.2	8.0	18.7	9.4	16.3	17.9	23.8	24.4	18.2	n.a.	5.2	5.2
Croatia	<2.5	<2.5	0.6	1.9	6.5	9.7	n.a.	n.a.	n.a.	n.a.	n.a.	22.5	24.4	20.4	21.0	n.a.	n.a.	5.0	5.0
Greece	<2.5	<2.5	2.6	1.5[b, e]	15.8	6.3[b, e]	n.a.	2.0	2.2	15.8	14.6	23.2	24.9	12.8	15.1	n.a.	n.a.	10.9	11.4
Italy	<2.5	<2.5	1.2	1.8	8.6	5.7	n.a.	n.a.	n.a.	n.a.	n.a.	18.7	19.9	11.8	13.6	n.a.	n.a.	7.1	7.2
Malta	<2.5	4.6	1.5	1.9	5.8	7.2	n.a.	n.a.	n.a.	n.a.	n.a.	27.5	28.9	12.3	13.7	n.a.	n.a.	7.0	7.2
Montenegro	5.4	<2.5	2.1	3.3	12.6	12.9	2.2	8.4	8.2	15.8	8.0	21.6	23.3	16.1	17.2	19.3	19.5	6.4	6.2
North Macedonia	4.9	3.6	3.6	6.9	15.1	24.0	3.4	5.8	3.7	13.6	9.9	20.8	22.4	17.2	19.3	23.0	27.5	8.2	8.3
Portugal	<2.5	<2.5	4.1	3.9	14.7	12.4	1.1[h]	3.8	3.1	8.2	8.9	19.0	20.8	12.0	13.2	n.a.	n.a.	8.4	8.9
Serbia	<2.5	<2.5	1.7	4.1	11.4	14.8	2.6	5.9	4.6	15.6	9.9	20.0	21.5	21.8	22.8	13.4	23.6	6.0	6.2
Slovenia	<2.5	<2.5	0.9	0.9	12.3	7.0	n.a.	n.a.	n.a.	n.a.	n.a.	18.8	20.2	20.2	21.8	n.a.	n.a.	6.2	6.3
Spain	<2.5	<2.5	1.1	1.8	7.1	8.0	n.a.	n.a.	n.a.	n.a.	n.a.	22.4	23.8	12.0	13.4	n.a.	n.a.	9.5	9.6

TABLE A1.1 (Continued)

REGIONS/ SUBREGIONS/ COUNTRIES/ TERRITORIES	PREVALENCE OF UNDERNOURISHMENT IN THE TOTAL POPULATION[1]		PREVALENCE OF SEVERE FOOD INSECURITY IN THE TOTAL POPULATION[1,2,3]		PREVALENCE OF MODERATE OR SEVERE FOOD INSECURITY IN THE TOTAL POPULATION[1,2,3]		PREVALENCE OF WASTING IN CHILDREN (<5 YEARS)	PREVALENCE OF STUNTING IN CHILDREN (<5 YEARS)		PREVALENCE OF OVERWEIGHT IN CHILDREN (<5 YEARS)		PREVALENCE OF OBESITY IN THE ADULT POPULATION (≥18 YEARS)		PREVALENCE OF ANAEMIA IN WOMEN (15–49 YEARS)		PREVALENCE OF EXCLUSIVE BREASTFEEDING AMONG INFANTS (0–5 MONTHS)		PREVALENCE OF LOW BIRTHWEIGHT	
	2004–06 (%)	2020–22[4] (%)	2014–16 (%)	2020–22 (%)	2014–16 (%)	2020–22 (%)	2022[5] (%)	2012 (%)	2022 (%)	2012 (%)	2022 (%)	2012 (%)	2016 (%)	2012 (%)	2019 (%)	2012[6] (%)	2021[7] (%)	2012 (%)	2020 (%)
Western Europe	**<2.5**	**<2.5**	**1.3**	**1.4**	**5.2**	**4.9**	**n.a.**	**2.8**	**2.6**	**5.0**	**5.1**	**20.1**	**21.7**	**9.6**	**11.6**	**n.a.**	**n.a.**	**7.0**	**6.8**
Austria	<2.5	<2.5	1.1	1.6	5.5	4.3	n.a.	n.a.	n.a.	n.a.	n.a.	18.4	20.1	11.5	13.0	n.a.	n.a.	6.7	6.3
Belgium	<2.5	<2.5	n.a.	1.5	n.a.	5.8	n.a.	2.8	2.4	3.6	4.0	20.7	22.1	11.3	13.6	n.a.	n.a.	7.0	6.8
France	<2.5	<2.5	1.6	1.6	6.8	6.6	n.a.	n.a.	n.a.	n.a.	n.a.	20.1	21.6	8.8	10.6	n.a.	n.a.	7.5	7.4
Germany	<2.5	<2.5	1.0	1.4	4.1	3.8	0.4[h]	1.5	2.1	3.4	3.1	20.7	22.3	9.6	11.7	n.a.	n.a.	6.9	6.7
Luxembourg	<2.5	<2.5	1.8	0.6	4.7	2.7	n.a.	n.a.	n.a.	n.a.	n.a.	20.9	22.6	9.0	10.2	n.a.	n.a.	7.5	7.7
Netherlands (Kingdom of the)	<2.5	<2.5	1.5	1.4	5.7	4.5	n.a.	1.5	1.6	4.1	5.1	18.6	20.4	10.9	12.8	n.a.	n.a.	6.1	5.7
Switzerland	<2.5	<2.5	1.5	0.6	4.8	2.1	n.a.	n.a.	n.a.	n.a.	n.a.	18.0	19.5	9.6	11.3	n.a.	n.a.	6.4	6.4

NOTES:
1. Regional estimates are included when more than 50 percent of population is covered. To reduce the margin of error, estimates are presented as three-year averages.
2. FAO estimates of the number of people living in households where at least one adult has been found to be food insecure.
3. Country-level results are presented only for those countries for which estimates are based on official national data (see note b) or as provisional estimates, based on FAO data collected through the Gallup© World Poll, Geopoll or Kantar for countries whose national relevant authorities expressed no objection to their publication. Note that consent to publication does not necessarily imply validation of the estimate by the national authorities involved and that the estimate is subject to revision as soon as suitable data from official national sources are available. Global, regional and subregional aggregates are based on data collected in approximately 150 countries.
4. The estimates referring to the middle of the projected ranges for the years 2020 to 2022 were used to calculate the three-year averages.
5. For regional estimates, values correspond to the model predicted estimates for 2022. For countries, the latest data available from 2016 to 2022 are used.
6. Regional estimates are included when more than 50 percent of population is covered. For countries, the latest data available from 2005 to 2012 are used.
7. Regional estimates are included when more than 50 percent of population is covered. For countries, the latest data available from 2015 to 2021 are used.
* Wasting under five years of age regional aggregates exclude Japan.
** The Northern America wasting estimates are derived applying mixed-effect models with subregions as fixed effects; data were available only for the United States of America, preventing the estimation of standard errors (and confidence intervals). Further details on the methodology are described in De Onis, M., Blössner, M., Borghi, E., Frongillo, E.A. & Morris, R. 2004. Estimates of global prevalence of childhood underweight in 1990 and 2015. *Journal of the American Medical Association*, 291(21): 2600–2606. Model selection is based on best fit.

a. Consecutive low population coverage; interpret with caution.
b. Based on official national data.
c. For years when official national data are not available, the estimates are integrated with FAO data. See **Annex 1B** for further details.
d. Data informing the 2020 food insecurity estimates come from a national COVID-19 impact assessment survey with a reference period of 3 months; therefore, comparability with the rest of the series may be affected.
e. Based on official national data collected in 2019–2022 through EU statistics on income and living conditions.
f. Most recent input data are from before 2000, interpret with caution.
g. The UNICEF-WHO low birthweight estimates are derived through standard methodology applied to all countries to ensure comparability and are not the official statistics of the Government of India. India's most recent national official low birthweight prevalence is 18.2 percent from the 2019–2021 National Family Health Survey–5 (NFHS-5), which is used as the basis of the UNICEF-WHO global estimation model to support cross-country comparability.
h. This estimate has been adjusted because the original estimate did not cover the full age range or the data source was only representative of rural areas.
<2.5 = prevalence of undernourishment less than 2.5 percent; <0.5 = prevalence of severe food insecurity less than 0.5 percent.
n.a. = data not available; n.r. = not reported.

SOURCES: Data for undernourishment and food insecurity are from FAO. 2023. FAOSTAT: Suite of Food Security Indicators. In: *FAO*. [Cited 12 July 2023]. www.fao.org/faostat/en/#data/FS; data for stunting, wasting and overweight are based on UNICEF, WHO & World Bank. 2023. *UNICEF-WHO-World Bank: Joint child malnutrition estimates - Levels and trends (2023 edition)*. [Cited 27 April 2023]. https://data.unicef.org/resources/jme-report-2023, www.who.int/teams/nutrition-and-food-safety/monitoring-nutritional-status-and-food-safety-and-events/joint-child-malnutrition-estimates, https://datatopics.worldbank.org/child-malnutrition; data for obesity are based on WHO. 2020. Global Health Observatory (GHO) data repository. In: *WHO*. [Cited 28 April 2020]. https://apps.who.int/gho/data/node.main.A900A?lang=en; data on anaemia are based on WHO. 2021. Global anaemia estimates, Edition 2021. In: *WHO | Global Health Observatory (GHO) data repository*. [Cited 20 April 2023]. www.who.int/data/gho/data/themes/topics/anaemia_in_women_and_children; data for exclusive breastfeeding are based on UNICEF. 2022. Infant and young child feeding. In: *UNICEF*. [Cited 6 April 2023]. https://data.unicef.org/topic/nutrition/infant-and-young-child-feeding; and data for low birthweight are from UNICEF & WHO. 2023. *Low birthweight joint estimates 2023 edition*. [Cited 12 July 2023]. https://data.unicef.org/topic/nutrition/low-birthweight; www.who.int/teams/nutrition-and-food-safety/monitoring-nutritional-status-and-food-safety-and-events/joint-low-birthweight-estimates

TABLE A1.2 PROGRESS TOWARDS THE SUSTAINABLE DEVELOPMENT GOALS AND GLOBAL NUTRITION TARGETS: NUMBER OF PEOPLE WHO ARE AFFECTED BY UNDERNOURISHMENT, MODERATE OR SEVERE FOOD INSECURITY AND SELECTED FORMS OF MALNUTRITION; NUMBER OF INFANTS EXCLUSIVELY BREASTFED AND NUMBER OF BABIES BORN WITH LOW BIRTHWEIGHT

REGIONS/ SUBREGIONS/ COUNTRIES/ TERRITORIES	NUMBER OF UNDERNOURISHED PEOPLE[1]		NUMBER OF SEVERELY FOOD-INSECURE PEOPLE[1,2,3]		NUMBER OF MODERATELY OR SEVERELY FOOD-INSECURE PEOPLE[1,2,3]		NUMBER OF CHILDREN (<5 YEARS) AFFECTED BY WASTING	NUMBER OF CHILDREN (<5 YEARS) WHO ARE STUNTED		NUMBER OF CHILDREN (<5 YEARS) WHO ARE OVERWEIGHT		NUMBER OF ADULTS (≥18 YEARS) WHO ARE OBESE		NUMBER OF WOMEN (15–49 YEARS) AFFECTED BY ANAEMIA		NUMBER OF INFANTS (0–5 MONTHS) EXCLUSIVELY BREASTFED		NUMBER OF BABIES WITH LOW BIRTHWEIGHT	
	2004–06 (millions)	2020–22[4] (millions)	2014–16 (millions)	2020–22 (millions)	2014–16 (millions)	2020–22 (millions)	2022[5] (millions)	2012 (millions)	2022 (millions)	2012 (millions)	2022 (millions)	2012 (millions)	2016 (millions)	2012 (millions)	2019 (millions)	2012[6] (millions)	2021[7] (millions)	2012 (millions)	2020 (millions)
WORLD	**786.7**	**725.1**	**575.7**	**892.7**	**1 626.1**	**2 335.5**	**45.0**	**177.9**	**148.1**	**37.0**	**37.0**	**574.3**	**675.7**	**519.5**	**570.8**	**24.3**	**31.2**	**21.6**	**19.8**
Least developed countries	**189.8**	**238.8**	**188.5**	**265.9**	**480.2**	**652.3**	**11.1**	**52.5**	**51.7**	**4.2**	**5.1**	**22.5**	**30.8**	**83.6**	**101.4**	**7.5**	**8.8**	**4.9**	**5.2**
Landlocked developing countries	**93.1**	**106.1**	**78.7**	**126.8**	**214.3**	**309.3**	**3.3**	**24.7**	**22.8**	**2.9**	**3.0**	**19.3**	**24.5**	**34.3**	**42.4**	**3.8**	**4.4**	**2.3**	**2.5**
Small Island Developing States	**10.4**	**10.9**	**14.5**	**14.5**	**30.7**	**33.4**	**0.2**	**1.3**	**1.3**	**0.4**	**0.5**	**8.1**	**9.5**	**4.6**	**4.9**	**0.2**	**0.3**	**0.2**	**0.2**
Low-income countries	**121.3**	**195.1**	**133.4**	**195.8**	**330.5**	**459.3**	**7.6**	**37.8**	**38.4**	**3.7**	**3.9**	**16.3**	**21.3**	**49.4**	**61.3**	**5.1**	**6.3**	**3.3**	**3.6**
Lower-middle-income countries	**490.0**	**458.7**	**344.0**	**551.5**	**869.8**	**1 351.8**	**32.5**	**119.3**	**94.6**	**14.3**	**15.3**	**128.9**	**162.9**	**318.5**	**355.1**	**13.5**	**17.5**	**14.4**	**12.9**
Upper-middle-income countries	**156.4**	**n.r.**	**73.6**	**116.7**	**311.8**	**411.0**	**2.5**	**17.5**	**12.2**	**13.9**	**12.9**	**205.7**	**244.4**	**113.7**	**113.7**	**3.9**	**4.9**	**2.8**	**2.3**
High-income countries	**n.r.**	**n.r.**	**18.3**	**20.0**	**98.3**	**92.3**	**0.2**	**2.7**	**2.5**	**5.0**	**4.7**	**206.5**	**231.3**	**36.2**	**38.9**	**n.a.**	**n.a.**	**1.1**	**1.0**
Low-income food-deficit countries	**179.6**	**249.4**	**177.0**	**261.6**	**444.5**	**627.2**	**n.a.**	**47.6**	**46.9**	**5.2**	**5.6**	**28.6**	**37.0**	**71.1**	**86.3**	**5.6**	**8.2**	**4.2**	**4.6**
AFRICA	**181.0**	**269.0**	**213.3**	**326.0**	**559.7**	**821.5**	**12.2**	**61.3**	**63.1**	**8.8**	**10.2**	**65.5**	**81.5**	**103.1**	**122.7**	**7.7**	**9.6**	**5.8**	**6.2**
Northern Africa	**11.5**	**17.4**	**22.4**	**27.9**	**65.4**	**82.4**	**1.8**	**6.2**	**6.3**	**3.1**	**3.6**	**30.2**	**35.7**	**17.6**	**18.9**	**1.2**	**n.a.**	**0.8**	**0.8**
Algeria	2.2	n.r.	5.2	2.5	9.0	8.6	0.1	0.5	0.4	0.6	0.6	6.2	7.4	3.4	3.6	0.1	0.1	0.1	0.1
Egypt	5.0	7.8	8.2	9.7	27.1	31.1	n.a.	2.8	2.5	1.8	2.3	15.6	18.4	6.9	7.0	0.6	n.a.	n.a.	n.a.
Libya	0.3	0.6	0.7	1.4	1.8	2.7	n.a.	0.2	0.3	0.2	0.2	1.2	1.4	0.5	0.6	n.a.	n.a.	n.a.	n.a.

TABLE A1.2 (Continued)

REGIONS/ SUBREGIONS/ COUNTRIES/ TERRITORIES	NUMBER OF UNDERNOURISHED PEOPLE[1]		NUMBER OF SEVERELY FOOD-INSECURE PEOPLE[1,2,3]		NUMBER OF MODERATELY OR SEVERELY FOOD-INSECURE PEOPLE[1,2,3]		NUMBER OF CHILDREN (<5 YEARS) AFFECTED BY WASTING	NUMBER OF CHILDREN (<5 YEARS) WHO ARE STUNTED		NUMBER OF CHILDREN (<5 YEARS) WHO ARE OVERWEIGHT		NUMBER OF ADULTS (≥18 YEARS) WHO ARE OBESE		NUMBER OF WOMEN (15–49 YEARS) AFFECTED BY ANAEMIA		NUMBER OF INFANTS (0–5 MONTHS) EXCLUSIVELY BREASTFED		NUMBER OF BABIES WITH LOW BIRTHWEIGHT	
	2004–06 (millions)	2020–22[4] (millions)	2014–16 (millions)	2020–22 (millions)	2014–16 (millions)	2020–22 (millions)	2022[5] (millions)	2012 (millions)	2022 (millions)	2012 (millions)	2022 (millions)	2012 (millions)	2016 (millions)	2012 (millions)	2019 (millions)	2012[6] (millions)	2021[7] (millions)	2012 (millions)	2020 (millions)
Morocco	1.7	2.3	n.r.	n.r.	n.r.	n.r.	0.1[h]	0.5	0.4	0.3	0.2	5.2	6.2	2.7	2.9	0.1	0.1	0.1	0.1
Sudan	–	5.4	5.1[b]	8.2[c]	15.8[b]	23.7[c]	n.a.	2.1	2.6	0.1	0.2	n.a.	n.a.	3.1	3.8	0.3	n.a.	n.a.	n.a.
Tunisia	0.4	0.4	1.1	1.6	2.1	3.5	<0.1	0.1	0.1	0.1	0.2	1.9	2.2	0.9	1.0	<0.1	<0.1	<0.1	<0.1
Northern Africa (excluding Sudan)	**9.7**	**12.0**	**17.3**	**19.6**	**49.6**	**58.7**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**30.2**	**35.7**	**n.a.**	**n.a.**	**0.9**	**n.a.**	**n.a.**	**n.a.**
Sub-Saharan Africa	**169.6**	**251.5**	**190.9**	**298.1**	**494.4**	**739.1**	**10.3**	**55.1**	**56.8**	**5.7**	**6.6**	**35.3**	**45.9**	**85.4**	**103.8**	**6.5**	**8.5**	**5.0**	**5.4**
Eastern Africa	**97.4**	**130.7**	**91.2**	**129.8**	**232.3**	**311.5**	**3.5**	**23.6**	**21.8**	**2.4**	**2.6**	**9.3**	**12.7**	**26.5**	**33.8**	**3.6**	**4.3**	**2.0**	**2.1**
Burundi	n.a.	n.a.	n.r.	n.r.	n.r.	n.r.	0.1[h]	1.1	1.2	<0.1	0.1	0.2	0.3	0.7	1.0	0.1	0.2	0.1	0.1
Comoros	<0.1	0.1	n.a.	0.2	n.a.	0.7	n.a.	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	0.1	<0.1	n.a.	<0.1	<0.1
Djibouti	0.3	0.2	n.a.	0.2	n.a.	0.5	<0.1[h]	<0.1	<0.1	<0.1	<0.1	0.1	0.1	0.1	0.1	<0.1	n.a.	n.a.	n.a.
Eritrea	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0.3	0.2	<0.1	<0.1	0.1	0.1	0.3	0.3	<0.1	n.a.	<0.1	<0.1
Ethiopia	28.7	26.4	14.9	25.3	57.6	69.9	1.2	6.4	6.3	0.4	0.5	1.6	2.4	4.8	6.6	0.8	1.1	n.a.	n.a.
Kenya	10.2	14.7	7.0[b, c]	14.8[c]	23.8[b, c]	38.3[c]	0.3	2.0	1.3	0.3	0.3	1.3	1.8	3.1	3.9	0.2	n.a.	0.2	0.1
Madagascar	6.3	14.8	n.a.	3.5	n.a.	18.8	0.3	1.7	1.6	0.1	0.1	0.5	0.7	2.0	2.5	0.2	0.2	0.2	0.2
Malawi	2.8	3.5	8.1[b, c]	10.4[b, c]	13.2[b, c]	16.4[b, c]	0.1	1.2	1.0	0.1	0.1	0.3	0.5	1.1	1.4	0.2	0.2	0.1	0.1
Mauritius	<0.1	<0.1	<0.1	0.1	0.2	0.4	n.a.	<0.1[f]	<0.1[f]	<0.1[f]	<0.1[f]	0.1	0.1	0.1	0.1	n.a.	n.a.	<0.1	<0.1
Mozambique	6.8	9.8	n.a.	12.7	n.a.	24.2	0.2	1.9	2.0	0.2	0.3	0.7	1.0	2.9	3.5	0.2	n.a.	0.2	0.2
Rwanda	3.1	4.3	n.r.	n.r.	n.r.	n.r.	<0.1	0.7	0.6	0.1	0.1	0.3	0.4	0.5	0.5	0.1	0.2	<0.1	<0.1
Seychelles	<0.1	<0.1	<0.1[b]	<0.1[c]	<0.1[b]	<0.1[c]	n.a.	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.0	n.a.	n.a.	<0.1	<0.1
Somalia	7.4	8.3	n.a.	7.4	n.a.	13.6	n.a.	0.7	0.6	0.1	0.1	0.4	0.5	1.2	1.5	<0.1	0.1	n.a.	n.a.
South Sudan	–	2.3	n.a.	6.8[b]	n.a.	9.4[b]	n.a.	0.5	0.4	0.1	0.1	n.a.	n.a.	0.8	0.9	0.1	n.a.	n.a.	n.a.
Uganda	4.7	14.5	8.1[c]	11.4[c]	24.9[c]	34.0[c]	0.3	2.1	1.8	0.2	0.3	0.7	1.0	2.5	3.4	0.4	0.5	n.a.	n.a.

TABLE A1.2 (Continued)

REGIONS/ SUBREGIONS/ COUNTRIES/ TERRITORIES	NUMBER OF UNDERNOURISHED PEOPLE[1] 2004–06 (millions)	NUMBER OF UNDERNOURISHED PEOPLE[1] 2020–22[4] (millions)	NUMBER OF SEVERELY FOOD-INSECURE PEOPLE[1, 2, 3] 2014–16 (millions)	NUMBER OF SEVERELY FOOD-INSECURE PEOPLE[1, 2, 3] 2020–22 (millions)	NUMBER OF MODERATELY OR SEVERELY FOOD-INSECURE PEOPLE[1, 2, 3] 2014–16 (millions)	NUMBER OF MODERATELY OR SEVERELY FOOD-INSECURE PEOPLE[1, 2, 3] 2020–22 (millions)	NUMBER OF CHILDREN (<5 YEARS) AFFECTED BY WASTING 2022[5] (millions)	NUMBER OF CHILDREN (<5 YEARS) WHO ARE STUNTED 2012 (millions)	NUMBER OF CHILDREN (<5 YEARS) WHO ARE STUNTED 2022 (millions)	NUMBER OF CHILDREN (<5 YEARS) WHO ARE OVERWEIGHT 2012 (millions)	NUMBER OF CHILDREN (<5 YEARS) WHO ARE OVERWEIGHT 2022 (millions)	NUMBER OF ADULTS (≥18 YEARS) WHO ARE OBESE 2012 (millions)	NUMBER OF ADULTS (≥18 YEARS) WHO ARE OBESE 2016 (millions)	NUMBER OF WOMEN (15–49 YEARS) AFFECTED BY ANAEMIA 2012 (millions)	NUMBER OF WOMEN (15–49 YEARS) AFFECTED BY ANAEMIA 2019 (millions)	NUMBER OF INFANTS (0–5 MONTHS) EXCLUSIVELY BREASTFED 2012[6] (millions)	NUMBER OF INFANTS (0–5 MONTHS) EXCLUSIVELY BREASTFED 2021[7] (millions)	NUMBER OF BABIES WITH LOW BIRTHWEIGHT 2012 (millions)	NUMBER OF BABIES WITH LOW BIRTHWEIGHT 2020 (millions)
United Republic of Tanzania	11.1	14.9	10.8[c]	16.7[c]	25.7[c]	37.4[c]	0.4	3.2	3.3	0.4	0.5	1.6	2.2	4.4	5.3	0.4	0.6	0.2	0.2
Zambia	5.9	5.8	3.6[c]	6.2[c]	8.3[c]	14.2[c]	0.1	1.1	1.0	0.2	0.2	0.5	0.6	1.0	1.4	0.2	0.2	0.1	0.1
Zimbabwe	3.7	6.1	5.0	4.6	9.2	11.8	0.1	0.7	0.5	0.1	0.1	1.0	1.1	1.0	1.1	0.1	0.1	0.1	0.1
Middle Africa	**36.2**	**54.1**	**n.a.**	**71.7**	**n.a.**	**142.2**	**1.9**	**10.0**	**12.9**	**1.2**	**1.6**	**4.5**	**6.0**	**14.6**	**17.2**	**1.0**	**1.6**	**0.8**	**0.9**
Angola	10.2	7.4	5.9	10.8[b, c]	18.7	27.1[b, c]	n.a.	1.5	2.7	0.1	0.2	0.8	1.1	2.6	3.3	n.a.	0.2	0.2	0.2
Cameroon	2.7	1.7	5.1	7.3	11.5	15.9	0.2	1.2	1.2	0.3	0.5	1.0	1.4	2.1	2.5	0.1	0.2	0.1	0.1
Central African Republic	1.6	2.7	n.a.	3.4	n.a.	4.4	0.1	0.4	0.4	<0.1	<0.1	0.1	0.2	0.5	0.5	<0.1	<0.1	<0.1	<0.1
Chad	3.8	5.4	n.r.	n.r.	n.r.	n.r.	0.3[h]	1.0	1.1	0.1	0.1	0.3	0.4	1.4	1.6	<0.1	0.1	n.a.	n.a.
Congo	1.3	1.9	2.2	3.4	4.2	5.1	n.a.	0.2	0.1	<0.1	<0.1	0.2	0.2	0.6	0.6	<0.1	n.a.	<0.1	<0.1
Democratic Republic of the Congo	16.1	33.8	n.a.	39.0	n.a.	73.5	1.0	5.7	7.3	0.6	0.7	1.8	2.5	7.1	8.2	0.5	1.0	0.4	0.4
Equatorial Guinea	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0.1	<0.1	<0.1	<0.1	<0.1	0.1	0.1	0.1	<0.1	n.a.	n.a.	n.a.
Gabon	0.2	0.5	n.r.	n.r.	n.r.	n.r.	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	0.2	0.2	0.3	<0.1	n.a.	<0.1	<0.1
Sao Tome and Principe	<0.1	<0.1	n.a.	<0.1	n.a.	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.0	<0.1	<0.1	<0.1	<0.1
Southern Africa	**2.9**	**6.9**	**5.7**	**7.8**	**13.8**	**17.1**	**0.2**	**1.5**	**1.6**	**0.8**	**0.8**	**9.6**	**11.2**	**4.7**	**5.5**	**n.a.**	**0.2**	**0.2**	**0.2**
Botswana	0.4	0.6	0.4[c]	0.7[b, c]	1.1[c]	1.5[b, c]	n.a.	0.1	0.1	<0.1	<0.1	0.2	0.2	0.2	0.2	<0.1	<0.1	<0.1	<0.1
Eswatini	0.1	0.1	n.a.	0.2	n.a.	0.8	n.a.	<0.1	<0.1	<0.1	<0.1	0.1	0.1	0.1	0.1	<0.1	n.a.	<0.1	<0.1
Lesotho	0.3	1.0	n.a.	0.7[c]	n.a.	1.3[c]	<0.1	0.1	0.1	<0.1	<0.1	0.2	0.2	0.1	0.2	<0.1	<0.1	<0.1	<0.1
Namibia	0.4	0.4	0.7[c]	0.8[c]	1.2[c]	1.5[c]	n.a.	0.1	0.1	<0.1	<0.1	0.2	0.2	0.1	0.2	<0.1	n.a.	<0.1	<0.1
South Africa	1.7	4.7	n.a.	5.3[c]	n.a.	12.1[c]	0.2[h]	1.3	1.3	0.7	0.7	9.0	10.4	4.2	4.8	n.a.	0.2	0.2	0.2

TABLE A1.2 (Continued)

REGIONS/ SUBREGIONS/ COUNTRIES/ TERRITORIES	NUMBER OF UNDERNOURISHED PEOPLE[1]		NUMBER OF SEVERELY FOOD-INSECURE PEOPLE[1, 2, 3]		NUMBER OF MODERATELY OR SEVERELY FOOD-INSECURE PEOPLE[1, 2, 3]		NUMBER OF CHILDREN (<5 YEARS) AFFECTED BY WASTING	NUMBER OF CHILDREN (<5 YEARS) WHO ARE STUNTED		NUMBER OF CHILDREN (<5 YEARS) WHO ARE OVERWEIGHT		NUMBER OF ADULTS (≥18 YEARS) WHO ARE OBESE		NUMBER OF WOMEN (15–49 YEARS) AFFECTED BY ANAEMIA		NUMBER OF INFANTS (0–5 MONTHS) EXCLUSIVELY BREASTFED		NUMBER OF BABIES WITH LOW BIRTHWEIGHT	
	2004–06 (millions)	2020–22[4] (millions)	2014–16 (millions)	2020–22 (millions)	2014–16 (millions)	2020–22 (millions)	2022[5] (millions)	2012 (millions)	2022 (millions)	2012 (millions)	2022 (millions)	2012 (millions)	2016 (millions)	2012 (millions)	2019 (millions)	2012[6] (millions)	2021[7] (millions)	2012 (millions)	2020 (millions)
Western Africa	**33.1**	**59.8**	**41.6**	**88.8**	**143.5**	**268.4**	**4.6**	**19.9**	**20.5**	**1.3**	**1.7**	**11.9**	**15.9**	**39.6**	**47.3**	**1.6**	**2.5**	**2.0**	**2.1**
Benin	1.0	1.3	1.1[c]	2.0[c]	6.0[c]	9.6[c]	0.1	0.6	0.7	<0.1	<0.1	0.4	0.5	1.3	1.5	0.1	0.1	0.1	0.1
Burkina Faso	2.5	3.6	1.9[b, c]	4.7	7.8[b, c]	12.6	0.4	1.0	0.8	0.1	0.1	0.4	0.5	2.0	2.5	0.1	0.2	0.1	0.1
Cabo Verde	<0.1	0.1	n.a.	<0.1[b]	n.a.	0.2[b]	n.a.	<0.1[f]	<0.1[f]	n.a.	n.a.	<0.1	<0.1	<0.1	0.0	<0.1	<0.1	n.a.	n.a.
Côte d'Ivoire	3.2	2.1	1.5[c]	2.7[c]	8.0[c]	12.1[c]	0.4	1.1	0.9	0.1	0.1	0.9	1.2	2.6	3.2	<0.1	0.2	0.2	0.2
Gambia	0.4	0.5	n.a.	0.7	n.a.	1.6	<0.1	0.1	0.1	<0.1	<0.1	0.1	0.1	0.3	0.3	<0.1	<0.1	<0.1	<0.1
Ghana	2.5	1.6	1.5[b, c]	2.0[c]	11.1[b, c]	12.9[c]	0.3	0.9	0.6	0.1	0.1	1.3	1.7	2.9	2.7	0.2	0.2	0.1	0.1
Guinea	1.4	1.8	5.1	6.7	8.4	9.9	0.2	0.6	0.6	0.1	0.1	0.3	0.4	1.3	1.5	<0.1	0.1	n.a.	n.a.
Guinea-Bissau	0.2	0.8	n.a.	0.7[c]	n.a.	1.6[c]	<0.1	0.1	0.1	<0.1	<0.1	0.1	0.1	0.2	0.2	<0.1	<0.1	<0.1	<0.1
Liberia	1.1	2.0	1.8	1.9	3.7	4.2	<0.1	0.2	0.2	<0.1	<0.1	0.2	0.2	0.4	0.5	<0.1	<0.1	<0.1	<0.1
Mali	1.8	2.8	n.r.	n.r.	n.r.	n.r.	0.4	1.0	1.0	0.1	0.1	0.5	0.7	2.0	2.6	0.1	0.2	n.a.	n.a.
Mauritania	0.3	0.4	0.2[c]	0.4[b, c]	1.0[c]	2.5[b, c]	0.1[h]	0.2	0.2	<0.1	<0.1	0.2	0.3	0.4	0.5	<0.1	<0.1	n.a.	n.a.
Niger	2.6	4.1	n.a.	7.7[c]	n.a.	18.0[c]	0.6	1.7	2.4	<0.1	0.1	0.3	0.5	1.8	2.4	0.1	0.1	n.a.	n.a.
Nigeria	9.8	34.0	20.3[b, c]	45.4[b, c]	63.8[b, c]	148.7[b, c]	2.2	11.4	12.1	0.8	0.8	6.1	8.2	20.9	25.5	0.5	1.1	n.a.	n.a.
Senegal	2.0	1.0	1.1[c]	1.9[c]	5.6[c]	8.4[c]	0.2	0.4	0.4	<0.1	0.1	0.5	0.7	1.8	2.1	0.1	0.1	0.1	0.1
Sierra Leone	2.6	2.3	2.0[b, c]	2.7	5.5[b, c]	7.5	0.1	0.4	0.3	<0.1	0.1	0.3	0.3	0.8	0.9	<0.1	0.1	<0.1	<0.1
Togo	1.6	1.5	1.2[c]	1.7[c]	4.5[c]	5.4[c]	0.1	0.3	0.3	<0.1	<0.1	0.2	0.3	0.8	0.9	0.1	0.1	<0.1	<0.1
Sub-Saharan Africa (including Sudan)	**169.6**	**257.0**	**196.0**	**306.3**	**510.1**	**762.8**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**35.3**	**45.9**	**n.a.**	**n.a.**	**6.8**	**8.8**	**n.a.**	**n.a.**
ASIA*	**542.6**	**404.0**	**297.4**	**464.2**	**789.2**	**1 164.4**	**31.6**	**106.8**	**76.6**	**18.2**	**17.7**	**181.7**	**231.3**	**351.9**	**380.7**	**13.0**	**17.1**	**13.7**	**11.8**
Central Asia	**8.3**	**2.4**	**1.2**	**3.6**	**6.4**	**14.0**	**0.2**	**1.1**	**0.7**	**0.6**	**0.4**	**6.6**	**8.1**	**5.2**	**5.3**	**0.3**	**0.4**	**0.1**	**0.1**
Kazakhstan	1.1	n.r.	n.a.	<0.1[b]	n.a.	0.5[b]	n.a.	0.2	0.1	0.2	0.2	2.2	2.6	1.3	1.3	0.1	0.1	<0.1	<0.1
Kyrgyzstan	0.4	0.3	n.a.	<0.1[c]	n.a.	0.5[c]	<0.1	0.1	0.1	0.1	0.1	0.5	0.6	0.5	0.6	<0.1	<0.1	<0.1	<0.1

TABLE A1.2 (Continued)

REGIONS/ SUBREGIONS/ COUNTRIES/ TERRITORIES	NUMBER OF UNDERNOURISHED PEOPLE[1]		NUMBER OF SEVERELY FOOD-INSECURE PEOPLE[1, 2, 3]		NUMBER OF MODERATELY OR SEVERELY FOOD-INSECURE PEOPLE[1, 2, 3]		NUMBER OF CHILDREN (<5 YEARS) AFFECTED BY WASTING	NUMBER OF CHILDREN (<5 YEARS) WHO ARE STUNTED		NUMBER OF CHILDREN (<5 YEARS) WHO ARE OVERWEIGHT		NUMBER OF ADULTS (≥18 YEARS) WHO ARE OBESE		NUMBER OF WOMEN (15–49 YEARS) AFFECTED BY ANAEMIA		NUMBER OF INFANTS (0–5 MONTHS) EXCLUSIVELY BREASTFED		NUMBER OF BABIES WITH LOW BIRTHWEIGHT	
	2004–06 (millions)	2020–22[4] (millions)	2014–16 (millions)	2020–22 (millions)	2014–16 (millions)	2020–22 (millions)	2022[5] (millions)	2012 (millions)	2022 (millions)	2012 (millions)	2022 (millions)	2012 (millions)	2016 (millions)	2012 (millions)	2019 (millions)	2012[6] (millions)	2021[7] (millions)	2012 (millions)	2020 (millions)
Tajikistan	2.6	0.9	n.r.	n.r.	n.r.	n.r.	0.1	0.3	0.2	0.1	<0.1	0.6	0.7	0.6	0.8	<0.1	<0.1	<0.1	<0.1
Turkmenistan	0.2	0.4	n.a.	n.a.	n.a.	n.a.	<0.1	0.1	<0.1	<0.1	<0.1	0.6	0.7	0.4	0.4	<0.1	<0.1	<0.1	<0.1
Uzbekistan	3.9	n.r.	0.6	2.3	3.5	8.9	0.1	0.4	0.3	0.2	0.2	2.8	3.5	2.4	2.2	0.1	0.2	<0.1	<0.1
Eastern Asia*	**105.7**	**n.r.**	**16.5**	**22.2**	**98.5**	**111.6**	**1.1**	**7.7**	**3.7**	**6.6**	**6.4**	**61.1**	**77.5**	**67.1**	**64.4**	**1.9**	**2.3**	**1.2**	**0.8**
China	93.6	n.r.	n.r.	n.r.	n.r.	n.r.	1.7	6.7	3.1	6.2	6.0	53.8	68.7	56.1	54.0	2.5	2.0	1.0	0.6
China, mainland	92.5	n.r.	n.r.	n.r.	n.r.	n.r.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Taiwan Province of China	1.0	0.7	n.r.	n.r.	n.r.	n.r.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	1.7	1.7	n.a.	n.a.	n.a.	n.a.
China, Hong Kong SAR	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
China, Macao SAR	<0.1	<0.1	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Democratic People's Republic of Korea	8.3	11.8	n.a.	n.a.	n.a.	n.a.	<0.1	0.4	0.3	<0.1	<0.1	1.1	1.3	2.1	2.2	0.1	0.1	n.a.	n.a.
Japan	n.r.	4.0	n.r.	1.2	3.3	5.5	n.a.	0.3	0.2	0.1	0.1	3.9	4.6	5.3	4.8	n.a.	n.a.	0.1	0.1
Mongolia	0.7	0.3	n.r.	n.r.	0.2	0.2[b, c]	<0.1	<0.1	<0.1	<0.1	<0.1	0.3	0.4	0.1	0.1	<0.1	<0.1	<0.1	<0.1
Republic of Korea	n.r.	n.r.	n.r.	0.4	2.4[b]	2.9	<0.1[h]	<0.1	<0.1	0.2	0.1	1.7	2.0	1.8	1.6	n.a.	n.a.	<0.1	<0.1
Eastern Asia (excluding China and Japan)	**6.8**	**9.5**	**n.r.**	**2.1**	**8.9**	**11.6**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**
South-eastern Asia	**96.3**	**35.1**	**12.6**	**16.5**	**93.9**	**110.9**	**4.3**	**17.2**	**14.4**	**3.6**	**4.1**	**22.2**	**29.5**	**41.7**	**47.4**	**1.8**	**2.6**	**1.5**	**1.4**
Brunei Darussalam	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.0	n.a.	n.a.	<0.1	<0.1

TABLE A1.2 (Continued)

REGIONS/ SUBREGIONS/ COUNTRIES/ TERRITORIES	NUMBER OF UNDERNOURISHED PEOPLE[1] 2004–06 (millions)	NUMBER OF UNDERNOURISHED PEOPLE[1] 2020–22[4] (millions)	NUMBER OF SEVERELY FOOD-INSECURE PEOPLE[1, 2, 3] 2014–16 (millions)	NUMBER OF SEVERELY FOOD-INSECURE PEOPLE[1, 2, 3] 2020–22 (millions)	NUMBER OF MODERATELY OR SEVERELY FOOD-INSECURE PEOPLE[1, 2, 3] 2014–16 (millions)	NUMBER OF MODERATELY OR SEVERELY FOOD-INSECURE PEOPLE[1, 2, 3] 2020–22 (millions)	NUMBER OF CHILDREN (<5 YEARS) AFFECTED BY WASTING 2022[5] (millions)	NUMBER OF CHILDREN (<5 YEARS) WHO ARE STUNTED 2012 (millions)	NUMBER OF CHILDREN (<5 YEARS) WHO ARE STUNTED 2022 (millions)	NUMBER OF CHILDREN (<5 YEARS) WHO ARE OVERWEIGHT 2012 (millions)	NUMBER OF CHILDREN (<5 YEARS) WHO ARE OVERWEIGHT 2022 (millions)	NUMBER OF ADULTS (≥18 YEARS) WHO ARE OBESE 2012 (millions)	NUMBER OF ADULTS (≥18 YEARS) WHO ARE OBESE 2016 (millions)	NUMBER OF WOMEN (15–49 YEARS) AFFECTED BY ANAEMIA 2012 (millions)	NUMBER OF WOMEN (15–49 YEARS) AFFECTED BY ANAEMIA 2019 (millions)	NUMBER OF INFANTS (0–5 MONTHS) EXCLUSIVELY BREASTFED 2012[6] (millions)	NUMBER OF INFANTS (0–5 MONTHS) EXCLUSIVELY BREASTFED 2021[7] (millions)	NUMBER OF BABIES WITH LOW BIRTHWEIGHT 2012 (millions)	NUMBER OF BABIES WITH LOW BIRTHWEIGHT 2020 (millions)
Cambodia	2.4	0.8	2.6	2.5	7.5	8.5	0.2	0.6	0.4	<0.1	0.1	0.3	0.4	1.9	2.1	0.1	0.1	<0.1	<0.1
Indonesia	44.2	16.2	1.8[b]	n.r.	15.5[b]	13.4[b]	2.4	8.3	6.9	2.2	2.4	9.1	12.2	18.3	22.3	1.0	1.1	0.5	0.4
Lao People's Democratic Republic	1.3	0.4	n.a.	0.5	n.a.	2.5	0.1	0.3	0.2	<0.1	<0.1	0.2	0.2	0.6	0.8	<0.1	<0.1	<0.1	<0.1
Malaysia	0.8	0.9	2.4	2.0	5.4	5.4	0.3	0.4	0.6	0.2	0.1	2.6	3.3	2.4	2.8	n.a.	0.1	0.1	0.1
Myanmar	13.8	2.1	n.a.	2.7	n.a.	15.8	0.3[h]	1.4	1.1	0.1	<0.1	1.5	2.1	5.7	6.3	0.1	0.2	0.1	0.1
Philippines	12.6	5.9	n.a.	6.5[b, c]	n.a.	50.9[b, c]	n.a.	3.7	3.5	0.4	0.6	3.2	4.1	4.2	3.5	0.4	0.7	0.5	0.5
Singapore	n.a.	n.a.	<0.1	0.1	0.2	0.4	n.a.	<0.1	<0.1	<0.1	<0.1	0.2	0.3	0.2	0.2	n.a.	n.a.	<0.1	<0.1
Thailand	7.8	3.7	0.5[c]	0.9[b, c]	3.3[c]	5.1[b, c]	0.3	0.6	0.4	0.4	0.3	4.1	5.4	4.1	4.2	<0.1	<0.1	0.1	0.1
Timor-Leste	0.3	0.3	n.a.	n.a.	n.a.	n.a.	<0.1	0.1	0.1	<0.1	<0.1	<0.1	<0.1	0.1	0.1	<0.1	<0.1	<0.1	<0.1
Viet Nam	12.6	4.9	n.a.	1.1[c]	n.a.	8.7[c]	0.3	1.8	1.4	0.3	0.6	1.0	1.4	4.3	5.3	0.1	0.3	0.1	0.1
Southern Asia	**315.9**	**315.8**	**243.5**	**392.8**	**512.6**	**822.2**	**25.1**	**75.3**	**53.7**	**5.0**	**4.9**	**49.7**	**65.4**	**218.4**	**241.0**	**8.3**	**10.6**	**10.2**	**8.8**
Afghanistan	8.5	12.0	5.0	11.4	15.2	31.7	0.3	2.3	2.2	0.3	0.2	0.6	0.9	2.5	3.8	n.a.	0.4	n.a.	n.a.
Bangladesh	19.2	18.9	20.9	18.7	50.9	52.7	1.4	6.0	3.9	0.3	0.3	2.7	3.7	14.9	16.8	1.0	0.9	0.7	0.7
Bhutan	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	0.1	<0.1	<0.1	<0.1	<0.1
India	247.2	233.9	n.r.	n.r.	n.r.	n.r.	21.9	52.5	36.1	2.8	3.2	25.2	34.3	171.5	187.3	5.9	7.2	7.7	6.3[g]
Iran (Islamic Republic of)	3.8	5.3	7.8	6.5	39.2	35.9	0.3	0.4	0.3	0.3	0.2	12.6	14.8	5.1	5.5	0.4	0.3	n.a.	n.a.
Maldives	n.a.	n.a.	n.a.	<0.1	n.a.	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1
Nepal	4.5	1.6	2.9	4.0	8.2	11.2	0.2	1.2	0.8	<0.1	<0.1	0.5	0.7	2.6	3.2	0.2	0.2	0.1	0.1
Pakistan	29.8	42.8	1.9[c]	29.9[b, c, d]	29.6[c]	97.9[b, c, d]	2.1	12.5	10.1	1.3	0.8	7.5	10.2	19.8	22.4	1.1	1.5	n.a.	n.a.
Sri Lanka	2.7	1.1	0.1[c]	0.3[c]	1.2[c]	2.4[c]	0.3	0.3	0.2	<0.1	<0.1	0.6	0.8	1.8	1.8	0.1	0.1	0.1	0.1

TABLE A1.2 (Continued)

REGIONS/ SUBREGIONS/ COUNTRIES/ TERRITORIES	NUMBER OF UNDERNOURISHED PEOPLE[1]		NUMBER OF SEVERELY FOOD-INSECURE PEOPLE[1, 2, 3]		NUMBER OF MODERATELY OR SEVERELY FOOD-INSECURE PEOPLE[1, 2, 3]		NUMBER OF CHILDREN (<5 YEARS) AFFECTED BY WASTING	NUMBER OF CHILDREN (<5 YEARS) WHO ARE STUNTED		NUMBER OF CHILDREN (<5 YEARS) WHO ARE OVERWEIGHT		NUMBER OF ADULTS (≥18 YEARS) WHO ARE OBESE		NUMBER OF WOMEN (15–49 YEARS) AFFECTED BY ANAEMIA		NUMBER OF INFANTS (0–5 MONTHS) EXCLUSIVELY BREASTFED		NUMBER OF BABIES WITH LOW BIRTHWEIGHT	
	2004–06 (millions)	2020–22[4] (millions)	2014–16 (millions)	2020–22 (millions)	2014–16 (millions)	2020–22 (millions)	2022[5] (millions)	2012 (millions)	2022 (millions)	2012 (millions)	2022 (millions)	2012 (millions)	2016 (millions)	2012 (millions)	2019 (millions)	2012[6] (millions)	2021[7] (millions)	2012 (millions)	2020 (millions)
Southern Asia (excluding India)	**68.7**	**81.9**	**38.7**	**70.8**	**144.7**	**232.2**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**24.5**	**31.1**	**n.a.**	**n.a.**	**3.1**	**3.4**	**n.a.**	**n.a.**
Western Asia	**16.4**	**30.4**	**23.5**	**29.2**	**77.9**	**105.7**	**1.0**	**5.3**	**3.9**	**2.5**	**2.0**	**42.4**	**51.4**	**19.6**	**22.5**	**0.9**	**0.9**	**0.7**	**0.7**
Armenia	0.4	n.r.	n.a.	n.r.	n.a.	0.2[b]	<0.1	<0.1	<0.1	<0.1	<0.1	0.4	0.5	0.1	0.1	<0.1	<0.1	<0.1	<0.1
Azerbaijan	0.4	n.r.	n.r.	n.r.	0.6	1.0	n.a.	0.2	0.1	0.1	0.1	1.2	1.4	0.9	0.9	<0.1	n.a.	<0.1	<0.1
Bahrain	n.a.	n.a.	n.r.	n.r.	n.r.	n.r.	n.a.	<0.1[f]	<0.1[f]	n.a.	n.a.	0.3	0.3	0.1	0.1	n.a.	n.a.	<0.1	<0.1
Cyprus	<0.1	n.r.	n.r.	n.r.	n.r.	n.r.	n.a.	n.a.	n.a.	n.a.	n.a.	0.2	0.2	<0.1	0.0	n.a.	n.a.	n.a.	n.a.
Georgia	0.2	0.1	0.3	0.4	1.2	1.4	<0.1	<0.1	<0.1	<0.1	<0.1	0.6	0.7	0.3	0.2	<0.1	<0.1	<0.1	<0.1
Iraq	5.1	7.1	n.r.	n.r.	n.r.	n.r.	0.2	1.0	0.6	0.5	0.4	4.7	6.1	2.3	2.8	0.1	0.2	0.1	0.1
Israel	n.r.	n.r.	0.1[b]	0.3[c]	0.9[b]	1.2[c]	n.a.	n.a.	n.a.	n.a.	n.a.	1.3	1.4	0.2	0.3	n.a.	n.a.	<0.1	<0.1
Jordan	n.a.	n.a.	n.r.	n.r.	n.r.	n.r.	<0.1	0.1	0.1	0.1	0.1	1.5	2.0	0.6	1.0	<0.1	<0.1	<0.1	<0.1
Kuwait	n.r.	n.r.	0.2	0.2	0.5	0.5	<0.1	<0.1	<0.1	<0.1	<0.1	0.9	1.1	0.2	0.2	n.a.	n.a.	<0.1	<0.1
Lebanon	n.a.	n.a.	n.a.	0.7	n.a.	2.0	<0.1	0.1	<0.1	<0.1	<0.1	1.1	1.5	0.4	0.5	n.a.	n.a.	<0.1	<0.1
Oman	0.2	0.1	n.a.	n.a.	n.a.	n.a.	<0.1	<0.1	0.1	<0.1	<0.1	0.6	0.9	0.2	0.3	n.a.	<0.1	<0.1	<0.1
Palestine	n.a.	n.a.	n.a.	0.2[b]	n.a.	1.4[b]	<0.1	0.1	0.1	<0.1	0.1	n.a.	n.a.	0.3	0.4	<0.1	<0.1	<0.1	<0.1
Qatar	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	<0.1[f]	<0.1[f]	<0.1[f]	<0.1[f]	0.6	0.8	0.1	0.1	<0.1	n.a.	<0.1	<0.1
Saudi Arabia	1.2	1.4	n.r.	n.r.	n.r.	n.r.	0.1[h]	0.4	0.4	0.3	0.3	6.4	8.1	1.9	2.3	n.a.	n.a.	n.a.	n.a.
Syrian Arab Republic	0.9	5.9	n.a.	n.a.	n.a.	n.a.	n.a.	0.8	0.5	0.5	0.2	3.0	3.0	1.7	1.5	0.1	0.1	n.a.	n.a.
Türkiye	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	0.1	0.6	0.4	0.7	0.5	15.1	17.8	n.a.	n.a.	0.3	0.3	0.2	0.2
United Arab Emirates	0.3	n.r.	n.a.	0.1[b, c]	n.a.	0.9[b, c]	n.a.	n.a.	n.a.	n.a.	n.a.	2.2	2.5	0.4	0.5	n.a.	n.a.	<0.1	<0.1
Yemen	5.8	11.4	3.5	4.2	13.0	22.2	n.a.	2.0	1.7	0.1	0.1	1.8	2.5	3.7	4.6	n.a.	n.a.	n.a.	n.a.

TABLE A1.2 (Continued)

REGIONS/ SUBREGIONS/ COUNTRIES/ TERRITORIES	NUMBER OF UNDERNOURISHED PEOPLE[1]		NUMBER OF SEVERELY FOOD-INSECURE PEOPLE[1, 2, 3]		NUMBER OF MODERATELY OR SEVERELY FOOD-INSECURE PEOPLE[1, 2, 3]		NUMBER OF CHILDREN (<5 YEARS) AFFECTED BY WASTING	NUMBER OF CHILDREN (<5 YEARS) WHO ARE STUNTED		NUMBER OF CHILDREN (<5 YEARS) WHO ARE OVERWEIGHT		NUMBER OF ADULTS (≥18 YEARS) WHO ARE OBESE		NUMBER OF WOMEN (15–49 YEARS) AFFECTED BY ANAEMIA		NUMBER OF INFANTS (0–5 MONTHS) EXCLUSIVELY BREASTFED		NUMBER OF BABIES WITH LOW BIRTHWEIGHT	
	2004–06 (millions)	2020–22[4] (millions)	2014–16 (millions)	2020–22 (millions)	2014–16 (millions)	2020–22 (millions)	2022[5] (millions)	2012 (millions)	2022 (millions)	2012 (millions)	2022 (millions)	2012 (millions)	2016 (millions)	2012 (millions)	2019 (millions)	2012[6] (millions)	2021[7] (millions)	2012 (millions)	2020 (millions)
Central Asia and Southern Asia	**324.2**	**318.2**	**244.7**	**396.4**	**518.9**	**836.2**	**25.3**	**76.4**	**54.3**	**5.6**	**5.3**	**56.4**	**73.5**	**223.5**	**246.3**	**8.6**	**11.0**	**10.3**	**8.9**
Eastern Asia and South-eastern Asia*	**202.0**	**n.r.**	**29.2**	**38.6**	**192.3**	**222.4**	**5.4**	**25.0**	**18.3**	**10.2**	**10.4**	**83.3**	**107.0**	**108.8**	**111.9**	**3.6**	**5.0**	**2.7**	**2.2**
Western Asia and Northern Africa	**27.8**	**47.8**	**46.0**	**57.0**	**143.3**	**188.1**	**2.8**	**11.5**	**10.2**	**5.6**	**5.6**	**72.6**	**87.0**	**37.2**	**41.4**	**2.1**	**n.a.**	**1.5**	**1.5**
LATIN AMERICA AND THE CARIBBEAN	**51.8**	**43.7**	**49.1**	**85.4**	**172.1**	**256.2**	**0.7**	**6.8**	**5.7**	**3.9**	**4.2**	**90.8**	**106.0**	**29.6**	**29.6**	**1.6**	**2.0**	**1.0**	**0.9**
Caribbean	**7.4**	**6.8**	**n.a.**	**12.7**	**n.a.**	**27.3**	**0.1**	**0.5**	**0.4**	**0.2**	**0.2**	**6.3**	**7.3**	**3.0**	**3.1**	**0.1**	**0.1**	**0.1**	**0.1**
Antigua and Barbuda	n.a.	n.a.	n.a.	<0.1	n.a.	<0.1	n.a.	n.a.	n.a.	n.a.	n.a.	<0.1	<0.1	<0.1	0.0	n.a.	n.a.	<0.1	<0.1
Bahamas	n.a.	n.a.	n.a.	<0.1	n.a.	<0.1	n.a.	n.a.	n.a.	n.a.	n.a.	0.1	0.1	<0.1	0.0	n.a.	n.a.	<0.1	<0.1
Barbados	<0.1	n.r.	n.a.	<0.1	n.a.	<0.1	n.a.	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	0.0	<0.1	n.a.	n.a.	n.a.
Cuba	n.r.	n.r.	n.a.	n.a.	n.a.	n.a.	<0.1	<0.1	<0.1	0.1	0.1	2.0	2.2	0.6	0.5	<0.1	<0.1	<0.1	<0.1
Dominica	<0.1	<0.1	n.r.	n.r.	n.r.	n.r.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	<0.1	0.0	n.a.	n.a.	n.a.	n.a.
Dominican Republic	1.8	0.7	2.5[b]	2.4[b, c]	5.6[b]	5.8[b, c]	<0.1	0.1	0.1	0.1	0.1	1.6	1.9	0.7	0.7	<0.1	<0.1	<0.1	<0.1
Grenada	n.a.	n.a.	n.a.	<0.1[b]	n.a.	<0.1[b]	n.a.	n.a.	n.a.	n.a.	n.a.	<0.1	<0.1	<0.1	0.0	n.a.	n.a.	n.a.	n.a.
Haiti	4.7	5.1	n.a.	4.9	n.a.	9.5	<0.1	0.3	0.2	<0.1	<0.1	1.2	1.5	1.3	1.4	0.1	0.1	n.a.	n.a.
Jamaica	0.2	0.2	0.7	0.7	1.3	1.5	<0.1	<0.1	<0.1	<0.1	<0.1	0.4	0.5	0.1	0.2	<0.1	n.a.	<0.1	<0.1
Puerto Rico	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0.2	0.1	n.a.	n.a.	n.a.	n.a.
Saint Kitts and Nevis	n.a.	n.a.	<0.1	<0.1	<0.1	<0.1	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	<0.1	0.0	n.a.	n.a.	n.a.	n.a.
Saint Lucia	n.a.	n.a.	<0.1[b]	<0.1	<0.1[b]	<0.1	n.a.	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.0	<0.1	n.a.	<0.1	<0.1

TABLE A1.2 (Continued)

REGIONS/ SUBREGIONS/ COUNTRIES/ TERRITORIES	NUMBER OF UNDERNOURISHED PEOPLE[1] 2004–06 (millions)	NUMBER OF UNDERNOURISHED PEOPLE[1] 2020–22[4] (millions)	NUMBER OF SEVERELY FOOD-INSECURE PEOPLE[1, 2, 3] 2014–16 (millions)	NUMBER OF SEVERELY FOOD-INSECURE PEOPLE[1, 2, 3] 2020–22 (millions)	NUMBER OF MODERATELY OR SEVERELY FOOD-INSECURE PEOPLE[1, 2, 3] 2014–16 (millions)	NUMBER OF MODERATELY OR SEVERELY FOOD-INSECURE PEOPLE[1, 2, 3] 2020–22 (millions)	NUMBER OF CHILDREN (<5 YEARS) AFFECTED BY WASTING 2022[5] (millions)	NUMBER OF CHILDREN (<5 YEARS) WHO ARE STUNTED 2012 (millions)	NUMBER OF CHILDREN (<5 YEARS) WHO ARE STUNTED 2022 (millions)	NUMBER OF CHILDREN (<5 YEARS) WHO ARE OVERWEIGHT 2012 (millions)	NUMBER OF CHILDREN (<5 YEARS) WHO ARE OVERWEIGHT 2022 (millions)	NUMBER OF ADULTS (≥18 YEARS) WHO ARE OBESE 2012 (millions)	NUMBER OF ADULTS (≥18 YEARS) WHO ARE OBESE 2016 (millions)	NUMBER OF WOMEN (15–49 YEARS) AFFECTED BY ANAEMIA 2012 (millions)	NUMBER OF WOMEN (15–49 YEARS) AFFECTED BY ANAEMIA 2019 (millions)	NUMBER OF INFANTS (0–5 MONTHS) EXCLUSIVELY BREASTFED 2012[6] (millions)	NUMBER OF INFANTS (0–5 MONTHS) EXCLUSIVELY BREASTFED 2021[7] (millions)	NUMBER OF BABIES WITH LOW BIRTHWEIGHT 2012 (millions)	NUMBER OF BABIES WITH LOW BIRTHWEIGHT 2020 (millions)
Saint Vincent and the Grenadines	<0.1	<0.1	n.a.	<0.1	n.a.	<0.1	n.a.	n.a.	n.a.	n.a.	n.a.	<0.1	<0.1	<0.1	0.0	n.a.	n.a.	n.a.	n.a.
Trinidad and Tobago	0.2	0.2	n.a.	0.2	n.a.	0.7	n.a.	<0.1	<0.1	<0.1	<0.1	0.2	0.2	0.1	0.1	<0.1	n.a.	<0.1	<0.1
Central America	**11.6**	**8.9**	**10.8**	**14.2**	**49.1**	**60.9**	**0.1**	**2.9**	**2.5**	**1.1**	**1.0**	**26.1**	**30.8**	**6.7**	**7.0**	**0.3**	**0.5**	**0.4**	**0.3**
Belize	<0.1	<0.1	n.a.	<0.1[b]	n.a.	0.2[b]	n.a.	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	0.0	<0.1	<0.1	<0.1	<0.1
Costa Rica	0.2	0.2	<0.1[c]	0.1[b]	0.6[c]	0.8[b]	<0.1	<0.1	<0.1	<0.1	<0.1	0.8	0.9	0.2	0.2	<0.1	<0.1	<0.1	<0.1
El Salvador	0.6	0.5	0.9	1.0	2.6	3.1	n.a.	0.1	0.1	<0.1	<0.1	0.9	1.0	0.2	0.2	<0.1	n.a.	<0.1	<0.1
Guatemala	2.5	2.3	2.6	3.7	6.8	10.5	<0.1	0.9	0.8	0.1	0.1	1.6	2.0	0.4	0.3	0.1	0.1	0.1	0.1
Honduras	1.7	1.9	1.3[c]	2.4[b]	3.9[c]	5.8[b]	<0.1	0.2	0.2	0.1	0.1	0.9	1.2	0.4	0.5	<0.1	<0.1	<0.1	<0.1
Mexico	4.6	n.r.	4.3[b]	4.5[b]	30.8[b]	35.0[b]	0.2	1.5	1.2	0.8	0.7	20.6	24.0	5.1	5.3	0.2	0.3	0.2	0.2
Nicaragua	1.3	1.2	n.r.	n.r.	n.r.	n.r.	n.a.	0.1	0.1	<0.1	0.1	0.8	0.9	0.2	0.3	<0.1	n.a.	<0.1	<0.1
Panama	0.7	0.2	n.r.	n.r.	n.r.	n.r.	<0.1	0.1	0.1	<0.1	<0.1	0.5	0.6	0.2	0.2	n.a.	n.a.	<0.1	<0.1
South America	32.8	28.0	24.7	58.5	96.8	167.9	0.4	3.4	2.8	2.6	3.0	58.4	67.9	19.9	19.5	1.3	1.4	0.6	0.5
Argentina	1.5	1.4	2.5	5.9	8.3	16.7	0.1	0.3	0.3	0.4	0.4	7.6	8.6	1.3	1.3	0.1	n.a.	0.1	<0.1
Bolivia (Plurinational State of)	2.5	2.3	n.r.	n.r.	n.r.	n.r.	<0.1	0.3	0.1	0.1	0.1	1.1	1.4	0.7	0.7	0.1	0.1	<0.1	<0.1
Brazil	12.1	10.1	4.0	21.1	37.6	70.3	0.5[h]	1.0	1.0	1.2	1.4	28.4	33.3	10.1	9.2	0.6	0.6	0.2	0.2
Chile	0.5	0.5	0.5[c]	0.8[b]	1.9[c]	3.5[b]	n.a.	<0.1	<0.1	0.1	0.1	3.4	3.8	0.4	0.4	n.a.	n.a.	<0.1	<0.1
Colombia	4.8	3.4	n.r.	n.r.	n.r.	n.r.	0.1	0.5	0.4	0.2	0.2	6.4	7.6	2.8	2.9	0.2	0.1	0.1	0.1
Ecuador	3.1	2.5	1.0[b, c]	2.3[c]	3.4[b, c]	6.6[c]	0.1	0.4	0.3	0.1	0.2	1.8	2.2	0.7	0.8	n.a.	n.a.	<0.1	<0.1
Guyana	<0.1	n.r.	n.a.	n.a.	n.a.	n.a.	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	0.1	0.1	0.1	<0.1	n.a.	<0.1	<0.1

TABLE A1.2 (Continued)

REGIONS/ SUBREGIONS/ COUNTRIES/ TERRITORIES	NUMBER OF UNDERNOURISHED PEOPLE[1]		NUMBER OF SEVERELY FOOD-INSECURE PEOPLE[1, 2, 3]		NUMBER OF MODERATELY OR SEVERELY FOOD-INSECURE PEOPLE[1, 2, 3]		NUMBER OF CHILDREN (<5 YEARS) AFFECTED BY WASTING	NUMBER OF CHILDREN (<5 YEARS) WHO ARE STUNTED		NUMBER OF CHILDREN (<5 YEARS) WHO ARE OVERWEIGHT		NUMBER OF ADULTS (≥18 YEARS) WHO ARE OBESE		NUMBER OF WOMEN (15–49 YEARS) AFFECTED BY ANAEMIA		NUMBER OF INFANTS (0–5 MONTHS) EXCLUSIVELY BREASTFED		NUMBER OF BABIES WITH LOW BIRTHWEIGHT	
	2004–06 (millions)	2020–22[4] (millions)	2014–16 (millions)	2020–22 (millions)	2014–16 (millions)	2020–22 (millions)	2022[5] (millions)	2012 (millions)	2022 (millions)	2012 (millions)	2022 (millions)	2012 (millions)	2016 (millions)	2012 (millions)	2019 (millions)	2012[6] (millions)	2021[7] (millions)	2012 (millions)	2020 (millions)
Paraguay	0.5	0.3	<0.1[c]	0.4[b, c]	0.5[c]	1.7[b, c]	<0.1	0.1	<0.1	0.1	0.1	0.7	0.9	0.4	0.4	<0.1	<0.1	<0.1	<0.1
Peru	5.3	2.4	n.r.	n.r.	n.r.	n.r.	<0.1	0.6	0.3	0.2	0.3	3.5	4.1	1.6	1.8	0.2	0.2	0.1	<0.1
Suriname	<0.1	<0.1	n.a.	<0.1	n.a.	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	0.1	<0.1	0.0	<0.1	<0.1	<0.1	<0.1
Uruguay	<0.1	n.r.	<0.1[c]	<0.1[b, c]	0.5[c]	0.5[b, c]	<0.1	<0.1	<0.1	<0.1	<0.1	0.6	0.7	0.1	0.1	n.a.	<0.1	<0.1	<0.1
Venezuela (Bolivarian Republic of)	2.2	5.1	n.r.	n.r.	n.r.	n.r.	n.a.	0.4	0.2	0.2	0.2	4.6	5.1	1.6	1.8	n.a.	n.a.	0.1	<0.1
OCEANIA	**2.3**	**2.9**	**1.1**	**1.6**	**4.5**	**5.6**	**n.a.**	**0.7**	**0.8**	**0.4**	**0.6**	**7.0**	**8.1**	**1.3**	**1.6**	**n.a.**	**n.a.**	**0.1**	**0.1**
Australia and New Zealand	**n.r.**	**n.r.**	**0.8**	**1.1**	**3.0**	**3.7**	**n.a.**	**0.1**	**0.1**	**0.2**	**0.4**	**5.7**	**6.5**	**0.5**	**0.6**	**n.a.**	**n.a.**	**<0.1**	**<0.1**
Australia	n.r.	n.r.	0.7	0.9	2.6	3.0	n.a.	<0.1	0.1	0.2	0.3	4.7	5.4	0.4	0.5	n.a.	n.a.	<0.1	<0.1
New Zealand	n.r.	n.r.	0.1	0.2	0.5	0.8	n.a.	n.a.	n.a.	n.a.	n.a.	1.0	1.1	0.1	0.1	n.a.	n.a.	<0.1	<0.1
Oceania excluding Australia and New Zealand	**2.0**	**2.7**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**0.1[a]**	**0.6**	**0.7**	**0.1**	**0.2**	**1.3**	**1.6**	**0.8**	**1.0**	**0.1**	**0.1**	**0.1**	**0.1**
Melanesia	**1.9**	**2.6**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**0.6**	**0.7**	**0.1**	**0.2**	**1.1**	**1.3**	**0.8**	**0.9**	**0.1**	**0.1**	**0.1**	**0.1**
Fiji	<0.1	<0.1	n.a.	<0.1	n.a.	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	0.2	0.1	0.1	n.a.	<0.1	<0.1	<0.1
New Caledonia	<0.1	<0.1	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Papua New Guinea	1.8	2.3	n.a.	n.a.	n.a.	n.a.	n.a.	0.5	0.6	0.1	0.2	0.8	1.0	0.6	0.8	0.1	0.1	<0.1	<0.1
Solomon Islands	<0.1	0.1	n.a.	n.a.	n.a.	n.a.	n.a.	<0.1	<0.1	<0.1	<0.1	0.1	0.1	0.1	0.1	<0.1	<0.1	<0.1	<0.1
Vanuatu	<0.1	<0.1	n.a.	<0.1	n.a.	<0.1	n.a.	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.0	<0.1	n.a.	<0.1	<0.1
Micronesia	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**<0.1**	**<0.1**	**<0.1**	**<0.1**	**0.1**	**0.1**	**<0.1**	**0.0**	**<0.1**	**<0.1**	**<0.1**	**<0.1**
Kiribati	<0.1	<0.1	n.a.	<0.1	n.a.	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.0	<0.1	<0.1	<0.1	<0.1
Marshall Islands	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	<0.1	<0.1	<0.1	<0.1	<0.1	n.a.	n.a.	<0.1	0.0	<0.1	<0.1	n.a.	n.a.

TABLE A1.2 (Continued)

REGIONS/ SUBREGIONS/ COUNTRIES/ TERRITORIES	NUMBER OF UNDERNOURISHED PEOPLE[1]		NUMBER OF SEVERELY FOOD-INSECURE PEOPLE[1, 2, 3]		NUMBER OF MODERATELY OR SEVERELY FOOD-INSECURE PEOPLE[1, 2, 3]		NUMBER OF CHILDREN (<5 YEARS) AFFECTED BY WASTING	NUMBER OF CHILDREN (<5 YEARS) WHO ARE STUNTED		NUMBER OF CHILDREN (<5 YEARS) WHO ARE OVERWEIGHT		NUMBER OF ADULTS (≥18 YEARS) WHO ARE OBESE		NUMBER OF WOMEN (15–49 YEARS) AFFECTED BY ANAEMIA		NUMBER OF INFANTS (0–5 MONTHS) EXCLUSIVELY BREASTFED		NUMBER OF BABIES WITH LOW BIRTHWEIGHT	
	2004–06 (millions)	2020–22[4] (millions)	2014–16 (millions)	2020–22 (millions)	2014–16 (millions)	2020–22 (millions)	2022[5] (millions)	2012 (millions)	2022 (millions)	2012 (millions)	2022 (millions)	2012 (millions)	2016 (millions)	2012 (millions)	2019 (millions)	2012[6] (millions)	2021[7] (millions)	2012 (millions)	2020 (millions)
Micronesia (Federated States of)	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	<0.1	<0.1	<0.1	0.0	n.a.	n.a.	n.a.	n.a.
Nauru	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	<0.1	<0.1	<0.1	<0.1	n.a.	n.a.	<0.1	0.0	<0.1	n.a.	n.a.	n.a.
Palau	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	<0.1	0.0	n.a.	n.a.	<0.1	<0.1
Polynesia	**<0.1**	**<0.1**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**<0.1**	**<0.1**	**<0.1**	**<0.1**	**0.2**	**0.2**	**<0.1**	**0.0**	**<0.1**	**<0.1**	**<0.1**	**<0.1**
American Samoa	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Cook Islands	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	<0.1	0.0	n.a.	n.a.	<0.1	<0.1
French Polynesia	<0.1	<0.1	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Niue	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	<0.1	0.0	n.a.	n.a.	n.a.	n.a.
Samoa	<0.1	<0.1	n.a.	<0.1	n.a.	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	n.a.	n.a.
Tokelau (Associate Member)	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Tonga	n.a.	n.a.	n.a.	<0.1[b]	n.a.	<0.1[b]	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.0	<0.1	<0.1	n.a.	n.a.
Tuvalu	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	<0.1	<0.1	<0.1	<0.1	<0.1	n.a.	n.a.	<0.1	0.0	<0.1	<0.1	n.a.	n.a.
NORTHERN AMERICA AND EUROPE	**n.r.**	**n.r.**	**14.8**	**15.6**	**100.6**	**87.8**	**n.a.**	**2.6**	**2.1**	**5.6**	**4.3**	**216.2**	**237.2**	**33.7**	**36.2**	**n.a.**	**n.a.**	**0.9**	**0.8**
Northern America**	**n.r.**	**n.r.**	**3.7**	**2.7**	**35.8**	**29.4**	**<0.1**	**0.6**	**0.7**	**1.9**	**1.7**	**87.8**	**98.7**	**8.1**	**9.8**	**0.5**	**0.5**	**0.3**	**0.3**
Bermuda	<0.1	n.r.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Canada	n.r.	n.r.	n.a.	0.5[c]	n.a.	2.9[c]	n.a.	n.a.	n.a.	0.2	0.2	7.6	8.6	0.7	0.9	n.a.	n.a.	<0.1	<0.1
Greenland	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
United States of America	n.r.	n.r.	3.5[b]	2.3[b]	34.0[b]	26.4[b]	<0.1	0.5	0.7	1.7	1.5	80.2	90.1	7.4	8.9	0.5	0.5	0.3	0.3

TABLE A1.2 (Continued)

REGIONS/ SUBREGIONS/ COUNTRIES/ TERRITORIES	NUMBER OF UNDERNOURISHED PEOPLE[1]		NUMBER OF SEVERELY FOOD-INSECURE PEOPLE[1, 2, 3]		NUMBER OF MODERATELY OR SEVERELY FOOD-INSECURE PEOPLE[1, 2, 3]		NUMBER OF CHILDREN (<5 YEARS) AFFECTED BY WASTING	NUMBER OF CHILDREN (<5 YEARS) WHO ARE STUNTED		NUMBER OF CHILDREN (<5 YEARS) WHO ARE OVERWEIGHT		NUMBER OF ADULTS (≥18 YEARS) WHO ARE OBESE		NUMBER OF WOMEN (15–49 YEARS) AFFECTED BY ANAEMIA		NUMBER OF INFANTS (0–5 MONTHS) EXCLUSIVELY BREASTFED		NUMBER OF BABIES WITH LOW BIRTHWEIGHT	
	2004–06 (millions)	2020–22[4] (millions)	2014–16 (millions)	2020–22 (millions)	2014–16 (millions)	2020–22 (millions)	2022[5] (millions)	2012 (millions)	2022 (millions)	2012 (millions)	2022 (millions)	2012 (millions)	2016 (millions)	2012 (millions)	2019 (millions)	2012[6] (millions)	2021[7] (millions)	2012 (millions)	2020 (millions)
Europe	**n.r.**	**n.r.**	**11.1**	**12.9**	**64.9**	**58.4**	**n.a.**	**2.1**	**1.4**	**3.7**	**2.6**	**128.4**	**138.4**	**25.5**	**26.5**	**n.a.**	**n.a.**	**0.6**	**0.5**
Eastern Europe	**n.r.**	**n.r.**	**4.3**	**4.9**	**32.8**	**30.6**	**n.a.**	**1.2**	**0.8**	**2.0**	**1.1**	**53.0**	**55.8**	**14.1**	**14.0**	**n.a.**	**n.a.**	**0.3**	**0.2**
Belarus	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.a.	<0.1	<0.1	<0.1	<0.1	1.8	1.9	0.5	0.4	<0.1	<0.1	<0.1	<0.1
Bulgaria	0.4	n.r.	0.1	0.2	1.1	1.1	n.a.	<0.1	<0.1	<0.1	<0.1	1.4	1.5	0.4	0.4	n.a.	n.a.	<0.1	<0.1
Czechia	n.r.	n.r.	<0.1	0.2	0.6	0.9	n.a.	<0.1	<0.1	<0.1	<0.1	2.1	2.3	0.5	0.5	n.a.	n.a.	<0.1	<0.1
Hungary	n.r.	n.r.	0.1	0.3	1.1	1.2	n.a.	n.a.	n.a.	n.a.	n.a.	2.0	2.1	0.5	0.4	n.a.	n.a.	<0.1	<0.1
Poland	n.r.	n.r.	0.7	0.4	3.4	2.9	n.a.	<0.1	<0.1	0.1	0.1	6.7	7.2	n.a.	n.a.	n.a.	n.a.	<0.1	<0.1
Republic of Moldova	1.3	n.r.	<0.1	0.2	0.6	0.7	n.a.	<0.1	<0.1	<0.1	<0.1	0.6	0.6	0.3	0.3	<0.1	n.a.	<0.1	<0.1
Romania	n.r.	n.r.	1.1	1.1	3.8	3.2	n.a.	0.1	0.1	0.1	<0.1	3.4	3.6	1.1	1.0	n.a.	n.a.	<0.1	<0.1
Russian Federation	n.r.	n.r.	1.0	n.r.	11.9	7.2[b]	n.a.	n.a.	n.a.	1.0	0.6	25.7	26.9	7.3	7.2	n.a.	n.a.	0.1	0.1
Slovakia	0.3	0.2	<0.1	<0.1	0.3	0.5	n.a.	n.a.	n.a.	n.a.	n.a.	0.8	0.9	0.3	0.3	n.a.	n.a.	<0.1	<0.1
Ukraine	n.r.	2.0	0.9	1.8	8.9	12.0	n.a.	0.5	0.2	0.6	0.2	8.5	8.8	1.6	1.8	0.1	n.a.	<0.1	<0.1
Northern Europe	**n.r.**	**n.r.**	**1.8**	**1.8**	**6.9**	**5.4**	**n.a.**	**0.2**	**0.2**	**0.5**	**0.5**	**19.0**	**21.2**	**2.5**	**2.8**	**n.a.**	**n.a.**	**0.1**	**0.1**
Denmark	n.r.	n.r.	<0.1	0.1	0.3	0.4	n.a.	n.a.	n.a.	n.a.	n.a.	0.8	0.9	0.1	0.2	n.a.	n.a.	<0.1	<0.1
Estonia	n.r.	n.r.	<0.1	<0.1	0.1	0.1	n.a.	<0.1	<0.1	<0.1	<0.1	0.2	0.2	0.1	0.1	n.a.	n.a.	<0.1	<0.1
Finland	n.r.	n.r.	0.1	0.1	0.5	0.6	n.a.	n.a.	n.a.	n.a.	n.a.	0.9	1.0	0.1	0.1	n.a.	n.a.	<0.1	<0.1
Iceland	n.r.	n.r.	<0.1	<0.1	<0.1	<0.1	n.a.	n.a.	n.a.	n.a.	n.a.	<0.1	0.1	<0.1	0.0	n.a.	n.a.	<0.1	<0.1
Ireland	n.r.	n.r.	0.2	0.1	0.4	0.3	n.a.	n.a.	n.a.	n.a.	n.a.	0.8	0.9	0.1	0.1	n.a.	n.a.	<0.1	<0.1
Latvia	n.r.	n.r.	<0.1	<0.1	0.2	0.2	<0.1[h]	<0.1	<0.1	<0.1	<0.1	0.4	0.4	0.1	0.1	n.a.	n.a.	<0.1	<0.1
Lithuania	n.r.	n.r.	<0.1	<0.1	0.5	0.2	<0.1[h]	<0.1	<0.1	<0.1	<0.1	0.6	0.6	0.1	0.1	n.a.	n.a.	<0.1	<0.1

TABLE A1.2 (Continued)

REGIONS/ SUBREGIONS/ COUNTRIES/ TERRITORIES	NUMBER OF UNDERNOURISHED PEOPLE[1] 2004–06 (millions)	NUMBER OF UNDERNOURISHED PEOPLE[1] 2020–22[4] (millions)	NUMBER OF SEVERELY FOOD-INSECURE PEOPLE[1, 2, 3] 2014–16 (millions)	NUMBER OF SEVERELY FOOD-INSECURE PEOPLE[1, 2, 3] 2020–22 (millions)	NUMBER OF MODERATELY OR SEVERELY FOOD-INSECURE PEOPLE[1, 2, 3] 2014–16 (millions)	NUMBER OF MODERATELY OR SEVERELY FOOD-INSECURE PEOPLE[1, 2, 3] 2020–22 (millions)	NUMBER OF CHILDREN (<5 YEARS) AFFECTED BY WASTING 2022[5] (millions)	NUMBER OF CHILDREN (<5 YEARS) WHO ARE STUNTED 2012 (millions)	NUMBER OF CHILDREN (<5 YEARS) WHO ARE STUNTED 2022 (millions)	NUMBER OF CHILDREN (<5 YEARS) WHO ARE OVERWEIGHT 2012 (millions)	NUMBER OF CHILDREN (<5 YEARS) WHO ARE OVERWEIGHT 2022 (millions)	NUMBER OF ADULTS (≥18 YEARS) WHO ARE OBESE 2012 (millions)	NUMBER OF ADULTS (≥18 YEARS) WHO ARE OBESE 2016 (millions)	NUMBER OF WOMEN (15–49 YEARS) AFFECTED BY ANAEMIA 2012 (millions)	NUMBER OF WOMEN (15–49 YEARS) AFFECTED BY ANAEMIA 2019 (millions)	NUMBER OF INFANTS (0–5 MONTHS) EXCLUSIVELY BREASTFED 2012[6] (millions)	NUMBER OF INFANTS (0–5 MONTHS) EXCLUSIVELY BREASTFED 2021[7] (millions)	NUMBER OF BABIES WITH LOW BIRTHWEIGHT 2012 (millions)	NUMBER OF BABIES WITH LOW BIRTHWEIGHT 2020 (millions)
Norway	n.r.	n.r.	<0.1	<0.1	0.2	0.3	n.a.	n.a.	n.a.	n.a.	n.a.	0.8	1.0	0.1	0.1	n.a.	n.a.	<0.1	<0.1
Sweden	n.r.	n.r.	<0.1	0.1	0.4	0.6	n.a.	n.a.	n.a.	n.a.	n.a.	1.4	1.6	0.3	0.3	n.a.	n.a.	<0.1	<0.1
United Kingdom of Great Britain and Northern Ireland	n.r.	n.r.	1.2	1.1	4.1	2.7	<0.1[h]	n.a.	n.a.	0.4	0.4	12.9	14.6	1.4	1.7	n.a.	n.a.	0.1	<0.1
Southern Europe	**n.r.**	**n.r.**	**2.6**	**3.4**	**15.2**	**12.9**	**n.a.**	**0.4**	**0.2**	**0.7**	**0.5**	**25.6**	**27.5**	**4.8**	**5.0**	**n.a.**	**n.a.**	**0.1**	**0.1**
Albania	0.3	0.1	0.3	0.2	1.1	0.9	<0.1	<0.1	<0.1	<0.1	<0.1	0.4	0.5	0.2	0.2	<0.1	<0.1	<0.1	<0.1
Andorra	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	<0.1	0.0	n.a.	n.a.	<0.1	<0.1
Bosnia and Herzegovina	n.r.	n.r.	<0.1	0.1	0.3	0.4	n.a.	<0.1	<0.1	<0.1	<0.1	0.5	0.5	0.2	0.2	<0.1	n.a.	<0.1	<0.1
Croatia	n.r.	n.r.	<0.1	<0.1	0.3	0.4	n.a.	n.a.	n.a.	n.a.	n.a.	0.8	0.8	0.2	0.2	n.a.	n.a.	<0.1	<0.1
Greece	n.r.	n.r.	0.3	0.2[b, e]	1.7	0.7[b, e]	n.a.	<0.1	<0.1	0.1	0.1	2.1	2.2	0.3	0.3	n.a.	n.a.	<0.1	<0.1
Italy	n.r.	n.r.	0.7	1.1	5.2	3.4	n.a.	n.a.	n.a.	n.a.	n.a.	9.3	10.1	1.6	1.7	n.a.	n.a.	<0.1	<0.1
Malta	n.r.	<0.1	<0.1	<0.1	<0.1	<0.1	n.a.	n.a.	n.a.	n.a.	n.a.	0.1	0.1	<0.1	0.0	n.a.	n.a.	<0.1	<0.1
Montenegro	<0.1	n.r.	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	0.1	<0.1	0.0	<0.1	<0.1	<0.1	<0.1
North Macedonia	0.1	<0.1	<0.1	0.1	0.3	0.5	<0.1	<0.1	<0.1	<0.1	<0.1	0.3	0.4	0.1	0.1	<0.1	<0.1	<0.1	<0.1
Portugal	n.r.	n.r.	0.4	0.4	1.5	1.3	<0.1[h]	<0.1	<0.1	<0.1	<0.1	1.6	1.8	0.3	0.3	n.a.	n.a.	<0.1	<0.1
Serbia	n.r.	n.r.	0.2	0.4	1.1	1.3	<0.1	<0.1	<0.1	0.1	<0.1	1.4	1.5	0.5	0.5	<0.1	<0.1	<0.1	<0.1
Slovenia	n.r.	n.r.	<0.1	<0.1	0.3	0.1	n.a.	n.a.	n.a.	n.a.	n.a.	0.3	0.3	0.1	0.1	n.a.	n.a.	<0.1	<0.1
Spain	n.r.	n.r.	0.5	0.8	3.3	3.8	n.a.	n.a.	n.a.	n.a.	n.a.	8.7	9.1	1.4	1.4	n.a.	n.a.	<0.1	<0.1

TABLE A1.2 (Continued)

REGIONS/ SUBREGIONS/ COUNTRIES/ TERRITORIES	NUMBER OF UNDERNOURISHED PEOPLE[1]		NUMBER OF SEVERELY FOOD-INSECURE PEOPLE[1, 2, 3]		NUMBER OF MODERATELY OR SEVERELY FOOD-INSECURE PEOPLE[1, 2, 3]		NUMBER OF CHILDREN (<5 YEARS) AFFECTED BY WASTING	NUMBER OF CHILDREN (<5 YEARS) WHO ARE STUNTED		NUMBER OF CHILDREN (<5 YEARS) WHO ARE OVERWEIGHT		NUMBER OF ADULTS (≥18 YEARS) WHO ARE OBESE		NUMBER OF WOMEN (15–49 YEARS) AFFECTED BY ANAEMIA		NUMBER OF INFANTS (0–5 MONTHS) EXCLUSIVELY BREASTFED		NUMBER OF BABIES WITH LOW BIRTHWEIGHT	
	2004–06 (millions)	2020–22[4] (millions)	2014–16 (millions)	2020–22 (millions)	2014–16 (millions)	2020–22 (millions)	2022[5] (millions)	2012 (millions)	2022 (millions)	2012 (millions)	2022 (millions)	2012 (millions)	2016 (millions)	2012 (millions)	2019 (millions)	2012[6] (millions)	2021[7] (millions)	2012 (millions)	2020 (millions)
Western Europe	**n.r.**	**n.r.**	**2.4**	**2.8**	**10.0**	**9.5**	**n.a.**	**0.3**	**0.2**	**0.5**	**0.5**	**30.8**	**33.9**	**4.1**	**4.8**	**n.a.**	**n.a.**	**0.1**	**0.1**
Austria	n.r.	n.r.	<0.1	0.1	0.5	0.4	n.a.	n.a.	n.a.	n.a.	n.a.	1.3	1.5	0.2	0.3	n.a.	n.a.	<0.1	<0.1
Belgium	n.r.	n.r.	n.a.	0.2	n.a.	0.7	n.a.	<0.1	<0.1	<0.1	<0.1	1.8	2.0	0.3	0.3	n.a.	n.a.	<0.1	<0.1
France	n.r.	n.r.	1.0	1.0	4.3	4.2	n.a.	n.a.	n.a.	n.a.	n.a.	10.0	10.9	1.2	1.5	n.a.	n.a.	0.1	0.1
Germany	n.r.	n.r.	0.8	1.2	3.3	3.2	<0.1[h]	0.1	0.1	0.1	0.1	14.0	15.3	1.7	2.0	n.a.	n.a.	<0.1	0.1
Luxembourg	n.r.	n.r.	<0.1	<0.1	<0.1	<0.1	n.a.	n.a.	n.a.	n.a.	n.a.	0.1	0.1	<0.1	0.0	n.a.	n.a.	<0.1	<0.1
Netherlands (Kingdom of the)	n.r.	n.r.	0.3	0.2	1.0	0.8	n.a.	<0.1	<0.1	<0.1	<0.1	2.5	2.8	0.4	0.5	n.a.	n.a.	<0.1	<0.1
Switzerland	n.r.	n.r.	0.1	<0.1	0.4	0.2	n.a.	n.a.	n.a.	n.a.	n.a.	1.2	1.3	0.2	0.2	n.a.	n.a.	<0.1	<0.1

NOTES:
1. Regional estimates are included when more than 50 percent of population is covered. To reduce the margin of error, estimates are presented as three-year averages.
2. FAO estimates of the number of people living in households where at least one adult has been found to be food insecure.
3. Country-level results are presented only for those countries for which estimates are based on official national data (see note b) or as provisional estimates, based on FAO data collected through the Gallup© World Poll, Geopoll or Kantar for countries whose national relevant authorities expressed no objection to their publication. Note that consent to publication does not necessarily imply validation of the estimate by the national authorities involved and that the estimate is subject to revision as soon as suitable data from official national sources are available. Global, regional and subregional aggregates are based on data collected in approximately 150 countries.
4. The estimates referring to the middle of the projected ranges for the years 2020 to 2022 were used to calculate the three-year averages.
5. For regional estimates, values correspond to the model predicted estimates for 2022. For countries, the latest data available from 2016 to 2022 are used.
6. Regional estimates are included when more than 50 percent of population is covered. For countries, the latest data available from 2005 to 2012 are used.
7. Regional estimates are included when more than 50 percent of population is covered. For countries, the latest data available from 2015 to 2021 are used.
* Wasting under five years of age regional aggregates exclude Japan.
** The Northern America wasting estimates are derived applying mixed-effect models with subregions as fixed effects; data were available only for the United States of America, preventing the estimation of standard errors (and confidence intervals). Further details on the methodology are described in De Onis, M., Blössner, M., Borghi, E., Frongillo, E.A. & Morris, R. 2004. Estimates of global prevalence of childhood underweight in 1990 and 2015. *Journal of the American Medical Association*, 291(21): 2600–2606. Model selection is based on best fit.

a. Consecutive low population coverage; interpret with caution.
b. Based on official national data.
c. For years when official national data are not available, the estimates are integrated with FAO data. See **Annex 1B** for further details.
d. Data informing the 2020 food insecurity estimates come from a national COVID-19 impact assessment survey with a reference period of 3 months; therefore, comparability with the rest of the series may be affected.
e. Based on official national data collected in 2019–2022 through EU statistics on income and living conditions.
f. Most recent input data are from before 2000, interpret with caution.
g. The UNICEF-WHO low birthweight estimates are derived through standard methodology applied to all countries to ensure comparability and are not the official statistics of the Government of India. India's most recent national official low birthweight prevalence is 18.2 percent from the 2019–2021 National Family Health Survey–5 (NFHS-5), which is used as the basis of the UNICEF-WHO global estimation model to support cross-country comparability.
h. This estimate has been adjusted because the original estimate did not cover the full age range or the data source was only representative of rural areas.
<0.1 = less than 100 000 people.
n.a. = data not available; n.r. = data not reported. In the case of the number of undernourished people, this is because the prevalence is less than 2.5 percent.

SOURCES: Data for undernourishment and food insecurity are from FAO. 2023. FAOSTAT: Suite of Food Security Indicators. In: *FAO*. [Cited 12 July 2023]. www.fao.org/faostat/en/#data/FS; data for stunting, wasting and overweight are based on UNICEF, WHO & World Bank. 2023. *UNICEF-WHO-World Bank: Joint child malnutrition estimates - Levels and trends (2023 edition)*. [Cited 27 April 2023]. https://data.unicef.org/resources/jme-report-2023, www.who.int/teams/nutrition-and-food-safety/monitoring-nutritional-status-and-food-safety-and-events/joint-child-malnutrition-estimates, https://datatopics.worldbank.org/child-malnutrition; data for obesity are based on WHO. 2020. Global Health Observatory (GHO) data repository. In: *WHO*. [Cited 28 April 2020]. https://apps.who.int/gho/data/node.main.A900A?lang=en; data on anaemia are based on WHO. 2021. Global anaemia estimates, Edition 2021. In: *WHO | Global Health Observatory (GHO) data repository*. [Cited 20 April 2023]. www.who.int/data/gho/data/themes/topics/anaemia_in_women_and_children; data for exclusive breastfeeding are based on UNICEF. 2022. Infant and young child feeding. In: *UNICEF*. [Cited 6 April 2023]. https://data.unicef.org/topic/nutrition/infant-and-young-child-feeding; and data for low birthweight are from UNICEF & WHO. 2023. *Low birthweight joint estimates 2023 edition*. [Cited 12 July 2023]. https://data.unicef.org/topic/nutrition/low-birthweight; www.who.int/teams/nutrition-and-food-safety/monitoring-nutritional-status-and-food-safety-and-events/joint-low-birthweight-estimates

TABLE A1.3 PREVALENCE OF MODERATE OR SEVERE FOOD INSECURITY, AND SEVERE FOOD INSECURITY ONLY, BY DEGREE OF URBANIZATION IN 2022

	Prevalence of severe food insecurity (%)			Prevalence of moderate or severe food insecurity (%)		
	Rural	Peri-urban	Urban	Rural	Peri-urban	Urban
WORLD	**12.8**	**11.6**	**9.4**	**33.3**	**28.8**	**26.0**
AFRICA	**25.9**	**23.1**	**20.2**	**64.5**	**60.3**	**54.2**
Northern Africa	10.1	8.2	11.9	29.9	23.4	30.0
Sub-Saharan Africa	27.6	26.3	23.0	68.1	68.4	62.5
Eastern Africa	25.7	26.7	20.5	68.3	68.9	60.0
Middle Africa	44.1	44.0	35.4	81.1	82.5	74.0
Southern Africa	15.9	13.1	10.2	31.7	28.2	21.3
Western Africa	24.5	22.1	20.2	67.2	69.3	65.3
ASIA	**10.3**	**11.0**	**8.3**	**26.5**	**25.1**	**21.8**
Central Asia	3.9	3.7	4.9	14.6	17.3	16.5
Eastern Asia	1.3	1.2	0.6	11.0	4.6	4.9
South-eastern Asia	3.1	2.4	2.1	17.8	17.1	12.9
Southern Asia	21.7	20.3	17.6	42.5	40.4	39.0
Western Asia	9.4	12.3	10.2	37.6	44.3	32.9
Western Asia and Northern Africa	*9.8*	*10.0*	*11.0*	*33.9*	*32.8*	*31.6*
LATIN AMERICA AND THE CARIBBEAN	**14.4**	**12.6**	**10.1**	**40.4**	**38.6**	**32.1**
Caribbean	28.0	21.7	20.8	57.8	48.6	47.3
Latin America	13.6	11.6	9.4	39.3	37.5	31.2
Central America	11.9	9.9	5.9	43.5	37.6	27.8
South America	14.5	12.3	10.7	37.2	37.5	32.5
OCEANIA	**2.3**	**3.4**	**2.6**	**9.6**	**13.6**	**11.1**
NORTHERN AMERICA AND EUROPE	**1.2**	**1.3**	**1.4**	**6.8**	**6.5**	**7.5**
Europe	1.4	1.7	1.6	6.7	6.6	6.7
Eastern Europe	1.3	1.6	1.4	7.1	7.3	7.0
Northern Europe	2.2	2.1	1.7	7.6	6.3	6.0
Southern Europe	1.2	1.6	1.6	7.7	7.8	7.4
Western Europe	1.5	1.7	1.8	5.0	4.9	6.1
Northern America	0.7	0.5	0.9	6.9	6.4	9.1
COUNTRY INCOME GROUP						
Low-income countries	30.0	29.0	24.5	71.0	71.5	63.7
Lower-middle-income countries	17.9	16.4	14.5	42.7	38.0	36.7
Upper-middle-income countries	5.1	3.6	4.2	19.0	11.8	14.8
High-income countries	1.5	1.7	1.8	7.7	7.4	8.2

SOURCE: FAO. 2023. FAOSTAT: Suite of Food Security Indicators. In: *FAO*. [Cited 12 July 2023]. www.fao.org/faostat/en/#data/FS

TABLE A1.4 PREVALENCE OF MODERATE OR SEVERE FOOD INSECURITY, AND SEVERE FOOD INSECURITY ONLY, AMONG ADULT MEN AND WOMEN IN 2022

	Prevalence of severe food insecurity (%)		Prevalence of moderate or severe food insecurity (%)	
	Men	Women	Men	Women
WORLD	**9.5**	**10.6**	**25.4**	**27.8**
AFRICA	**22.9**	**23.4**	**58.7**	**59.9**
Northern Africa	11.3	12.3	30.9	32.8
Sub-Saharan Africa	26.0	26.3	66.0	66.8
Eastern Africa	27.1	27.7	68.1	70.0
Middle Africa	39.6	38.4	78.0	78.4
Southern Africa	12.2	12.4	26.0	25.1
Western Africa	21.5	22.0	66.0	66.4
ASIA	**8.5**	**9.9**	**22.1**	**24.0**
Central Asia	4.4	4.6	17.3	17.4
Eastern Asia	1.0	0.9	6.8	5.6
South-eastern Asia	2.4	2.7	16.1	16.5
Southern Asia	17.8	21.0	37.3	42.7
Western Asia	8.6	11.5	30.8	38.4
Western Asia and Northern Africa	*9.8*	*11.9*	*30.9*	*35.8*
LATIN AMERICA AND THE CARIBBEAN	**11.2**	**13.8**	**32.7**	**41.8**
Caribbean	26.7	29.8	58.9	62.8
Latin America	10.0	12.7	30.8	40.3
Central America	7.3	9.3	29.5	38.7
South America	11.1	14.0	31.3	40.9
OCEANIA	**3.4**	**3.4**	**12.5**	**13.3**
NORTHERN AMERICA AND EUROPE	**1.4**	**1.7**	**6.9**	**9.2**
Europe	1.8	2.0	7.2	9.2
Eastern Europe	1.8	2.1	9.4	12.5
Northern Europe	n.a.	n.a.	n.a.	n.a.
Southern Europe	1.5	1.7	7.2	7.6
Western Europe	1.7	1.9	5.0	6.4
Northern America	0.5	0.9	6.2	9.2

SOURCE: FAO. 2023. FAOSTAT: Suite of Food Security Indicators. In: *FAO*. [Cited 12 July 2023]. www.fao.org/faostat/en/#data/FS

ANNEX 1B
METHODOLOGICAL NOTES FOR THE FOOD SECURITY AND NUTRITION INDICATORS

PREVALENCE OF UNDERNOURISHMENT

Definition: Undernourishment is defined as the condition of an individual whose habitual food consumption is insufficient to provide, on average, the amount of dietary energy required to maintain a normal, active and healthy life.

How it is reported: The indicator (denominated as "prevalence of undernourishment" [PoU]) is an estimate of the percentage of individuals in the population that are in a condition of undernourishment. National estimates are reported as three-year moving averages, to control for the low reliability of the estimates of some of the underlying parameters due to elements for which complete, reliable information is very scarce, such as the year-to-year variation in food commodity stocks, one of the components of the annual FAO Food Balance Sheets (FBS). Regional and global aggregates, on the other hand, are reported as annual estimates, as possible estimation errors are expected not to be correlated and therefore to be greatly reduced to acceptable levels when aggregating across countries.

The entire series of PoU values is revised with each new edition of this report to reflect new data and information that FAO has obtained since the release of the previous edition. As this process usually implies backward revisions of the entire PoU series, readers are advised to refrain from comparing series across different editions of this report and should always refer to the current edition of the report, including for values in past years.

Methodology: To compute an estimate of the prevalence of undernourishment in a population, the probability distribution of habitual dietary energy intake levels (expressed in kcal per person per day) for the average individual is modelled as a parametric probability density function, f(x).[1, 2] The indicator is obtained as the cumulative probability that the habitual dietary energy intake (x) is below the minimum dietary energy requirement (MDER) (i.e. the lowest limit of the range of energy requirements that is appropriate for the population's representative average individual) as in the formula below:

$$PoU = \int_{x<MDER} f(x|\theta)dx,$$

where θ is a vector of parameters that characterizes the probability density function. In the actual computations, the distribution is assumed to be lognormal and thus fully characterized by only two parameters: the mean dietary energy consumption (DEC) and its coefficient of variation (CV).

Data source: Different data sources are used to estimate the different parameters of the model.

Minimum dietary energy requirement (MDER): Human energy requirements for an individual in a given sex/age class are determined on the basis of normative requirements for basic metabolic rate per kilogram of body mass, multiplied by the ideal weights that a healthy person of that sex/age class may have, given his or her height, and then multiplied by a coefficient of physical activity level (PAL) to take into account physical activity.[bd] Given that both healthy body mass indices (BMIs) and normal PALs vary among active and healthy individuals of the same sex and age, a range of energy requirements applies to each sex and age group of the population. The MDER for the average individual in the population, which is the parameter used in the PoU formula, is obtained as the weighted average of the lower bounds of the energy requirement ranges for each sex and age group, using the shares of the population in each sex and age group as weights. Similar to the MDER, the average dietary energy requirement (ADER) (used to estimate the one component of

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bd A person is considered healthy if his or her BMI indicates neither underweight nor overweight. Human energy requirement norms per kilogram of body mass are given in FAO and WHO (2004).[3]

the CV as described below) is estimated using the average values of the PAL category "Active or moderately active lifestyle".

Information on the population structure by sex and age needed to compute the MDER is available for most countries in the world and for each year from the UN Department of Economic and Social Affairs (UN DESA) *World Population Prospects*, revised every two years. This edition of *The State of Food Security and Nutrition in the World* uses the 2022 revision of the *World Population Prospects*.[4]

Information on the median height in each sex and age group for a given country is derived from a recent demographic and health survey (DHS) or from other surveys that collect anthropometry data on children and adults. Even if such surveys do not refer to the same year for which the PoU is estimated, the impact of possible small intervening changes in median heights over the years on the MDER, and therefore on the PoU estimates, is expected to be negligible.

Dietary energy consumption (DEC): Ideally, DEC could be estimated from data on food consumption coming from nationally representative household surveys (such as Living Standards Measurement Study surveys or Household Consumption and Expenditure Surveys). However, only very few countries conduct such surveys on an annual basis. Thus, in FAO's PoU estimates for global monitoring, DEC values are estimated from the dietary energy supply (DES) reported in the FBS, compiled by FAO for most countries in the world.[5]

Since the last edition of this report, the FBS domain on FAOSTAT has been updated with new values of the series up to 2020 for all countries. In addition, at the time of closing this report, the FBS series were updated to 2021 for the following 66 countries, selected as a priority due to the high contribution they make to the total number of undernourished people in the world: Afghanistan, Angola, Argentina, Bangladesh, Benin, Bolivia (Plurinational State of), Brazil, Burkina Faso, Cambodia, Cameroon, Central African Republic, Chad, Colombia, Congo, Côte d'Ivoire, Democratic People's Republic of Korea, Democratic Republic of the Congo, Dominican Republic, Ecuador, Egypt, Ethiopia, Ghana, Guatemala, Haiti, Honduras, India, Indonesia, Iran (Islamic Republic of), Iraq, Japan, Jordan, Kenya, Liberia, Madagascar, Malawi, Mali, Mexico, Morocco, Myanmar, Nepal, Nicaragua, Niger, Nigeria, Pakistan, Papua New Guinea, Peru, Philippines, Rwanda, Saudi Arabia, Senegal, Sierra Leone, Somalia, South Africa, Sudan, Syrian Arab Republic, Tajikistan, Thailand, Togo, Uganda, Ukraine, United Republic of Tanzania, Venezuela (Bolivarian Republic of), Viet Nam, Yemen, Zambia and Zimbabwe.

The revision of the FBS series this year reflects the inclusion of new official data on food production, trade and utilization reported by these countries, as usual, but it also reflects a substantial revision of the FBS series up to 2021 given the introduction of improved nutrient conversion factors[6] and adjustments needed to consider the new population estimates provided by the UN DESA *World Population Prospects*, 2022 revision.[4]

Per capita average DES in 2021 (for countries other than the ones listed above) and in 2022 (for all countries) are nowcast on the basis of the short-run market outlook exercises conducted by FAO to inform the World Food Situation Portal[7] and used to nowcast the 2021 and 2022 values of DEC for each country, starting from the last available year of the DES in the FBS series.

Coefficient of variation (CV): The CV of habitual DEC in the population is obtained as the geometric mean of two components, labelled respectively $CV|y$ and $CV|r$:

$$CV = \sqrt{(CV|y)^2 + (CV|r)^2}$$

The first component refers to variability in the per capita consumption across households belonging to different sociodemographic strata, and therefore is referred to as the CV "due to income", while the second component captures variability across individuals, due to differences in sex, age, body mass and PAL that can be found among members of the same household. As these are the same elements that determine energy requirements, the second component is referred to as CV "due to requirements".

CV|y

When reliable data on food consumption are available from nationally representative household surveys, the CV due to income (CV|y) can be estimated directly. Since the last edition of this report, 14 new surveys from the following 10 countries have been processed to update the CV|y: Argentina (2018), Armenia (2019, 2020, 2021), Benin (2019), Bhutan (2012), Cambodia (2019), Guinea-Bissau (2019), Mexico (2012, 2020), Mongolia (2020, 2021), Peru (2019) and Uruguay (2017). That makes for a total of 129 surveys from 65 countries for which the estimate of the CV|y is based on data from national surveys.

When no suitable survey data are available, Food Insecurity Experience Scale (FIES) data collected by FAO since 2014 are used to project the changes in the CV|y from 2015 (or from the year of the last food consumption survey, if more recent) up to 2019, based on the observed trend in severe food insecurity. The projections are based on the assumption that observed changes in the extent of severe food insecurity measured with the FIES might be indicative of equivalent changes in the PoU. To the extent that such implied changes in the PoU cannot be fully explained by the "supply-side" effects of changes in average food supplies, they can be confidently attributed to unobserved changes in the CV|y that might have occurred at the same time. Analysis of historical PoU estimates reveals that, on average, and once differences in DEC, MDER and CV|r have been controlled for, differences in the CV|y explain about one-third of the differences in PoU across time and space. Based on all this, for each country for which FIES data are available, the change in the CV|y that may have occurred from 2015, or from the date of the last available survey, is therefore estimated as the change that would generate one-third of a percentage point change in the PoU for each observed percentage point change in the prevalence of severe food insecurity. For all other countries, lacking any supporting evidence, the CV|y is kept constant at the last available estimate. As in last year's report, the nowcast of the CV|y for 2020, 2021 and 2022 required special treatment to account for the effects of the COVID-19 pandemic (see **Annex 2, Section A**).

CV|r

CV|r represents the variability of the distribution of dietary energy requirements of a hypothetical average individual representative of a healthy population, which is also equal to the CV of the distribution of dietary energy intakes of a hypothetical average individual if everyone in the population were perfectly nourished. For estimation purposes, the distribution of dietary energy requirements of such a hypothetical average individual is assumed to be normal and its standard deviation can be estimated from any two known percentiles. We use the MDER and the ADER mentioned above to approximate the 1st and the 50th percentiles.[8, 9] The value of CV|r is then derived as the inverse cumulative standard normal distribution of the difference between the MDER and the ADER.

Challenges and limitations: While formally the state of being undernourished or not is a condition that applies to individuals, given the data usually available on a large scale, it is impossible to reliably identify which individuals in a certain group are actually undernourished. Through the statistical model described above, the indicator can only be computed with reference to a population or a group of individuals for which a sufficiently representative sample is available. The prevalence of undernourishment is thus an estimate of the percentage of individuals in that group that are in such condition, but it cannot be further disaggregated.

Due to the probabilistic nature of the inference and the margins of uncertainty associated with estimates of each of the parameters in the model, the precision of the PoU estimates is generally low. While it is not possible to formally compute margins of error around PoU estimates, they are expected to exceed 5 percent in most cases. For this reason, FAO does not consider PoU estimates that result lower than 2.5 percent as sufficiently reliable to be reported.

It is important to note that the ranges presented for the values of the PoU in 2020, 2021 and 2022 should not be interpreted as statistical confidence intervals. Rather, they represent different scenarios used to nowcast the values of CV|y from 2020 to 2022.

Recommended readings:

FAO. 1996. Methodology for assessing food inadequacy in developing countries. In: FAO. *The Sixth World Food Survey*, pp. 114–143. Rome.
FAO. 2003. *Proceedings: Measurement and Assessment of Food Deprivation and Undernutrition: International Scientific Symposium*. Rome.
FAO. 2014. *Advances in hunger measurement: traditional FAO methods and recent innovations*. FAO Statistics Division Working Paper, No. 14–04. Rome.
Naiken, L. 2002. *Keynote paper: FAO methodology for estimating the prevalence of undernourishment*. Paper presented at the Measurement and Assessment of Food Deprivation and Undernutrition International Scientific Symposium, Rome, 26–28 June 2002. Rome, FAO.
Wanner, N., Cafiero, C., Troubat, N. & Conforti, P. 2014. *Refinements to the FAO methodology for estimating the prevalence of undernourishment indicator.* Rome, FAO.

PREVALENCE OF FOOD INSECURITY AS MEASURED BY THE FOOD INSECURITY EXPERIENCE SCALE (FIES)

Definition: Food insecurity as measured by this indicator refers to limited **access to food,** at the level of individuals or households, due to lack of money or other resources. The severity of food insecurity is measured using data collected with the Food Insecurity Experience Scale Survey Module (FIES-SM), a set of eight questions asking respondents to self-report conditions and experiences typically associated with limited access to food. For purposes of annual SDG monitoring, the questions are asked with reference to the 12 months preceding the survey.

Using sophisticated statistical techniques based on the Rasch measurement model, the information obtained in an FIES-SM survey is validated for internal consistency and converted into a quantitative measure along a scale of severity, ranging from low to high. Based on their responses to the survey items, the individuals or households interviewed in a nationally representative survey of the population are assigned a probability of being in one of three classes: i) food secure or only marginally insecure; ii) moderately food insecure; and iii) severely food insecure, as defined by two globally set thresholds. Based on FIES data collected over three years from 2014 to 2016, FAO has established the FIES reference scale, which is used as the global standard for experience-based food-insecurity measures, and to set the two reference thresholds of severity.

SDG Indicator 2.1.2 is obtained as the cumulated probability to be in the two classes of moderate and severe food insecurity. A separate indicator (FI_{sev}) is computed by considering only the severe food insecurity class.

How it is reported: In this report, FAO provides estimates of food insecurity at two different levels of severity: moderate or severe food insecurity ($FI_{mod+sev}$), and severe food insecurity (FI_{sev}). For each of these two levels, two estimates are reported:

- the **prevalence (percent) of individuals** in the population living in households where at least one adult was found to be food insecure; and
- the estimated **number of individuals** in the population living in households where at least one adult was found to be food insecure.

Data source: Since 2014, the eight-question FIES-SM has been applied in nationally representative samples of the adult population (defined as aged 15 or older) in more than 140 countries included in the Gallup© World Poll (GWP), covering more than 90 percent of the world population. In 2022, interviews were conducted in both telephone and face-to-face modality. Telephone interviews were maintained in some countries already covered with this modality in 2020 given the high risk of community transmission from conducting face-to-face data collection during the COVID-19 pandemic. By evaluating dual frame coverage (i.e. the proportion of the adult population that is covered by a combination of landline and mobile phones), countries with a minimum of 70 percent coverage were included as part of the 2020 GWP through computer-assisted telephone interviews.

Gallup© traditionally uses telephone surveys in Northern America, Western Europe, some parts of Asia, and Cooperation Council for the Arab States of the Gulf countries. In Central and Eastern Europe, much of Latin America, and nearly all of Asia, the Near East and Africa, an area frame design is used for face-to-face interviewing.

In most countries, samples include about 1 000 individuals, with larger samples of 3 000 individuals in India, 3 500 in China (mainland) and 2 000 in the Russian Federation. No data were collected in China (mainland) in 2022.

In addition to the GWP, in 2022 FAO collected data in seven countries through Geopoll® and Kantar® with the objective of filling data gaps on access to food.[72] The countries covered were: Cameroon, Democratic Republic of the Congo, Guinea-Bissau, Haiti, Liberia, Rwanda and Zambia.

National government survey data were used to calculate the food insecurity prevalence estimates for 60 countries, covering more than a quarter of the world population, by applying FAO's statistical methods to adjust national results to the same global reference standard. The countries are: Afghanistan, Angola, Armenia, Belize, Benin, Botswana, Burkina Faso, Cabo Verde, Canada, Chad, Chile, Costa Rica, Côte d'Ivoire, Dominican Republic, Ecuador, Fiji, Ghana, Greece, Grenada, Guinea-Bissau, Honduras, Indonesia, Israel, Kazakhstan, Kenya, Kiribati, Kyrgyzstan, Lesotho, Malawi, Mexico, Namibia, Niger, Nigeria, Pakistan, Palestine, Paraguay, Philippines, Republic of Korea, Russian Federation, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Samoa, Senegal, Seychelles, Sierra Leone, South Africa, South Sudan, Sri Lanka, Sudan, Togo, Tonga, Uganda, United Arab Emirates, United Republic of Tanzania, United States of America, Uruguay, Vanuatu, Viet Nam and Zambia. Countries are considered for the year or years when national data are available. For the remaining years, the following strategy was followed:

- When more than one year of national data is available, the missing years are linearly interpolated.
- If only one year of data is available, missing years are informed as follows:
  - using FAO data if considered compatible with the national surveys;
  - imputed using the trend suggested by FAO data if national data are not compatible;
  - imputed using the trend of the subregion if no other reliable and timely information is available; or
  - considered constant to the level of the national survey if the subregion cannot be computed or the trend of other surveys or the subregion is not applicable to the country-specific situation considering evidence found in support of the trend (for instance, evolution of poverty, extreme poverty, employment and food inflation, among others); this applies also to countries where the prevalence of food insecurity is very low (below 3 percent at the severe level) or very high (above 85 percent at the moderate or severe level).

Given the heterogeneity of the survey sources and the small sample size of some of the FAO surveys, new data can occasionally predict a notably large increase or decrease from one year to the next. In such situations, the protocol is to look for external information for the country (data and/or reports, possibly in consultation with country experts like FAO country or regional officers) to explore whether big shocks or interventions have occurred. If the trend can be justified by supporting evidence, but seems excessive, the trend is kept but smoothed (for example, using the three-year average). Otherwise, the same protocol used for missing years is applied (i.e. keeping the level constant or applying the subregional trend). In 2022, no FIES data were collected in China (mainland), therefore the trend was kept constant.

Methodology: The data were validated and used to construct a scale of food-insecurity severity using the Rasch model, which postulates that the probability of observing an affirmative answer by respondent i to question j is a logistic function of the distance, on an underlying scale of severity, between the position of the respondent, a_i, and that of the item, b_j.

$$Prob(X_{i,j} = \text{Yes}) = \frac{\exp(a_i - b_j)}{1 + \exp(a_i - b_j)}$$

By applying the Rasch model to the FIES data, it is possible to estimate the cross-country comparable probability of being food insecure ($p_{i,L}$) at each level of severity of food insecurity L (moderate or severe, or severe only), for each respondent i, with $0 < p_{i,L} < 1$.

The prevalence of food insecurity at each level of severity (FI_L) in the population is computed as the weighted sum of the probability of being food insecure for all respondents (i) in a sample:

$$FI_L = \sum p_{i,L} w_i$$

where w_i are post-stratification sampling weights that indicate the proportion of individuals or households in the national population represented by each record in the sample.

As only individuals aged 15 years or more are sampled in the GWP, the prevalence estimates directly produced from these data refer to the population aged 15 years and older. To arrive at the **prevalence and number of individuals (of all ages) in the population**, an estimate is required of the number of people living in households where at least one adult is estimated to be food insecure. This involves a multistep procedure detailed in Annex II of the *Voices of the Hungry Technical Report* (see link in the "Recommended readings" section, below).

Regional and global aggregates of food insecurity at moderate or severe, and severe levels, $FI_{L,r}$, are computed as:

$$FI_{L,r} = \frac{\sum_c FI_{L,c} \times N_c}{\sum_c N_c}$$

where r indicates the region, $FI_{L,c}$ is the value of FI at level L estimated for country c in the region, and N_c is the corresponding population size. When no estimate of FI_L is available for a country, it is assumed to be equal to the population-weighted average of the estimated values of the remaining countries in the same subregion. A regional aggregate is produced only if the countries for which an estimate is available cover at least 50 percent of the region's population.

Universal thresholds are defined on the FIES global standard scale (a set of item parameter values based on results from all countries covered by the GWP in 2014–2016) and converted into corresponding values on local scales. The process of calibrating each country's scale against the FIES global standard can be referred to as **equating** and permits the production of **internationally comparable** measures of food insecurity severity for individual respondents, as well as comparable national prevalence rates.

The problem stems from the fact that, when defined as a *latent* trait, the severity of food insecurity has no absolute reference against which it could be evaluated. The Rasch model enables identification of the relative position that the various items occupy on a scale that is denominated in logit units but whose "zero" is arbitrarily set, usually to correspond to the mean estimated severity. This implies that the zero of the scale changes in each application. To produce comparable measures over time and across different populations requires establishing a common scale to use as a reference and finding the formula needed to convert measures across different scales. As is the case for converting measures of temperature across difference measuring scales (such as Celsius and Fahrenheit), this requires the identification of a number of "anchoring" points. In the FIES methodology, these anchoring points are the severity levels associated with the items whose *relative* position on the scale of severity can be considered equal to that of the corresponding items on the global reference scale. The "mapping" of the measures from one scale to the other is then obtained by finding the formula that equates the mean and the standard deviation (SD) of the common items' severity levels.

Challenges and limitations: When food-insecurity prevalence estimates are based on FIES data collected in the GWP, with national sample sizes of about 1 000 individuals in most countries, confidence intervals rarely exceed 20 percent of the measured prevalence (that is, prevalence rates of 50 percent would have margins of error of up to plus or minus 5 percent). Confidence intervals are likely to be much smaller, however, when national prevalence rates are estimated using larger samples and for estimates referring to aggregates of several countries. To reduce the impact of year-to-year sampling variability, country-level estimates are presented as three-year averages, computed as averages of all available years in the considered triennia.

Recommended readings:

FAO. 2016. *Methods for estimating comparable rates of food insecurity experienced by adults throughout the world*. Rome. www.fao.org/3/a-i4830e.pdf
FAO. 2018. Voices of the Hungry. In: *FAO*. [Cited 28 April 2020]. www.fao.org/in-action/voices-of-the-hungry

Gallup. 2020. Gallup Keeps Listening to the World Amid the Pandemic. In: *Gallup*. [Cited 25 May 2021]. https://news.gallup.com/opinion/gallup/316016/gallup-keeps-listening-world-amid-pandemic.aspx

STUNTING, WASTING AND OVERWEIGHT IN CHILDREN UNDER FIVE YEARS OF AGE

Definition of stunting (children under five years of age): Height/length (cm) for age (months) <–2 SD of the WHO Child Growth Standards median. Low height-for-age is an indicator that reflects the cumulative effects of undernutrition and infections since and even before birth. It may be the result of long-term nutritional deprivation, recurrent infections and lack of water and sanitation infrastructures.

How it is reported: The percentage of children aged 0 to 59 months who are below –2 SD from the median height-for-age of the WHO Child Growth Standards.

Definition of wasting: Weight (kg) for height/length (cm) <–2 SD of the WHO Child Growth Standards median. Low weight-for-height is an indicator of acute weight loss or a failure to gain weight and can be a consequence of insufficient food intake and/or an incidence of infectious diseases, especially diarrhoea.

How it is reported: The percentage of children aged 0 to 59 months who are below –2 SD from the median weight-for-height of the WHO Child Growth Standards.

Definition of overweight: Weight (kg) for height/length (cm) >+2 SD of the WHO Child Growth Standards median. This indicator reflects excessive weight gain for height generally due to energy intakes exceeding children's energy requirements.

How it is reported: The percentage of children aged 0 to 59 months who are above +2 SD from the median weight-for-height of the WHO Child Growth Standards.

Data source: UNICEF, WHO & World Bank. 2023. *UNICEF-WHO-World Bank: Joint child malnutrition estimates – Levels and trends (2023 edition).* [Cited 27 April 2023]. https://data.unicef.org/resources/jme-report-2023, www.who.int/teams/nutrition-and-food-safety/monitoring-nutritional-status-and-food-safety-and-events/joint-child-mal nutrition-estimates, https://datatopics.worldbank.org/child-malnutrition

Methodology:

Country-level estimates

The UNICEF/WHO-World Bank Group Joint Child Malnutrition Estimates (JME) country dataset

The UNICEF/WHO-World Bank Group JME dataset of country estimates requires the collection of national data sources that contain information on child malnutrition – specifically, data on the height, weight and age of children under five years, which can be used to generate national-level prevalence estimates for stunting, wasting and overweight. These national-level data sources mainly comprise household surveys (e.g. Multiple Indicator Cluster Surveys [MICS], DHS). Some administrative data sources (e.g. from surveillance systems) are also included where population coverage is high. As of the latest review closure on 28 February 2023, the primary source dataset contained 1 100 data sources from 162 countries and territories, with nearly 80 percent of children living in countries with at least one data point within the past five years on stunting, wasting and overweight. This suggests that the global estimates are highly representative of the majority of children across the globe for the most recent period. The dataset contains the point estimate (and where available, the standard error), the 95 percent confidence bounds and the unweighted sample size. Where microdata are available, the JME uses estimates that have been recalculated to adhere to the global standard definition. Where microdata are not available, reported estimates are used, except in cases where adjustments are required to standardize for: i) use of an alternate growth reference from the 2006 WHO Growth Standards; ii) age ranges that do not include the full 0–59-month age group; and iii) data sources that were only nationally representative for populations residing in rural areas. Further details related to data source compilation, re-analysis of microdata, and data source review are described elsewhere.[10]

The JME country dataset serves different purposes for different indicators. For wasting, the JME country dataset serves as the country estimates themselves (i.e. the wasting prevalence in the JME country dataset from a household survey for a country in a given year is the wasting prevalence reported for that country in that year). For stunting and overweight, the JME country dataset is used to generate country-modelled estimates which serve as the official JME estimates (i.e. the stunting prevalence from a household survey for a given country in a given year is not reported as the prevalence for that country in that year; rather, it feeds into the modelled estimates described in the next section below).

Country-level model for stunting and overweight estimates

The technical details of the statistical models are provided elsewhere.[10] Briefly, for both stunting and overweight, the prevalence was modelled at logit (log-odds) scale using a penalized longitudinal mixed model with a heterogeneous error term. The quality of the models was quantified with model-fit criteria that balance the complexity of the model with the closeness of the fit to the observed data. The proposed method has important characteristics, including non-linear time trends, regional trends, country-specific trends, covariate data and a heterogeneous error term. All countries with data contribute to estimates of the overall time trend and the impact of covariate data on the prevalence. For overweight, the covariate data consisted of linear and quadratic sociodemographic index (SDI),[be] and data source type. The same covariates were used for stunting, plus an additional covariate of the average health system access over the previous five years.

Annual country-level modelled estimates from 2000 to 2022 on stunting and overweight were disseminated by the JME in 2023 for 160 countries with at least one data point (e.g. from a household survey) included in the JME country dataset described above. Modelled country estimates were also produced for an additional 45 countries, used solely for generation of regional and global aggregates. Modelled estimates for these 45 countries are not shown because they did not have any household surveys in the JME country dataset or because the modelled estimates remained pending final review at the time of publication. The results for the 205 countries can be used to calculate estimates and uncertainty intervals for any group of countries aggregated. The uncertainty intervals are important in monitoring trends, especially for countries with sparse data and where primary data sources present large primary data source sampling errors. When only sparse data are available in the most recent period, the inclusion of a survey can affect a substantial change in the predicted trajectory. For this reason, uncertainty intervals are needed to enhance trend interpretability in terms of the caution level employed. The uncertainty intervals for the new JME method have been tested and validated with various data types.

Regional and global estimates

Regional and global wasting estimates are only presented for the most recent year, 2022, unlike stunting and overweight estimates, for which an annual time series is available from 2000 to 2022. This is because the JME are based on national-level country prevalence data, which come from cross-sectional surveys (i.e. a snapshot at one point in time) that are collected infrequently (every three to five years) in most countries. Since stunting and overweight are relatively stable over the course of a calendar year, it is reasonable to track changes in these two conditions over time with these data, whereas wasting is an acute condition that can change frequently and rapidly. An individual child can be affected by wasting more than once in a calendar year (i.e. can recover but then become wasted again in the same year), and the risk of wasting in many contexts can be driven by seasonal variations, which can result in seasonal spikes in prevalence. For example, wasting prevalence, in some contexts, may double between the post-harvest season (often associated with higher food availability and weather patterns that are less likely to cause disease) and the pre-harvest season (often associated with food shortages, heavy rains and related diseases that can affect nutrition status). Given that country surveys can be collected during any season, the prevalence

be SDI is a summary measure that identifies where countries or other geographic areas sit on the spectrum of development. Expressed on a scale of 0 to 1, SDI is a composite average of the rankings of the income per capita, average educational attainment, and fertility rates of all areas in the Global Burden of Disease study.

estimate from any survey may be at a high or a low; or it may fall somewhere in between if data collection spanned across several seasons. Thus, the prevalence of wasting captures the situation of wasting at a specific point in time and not over an entire year. Variations in seasons across surveys make it difficult to draw inferences on trends. The lack of methods to account for seasonality and incident cases of wasting are the main reasons why the JME does not present annual trends for this form of malnutrition.

Generation of regional and global estimates
Different methods were applied to generate regional and global estimates for stunting and overweight compared to wasting, as described below. In short, results from the new country-level model were used to generate the regional and global estimates for stunting and overweight, while the JME subregional multilevel model was used to generate the global and regional estimates for wasting.

Stunting and overweight
Global and regional estimates for all years from 2000 to 2022 were derived as the respective country averages weighted by the countries' under-five population from the UN DESA *World Population Prospects*, 2022 revision,[4] using model-based estimates for 204 countries. This includes 155 countries with national data sources (e.g. household surveys) included in the JME country dataset described above. It also includes 49 countries with modelled estimates generated for development of regional and global aggregates but for which country modelled estimates are not shown, either because they did not have any household surveys in the JME country dataset or because the modelled estimates remained pending final review at the time of publication. Confidence intervals were generated based on bootstrapping methodology.

Wasting
The wasting prevalence data from national data sources described in the above section about the JME country dataset were used to generate the regional and global estimates for 2020 using the JME subregional multilevel model, applying population weights for children under five years of age from the UN DESA *World Population Prospects*, 2022 revision.

Challenges and limitations: The recommended periodicity for countries to report on stunting, overweight and wasting is every three to five years; however, for some countries, data are available less frequently. While every effort has been made to maximize the comparability of statistics across countries and over time, country data may differ in terms of data collection methods, population coverage and estimation methods used. Survey estimates come with levels of uncertainty due to both sampling errors and non-sampling errors (technical measurement errors, recording errors, etc.). Neither of the two sources of error has been fully taken into account for deriving estimates at the country or regional and global levels.

For the prevalence of wasting, as surveys are generally carried out during a specific period of the year, the estimates can be affected by seasonality. Seasonal factors related to wasting include food availability (e.g. pre-harvest periods) and disease (rainy season and diarrhoea, malaria, etc.), while natural disasters and conflicts can also show real shifts in trends that would need to be treated differently from a seasonal variation. Hence, country-year estimates for wasting may not necessarily be comparable over time. Consequently, only estimates from the most recent year (2022) are provided.

Recommended readings:
de Onis, M., Blössner, M., Borghi, E., Morris, R. & Frongillo, E.A. 2004. Methodology for estimating regional and global trends of child malnutrition. *International Journal of Epidemiology*, 33(6): 1260–1270. https://doi.org/10.1093/ije/dyh202
GBD 2019 Risk Factors Collaborators. 2020. Global burden of 87 risk factors in 204 countries and territories, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. *The Lancet*, 396(10258): 1223–1249. https://doi.org/10.1016/s0140-6736(20)30752-2
UNICEF, WHO & World Bank. 2021. *Technical notes from the background document for country consultations on the 2021 edition of the UNICEF-WHO-World Bank Joint Malnutrition Estimates. SDG Indicators 2.2.1 on stunting, 2.2.2a on wasting and 2.2.2b on overweight*. New York, USA, UNICEF. data.unicef.org/resources/jme-2021-country-consultations

UNICEF, WHO & World Bank. 2023. *UNICEF-WHO-World Bank: Joint child malnutrition estimates – Levels and trends (2023 edition).* [Cited 27 April 2023]. https://data.unicef.org/resources/jme-report-2023, www.who.int/teams/nutrition-and-food-safety/monitoring-nutritional-status-and-food-safety-and-events/joint-child-malnutrition-estimates, https://datatopics.worldbank.org/child-malnutrition
WHO. 2014. *Comprehensive Implementation Plan on maternal, infant and young child nutrition*. Geneva, Switzerland. www.who.int/nutrition/publications/CIP_document/en
WHO. 2019. *Nutrition Landscape Information System (NLIS) country profile indicators: interpretation guide*. Geneva, Switzerland. www.who.int/publications/i/item/9789241516952

EXCLUSIVE BREASTFEEDING

Definition: Exclusive breastfeeding for infants under six months of age is defined as receiving only breastmilk and no additional food or drink, not even water. Exclusive breastfeeding is a cornerstone of child survival and is the best feeding option for newborns, as breastmilk shapes the baby's microbiome, strengthens the immune system and reduces the risk of developing chronic diseases.

Breastfeeding also benefits mothers by preventing postpartum haemorrhage and promoting uterine involution, decreasing risk of iron-deficiency anaemia, reducing the risk of various types of cancer and providing psychological benefits.

How it is reported: Percentage of infants aged 0 to 5 months who are fed exclusively on breastmilk with no additional food or drink, not even water, in the 24 hours preceding the survey.[11]

Data source: UNICEF. 2022. Infant and young child feeding. In: *UNICEF*. [Cited 6 April 2023]. data.unicef.org/topic/nutrition/infant-and-young-child-feeding

Methodology:

$$\frac{\textit{Infants 0–5 months of age who received only breastmilk during the previous day}}{\textit{Infants 0–5 months of age}}$$

This indicator includes breastfeeding by a wet nurse and feeding expressed breastmilk.

The indicator is based on a recall of the previous day's feeding to a cross-section of infants 0 to 5 months of age.

In 2012, the regional and global exclusive breastfeeding estimates were generated using the most recent estimate available for each country between 2005 and 2012. Similarly, 2020 estimates were developed using the most recent estimate available for each country between 2014 and 2020. Global and regional estimates were calculated as weighted averages of the prevalence of exclusive breastfeeding in each country, using the total number of infants aged 0 to 5 months from the *World Population Prospects*, 2022 revision[4] (2012 for the baseline and 2021 for the current) as weights. Estimates are presented only where the available data are representative of at least 50 percent of corresponding regions' total number of births, unless otherwise noted.

Challenges and limitations: While a high proportion of countries collect data for exclusive breastfeeding, data are lacking in high-income countries in particular. The recommended periodicity of reporting on exclusive breastfeeding is every three to five years. However, for some countries, data are reported less frequently, meaning changes in feeding patterns are often not detected for several years after the change occurs.

Regional and global averages may be affected depending on which countries had data available for the periods considered in this report.

Using the previous day's feeding as a basis may cause the proportion of exclusively breastfed infants to be overestimated, as some infants who may have been given other liquids or foods irregularly may not have received these on the day before the survey.

Recommended readings:
UNICEF. 2022. Infant and young child feeding: exclusive breastfeeding. In: *UNICEF*. [Cited 6 April 2023]. data.unicef.org/topic/nutrition/infant-and-young-child-feeding
WHO. 2014. *Comprehensive Implementation Plan on maternal, infant and young child nutrition*. Geneva, Switzerland. www.who.int/nutrition/publications/CIP_document/en

WHO. 2019. *Nutrition Landscape Information System (NLIS) country profile indicators: interpretation guide*. Geneva, Switzerland. www.who.int/publications/i/item/9789241516952

WHO & UNICEF. 2021. Indicators for assessing infant and young child feeding practices: definitions and measurement methods. https://apps.who.int/iris/rest/bitstreams/1341846/retrieve

LOW BIRTHWEIGHT

Definition: Low birthweight is defined as a weight at birth of less than 2 500 g (less than 5.51 lbs), regardless of gestational age. A newborn's weight at birth is an important marker of maternal and foetal health and nutrition.[12]

How it is reported: The percentage of newborns weighing less than 2 500 g (less than 5.51 lbs) at birth.

Data source: UNICEF & WHO. 2023. *Low birthweight joint estimates 2023 edition*. [Cited 12 July 2023]. https://data.unicef.org/topic/nutrition/low-birthweight; www.who.int/teams/nutrition-and-food-safety/monitoring-nutritional-status-and-food-safety-and-events/joint-low-birthweight-estimates

Methodology: Nationally representative estimates of low birthweight prevalence can be derived from a range of sources, broadly defined as national administrative data or representative household surveys. National administrative data are those coming from national systems including civil registration and vital statistics systems, national health management information systems and birth registries. National household surveys which contain information about birthweight as well as key related indicators including maternal perception of size at birth (MICS, DHS) are also an important source of data on low birthweight especially in contexts where many births are unweighed and/or data heaping is a problem. Prior to entry into the country dataset, country data are reviewed for coverage and quality and adjusted where the source is a household survey. To be included, available birthweights from administrative data need to cover at least 80 percent of the UN DESA *World Population Prospects* estimated live births for that year. To be included in the dataset, survey data need to have:

i. a birthweight in the dataset for a minimum of 30 percent of the sample;
ii. a minimum of 200 birthweights in the dataset;
iii. no indication of severe data heaping – this means that: a) ≤55 percent of all birthweights can fall on the three most frequent birthweights (i.e. if 3 000 g, 3 500 g and 2 500 g were the three most frequent birthweights, when added together, they would have to make up ≤55 percent of all birthweights in the dataset); b) ≤10 percent of all birthweights are ≥4 500 g; and c) ≤5 percent of birthweights fall on tail ends of 500 g and 5 000 g; and
iv. undergone an adjustment for missing birthweights and heaping.[12]

Estimates of low birthweight prevalence at the national level were predicted from a Bayesian multilevel-regression model.[13] The model is fit on the logit (log-odds) scale to ensure that proportions are bounded between zero and one, and then back-transformed and multiplied by 100 to obtain prevalence estimates.

Hierarchical random country-specific intercepts (countries within regions within global) accounted for the correlation within and between the regions. The six SDG regions were adapted and used in the modelling. Penalized splines were used as temporal smoothing across the time series 26–28, meaning that country-level non-linear time trends were captured without random variation affecting the trend. Country-level covariates were also included in the modelling. The final covariates included in the model were: gross national income per person purchasing power parity (constant 2017 international dollars), the prevalence of underweight among female adults, the adult female literacy rate, the modern contraception prevalence rate and the percentage of urban population.

Alongside this, data quality categories (Table A1.5) were used to apply bias shifts and additional variance terms. The bias shift was applied to administrative data from lower quality categories, which approximated the expected bias from heaping that was already accounted for in the survey adjustment. The additional variance was based on 1) the data quality category of the administrative data, and 2) the weighting between administrative and survey data if the country had both.

TABLE A1.5 DATA QUALITY CATEGORIES FOR ADMINISTRATIVE SOURCES

DQC	Criteria 1 – Coverage compared to *World Population Prospects* estimated live births	Criteria 2 – Data source type	Criteria 3 – Denominator used to calculate low birthweight rate	Criteria 4 – Omission of babies around threshold of viability	Criteria 5 – Whether country has only admin data or admin data and surveys
A*	≥90% recorded birthweight coverage** and ≥90% facility births***	Civil registration and vital statistics or medical birth registry	Live births with birthweight for all country-years, and not reported prevalence of low birthweight	<1 000/<2 500g ≥4%* or if <1 000/<2 500g is unavailable, <1 500/<2 500g ≥12.5%***	–
B1	Not meeting criteria for category A	Civil registration and vital statistics or medical birth registry	Denominator is live births only or total births, and not reported prevalence of low birthweight	Not applied as relevant data not available for all years for these countries	Admin data + survey
B2					Admin data only
C1	Not meeting criteria for category A	Any denominator OR reported low birthweight only (i.e. no denominator)	Any denominator	Not applied as relevant data not available for all years for these countries	Admin data + survey
C2					Admin data only

NOTES: DQC – data quality category. * France included as an exception. ** Recorded birthweight coverage was calculated by dividing the number of live births with a birthweight in the administrative data source by the *World Population Prospects 2022* edition estimated live births. *** Across ≥80 percent of the time series 2000–2019 (i.e. ≥16 country-years).
SOURCE: Okwaraji, Y.B., Krasevec, J., Bradley, E., Conkle, J., Stevens, G.A., Gatica-Domínguez, G., Ohuma, E.O. *et al.* 2023. National, regional, and global estimates of low birthweight in 2020, with trends from 2000: a systematic analysis. *The Lancet* (in press).

Standard diagnostic checks were used to assess for convergence and the sampling efficiency. Cross-validation was implemented, averaging over 200 random splits of 20 percent test data, 80 percent training data. Sensitivity analyses were undertaken including checks on covariates, bias method, temporal smoothing and non-informative priors. All models were fitted in R statistical software and the R packages "rjags" and "R2jags".

The model included all 2 040 country-years of data meeting the inclusion criteria and generated annual estimates from 2000 to 2020 with 95 percent credible intervals for 195 countries and areas.[bf] Only estimates for countries and areas with data are reported. For the 37 (out of 195) countries with no data or data not meeting inclusion criteria, the final model was used to predict estimates of the prevalence of low birthweight based on country intercepts and time trends estimated from the region- and country-level covariates for all country-years. Regional and global aggregates were then produced using estimates from all 195 countries and areas.

Challenges and limitations: A major limitation of monitoring low birthweight globally is the lack of birthweight data for many of the world's children. Here there is a notable bias, with children born to poorer, less educated, rural mothers being less likely to have a recorded birthweight when compared to their richer, urban counterparts with more highly educated mothers.[13] As the characteristics of the unweighed are risk factors for having a low birthweight, estimates that do not well represent these children may be lower than the true value. Furthermore, poor quality of available data with regard to excessive heaping on multiples of 500 g or 100 g exists in the majority of available data from LMICs[13] and can further bias low birthweight estimates. The methods applied to adjust for missing birthweights and heaping for survey estimates in the current database[13] are meant to address the problem. A recent validation study found that the adjusted low birthweight estimate was similar to the true prevalence while the unadjusted value didn't capture even half of the low-weight births in one population.[14]

The administrative input data also have limitations, including a lack of individual-level data, and limited information on heaping and missing birthweights. The data quality categorization (Table A1.5) attempted to account for this by grouping countries according to data quality indicators, but more robust methods need to be developed to adjust for administrative data quality differences at an individual country level as opposed to having a single bias adjustment for a group of countries. Furthermore, for surveys, the standard errors are larger than those developed for the administrative input data due to the nature of sampling in household surveys. These differences in standard errors between administrative and survey data may affect the model outcome artificially.

The SDG geographical groupings used in the modelling may not be appropriate for epidemiological or economic regional outliers. In all, the estimates for 37 (of 195) countries without input data may have been affected. For example,

bf While the world comprises 203 countries in the FAO regional grouping, eight countries did not have low birthweight input data or covariate data. It was therefore not possible to generate any estimates for these countries, and they are not included in the regional and global estimates.

the predicted prevalence for Haiti, a country without input data meeting inclusion criteria, was based on country-level covariates as well as country intercepts and time trends from the Latin America and the Caribbean region which may not be appropriate for this particular country.

In addition, the confidence limits of the regional and global estimates may be artificially small given that about half of the modelled countries had a country-specific effect generated at random for each bootstrap prediction, some of which were positive and others negative, making the relative uncertainty at the regional and global level tend to be less than that at the individual country level.

Recommended readings:

Blanc, A. & Wardlaw, T. 2005. Monitoring low birth weight: An evaluation of international estimates and an updated estimation procedure. *Bulletin World Health Organization*, 83(3): 178–185. www.ncbi.nlm.nih.gov/pmc/articles/PMC2624216

Blencowe, H., Krasevec, J., de Onis, M., Black, R.E., An, X., Stevens, G.A., Borghi, E., Hayashi, C., Estevez, D., Cegolon, L., Shiekh, S., Ponce Hardy, V., Lawn, J.E. & Cousens, S. 2019. National, regional, and worldwide estimates of low birthweight in 2015, with trends from 2000: a systematic analysis. *The Lancet Global Health*, 7(7): e849–e860. https://doi.org/10.1016/S2214-109X(18)30565-5

Chang, K.T., Carter, E.D., Mullany, L.C., Khatry, S.K., Cousens, S., An, X., Krasevec, J., LeClerq, S.C., Munos, M.K. & Katz, J. 2022. Validation of MINORMIX approach for estimation of low birthweight prevalence using a rural Nepal dataset. *The Journal of Nutrition*, 152(3): 872–879. https://doi.org/10.1093/jn/nxab417

Okwaraji, Y.B., Krasevec, J., Bradley, E., Conkle, J., Stevens, G.A., Gatica-Domínguez, G., Ohuma, E.O. *et al*. 2023. National, regional, and global estimates of low birthweight in 2020, with trends from 2000: a systematic analysis. *The Lancet* (in press).

ADULT OBESITY

Definition: BMI ≥30.0 kg/m². The body mass index (BMI) is the weight-to-height ratio commonly used to classify the nutritional status of adults. It is calculated as the body weight in kilograms divided by the square of the body height in metres (kg/m²). Obesity includes individuals with BMI equal to or higher than 30 kg/m².

How it is reported: Percentage of the population over 18 years of age with BMI ≥30.0 kg/m² standardized by age and weighted by sex.[15]

Data source: WHO. 2020. Global Health Observatory (GHO) data repository. In: *WHO*. [Cited 28 April 2020]. apps.who.int/gho/data/node.main.A900A?lang=en (1 698 population-based studies with more than 19.2 million participants aged 18 years or older, measured in 186 countries).[16]

Methodology: A Bayesian hierarchical model was applied to selected population-based studies that had measured height and weight in adults aged 18 years and older to estimate trends from 1975 to 2014 in mean BMI and in the prevalence of BMI categories (underweight, overweight and obesity). The model incorporated non-linear time trends and age patterns, national versus subnational and community representativeness, and whether data covered both rural and urban areas versus only one of them. The model also included covariates that help predict BMI, including national income, proportion of the population living in urban areas, mean number of years of education, and summary measures of availability of different food types for human consumption.

Challenges and limitations: Some countries had few data sources, and only 42 percent of included sources reported data for people older than 70 years.

Recommended readings:

NCD-RisC (NCD Risk Factor Collaboration). 2016. Trends in adult body-mass index in 200 countries from 1975 to 2014: a pooled analysis of 1698 population-based measurement studies with 19.2 million participants. *The Lancet*, 387(10026): 1377–1396. https://doi.org/10.1016/S0140-6736(16)30054-X

WHO. 2019. *Nutrition Landscape Information System (NLIS) country profile indicators: interpretation guide*. Geneva, Switzerland. www.who.int/publications/i/item/9789241516952

ANAEMIA IN WOMEN AGED 15 TO 49 YEARS

Definition: Percentage of women aged 15 to 49 years with a haemoglobin concentration of less than 120 g/L for non-pregnant women and lactating women, and less than 110 g/L for pregnant women, adjusted for altitude and smoking.

How it is reported: Percentage of women aged 15 to 49 years with a haemoglobin concentration below 110 g/L for pregnant women and below 120 g/L for non-pregnant women.

Data source:
WHO. 2021. Global anaemia estimates, edition 2021. In: *WHO | Global Health Observatory (GHO) data repository*. [Cited 20 April 2023]. www.who.int/data/gho/data/themes/topics/anaemia_in_women_and_children

Methodology: The 2021 edition of anaemia estimates in women aged 15 to 49 years, by pregnancy status, included data sources from the Micronutrients Database, part of the WHO Vitamin and Mineral Nutrition Information System and from anonymized individual-level data which span from 1995 to 2020. Adjustments of data on blood haemoglobin concentrations for altitude and smoking were carried out whenever possible. Biologically implausible haemoglobin values (<25 g/L or >200 g/L) were excluded. A Bayesian hierarchical mixture model was used to estimate haemoglobin distributions and systematically address missing data, non-linear time trends, and representativeness of data sources. Briefly, the model calculates estimates for each country and year, informed by data from that country and year themselves, if available, and by data from other years in the same country and in other countries with data for similar time periods, especially countries in the same region. The model borrows data, to a greater extent, when data are non-existent or weakly informative, and to a lesser extent for data-rich countries and regions. The resulting estimates are also informed by covariates that help predict blood haemoglobin concentrations (e.g. sociodemographic index, meat supply [kcal/capita], mean BMI for women, and log of under-five mortality for children). The uncertainty ranges (credibility intervals) reflect the major sources of uncertainty, including sampling error, non-sampling error due to issues in sample design/measurement, and uncertainty from making estimates for countries and years without data.

Challenges and limitations: Despite a high proportion of countries having nationally representative survey data available for anaemia, there is still a lack of reporting on this indicator, especially in high-income countries. As a result, the estimates may not capture the full variation across countries and regions, thus tending to "shrink" towards global means when data are sparse.

Recommended readings:

Stevens, G.A., Finucane, M.M., De-Regil, L.M., Paciorek, C.J., Flaxman, S.R., Branca, F., Peña-Rosas, J.P., Bhutta, Z.A. & Ezzati, M. 2013. Global, regional, and national trends in haemoglobin concentration and prevalence of total and severe anaemia in children and pregnant and non-pregnant women for 1995–2011: a systematic analysis of population-representative data. *The Lancet Global Health*, 1(1): e16–e25. https://doi.org/10.1016/s2214-109x(13)70001-9

Stevens, G.A., Paciorek, C.J., Flores-Urrutia, M.C., Borghi, E., Namaste, S., Wirth, J.P., Suchdev, P.S., EzzatI, M., Rohner, F., Flaxman, S.R. & Rogers, L.M. 2022. National, regional, and global estimates of anaemia by severity in women and children for 2000–19: a pooled analysis of population-representative data. *The Lancet Global Health*, 10(5): e627–e639. https://doi.org/10.1016/S2214-109X(22)00084-5

WHO. 2011. *Haemoglobin concentrations for the diagnosis of anaemia and assessment of severity. Vitamin and Mineral Nutrition Information System*. Geneva, Switzerland. https://apps.who.int/iris/bitstream/handle/10665/85839/WHO_NMH_NHD_MNM_11.1_eng.pdf

WHO. 2014. *Comprehensive Implementation Plan on Maternal, Infant and Young Child Nutrition*. Geneva, Switzerland.

WHO. 2021. Global anaemia estimates, edition 2021. In: *WHO | Global Health Observatory (GHO) data repository*. [Cited 20 April 2023]. www.who.int/data/gho/data/themes/topics/anaemia_in_women_and_children

WHO. 2021. Vitamin and Mineral Nutrition Information System (VMNIS). In: *WHO*. [Cited 20 April 2023]. www.who.int/teams/nutrition-food-safety/databases/vitamin-and-mineral-nutrition-information-system

WHO. 2021. Nutrition Landscape Information System (NliS) Country Profile. In: *WHO*. [Cited 20 April 2023]. www.who.int/data/nutrition/nlis/country-profile

WHO. 2023. Nutrition Data Portal. In: *WHO*. [Cited 20 April 2023]. https://platform.who.int/nutrition/nutrition-portals ■

ANNEX 2 METHODOLOGIES USED IN CHAPTER 2

A. Methodology for estimating the PoU for 2020, 2021 and 2022

As in previous editions of this report, due to lack of direct information on the most recent values of each of the elements that contribute to computing the prevalence of undernourishment (PoU) and number of undernourished people (NoU) (see **Annex 1B**), estimates referring to the most recent years are nowcasted; in other words, they are predictions of the very recent past.

As already noted in last year's edition of this report, 2020 and 2021 were unique in many respects due to the COVID-19 pandemic and its lingering effects. This demanded special considerations when nowcasting the values of the PoU, especially with respect to estimating the likely change in the coefficient of variation (CV) and to modelling the way in which inequality in access to food contributes to rates of undernourishment. Both aspects required special treatment in consideration of the very special conditions under which food systems operated during the pandemic.

The strategy used to project values of the CV|y from 2019 to 2021 and the ranges of global PoU and NoU estimates followed the same approach as in last year's edition of this report, while additional considerations were made for 2022. Both are described below.

Projecting CV|y up to 2021

While the values of dietary energy consumption (DEC) are nowcasted using the traditional approach based on information provided by the Markets and Trade Division of FAO, used to inform FAO Agricultural Outlooks, the traditional approach used to nowcast the CV had to be modified to reflect the peculiar conditions of 2020 and 2021. Normally, changes in CV|y (the component of the CV associated with differences in households' economic conditions) are derived from differences in three-year averages of the prevalence of severe food insecurity based on the FIES (FI_{sev}) that are not explained by changes in food supplies. Use of the three-year average addressed the need to control for possible excess sampling variability in country-level estimates of the FI_{sev} (which, for most countries, is based on relatively small samples of FIES data) and is consistent with an assumption that CV|y follows a relatively stable trend. The exceptional nature of 2020 and 2021 made it difficult to maintain that last assumption. Because of that, the changes between the 2017–2019 average and the 2020 annual values of FI_{sev} were used to nowcast the 2020 values of CV|y, and the changes between the 2020 and 2021 annual values of FI_{sev} were used to nowcast the 2021 values of CV|y.

Another parameter that needed attention to nowcast the 2020 value of PoU was the percentage of change in FI_{sev} (used as a proxy for the expected change in the PoU) that is attributed to CV|y. Normally, this had been assumed to be equal to one-third, based on an econometric analysis of past values of PoU, DEC and CV|y. The exceptional nature of 2020 and 2021 called into question that regularity. As no national household consumption and expenditure survey data in 2020 or in 2021 were available, there is still no empirical basis to determine how to properly modify it. The solution was to conduct a sensitivity analysis modifying the percentage of change in FI_{sev} that is attributed to CV|y from a minimum of one-third to a maximum of one. This defined the lower and upper bounds of the estimated series for 2020 and 2021.

Special considerations for 2022

While the main effects of the COVID-19 pandemic have receded and data collection began to normalize in 2022, there is still considerable uncertainty regarding the extent of the changes in inequality in access to food that may have occurred that year. It is not yet known whether the pandemic and all other disruptive events that have affected agrifood systems worldwide in the last three years have had any persisting effect on the relative roles of demand and supply side elements in people's access to food. This, in turn, demanded a slight modification of the approach to produce nowcasts of the CV|y, and hence of the PoU, in 2022.

In particular, the value of 33 percent as probable contribution of changes in the CV to the observed

TABLE A2.1 RANGES OF PoU AND NoU NOWCASTED IN 2020, 2021 AND 2022

	2020				2021				2022			
	PoU (%)		NoU (millions)		PoU (%)		NoU (millions)		PoU (%)		NoU (millions)	
	Lower bound	Upper bound	Lower bound	Upper bound	Lower bound	Upper bound	Lower bound	Upper bound	Lower bound	Upper bound	Lower bound	Upper bound
WORLD	**8.4**	**9.5**	**656.6**	**743.7**	**8.5**	**10.1**	**674.6**	**796.9**	**8.7**	**9.8**	**690.6**	**783.1**
AFRICA	**17.6**	**19.8**	**238.4**	**270.0**	**17.7**	**20.9**	**247.1**	**291.9**	**19.0**	**20.5**	**271.6**	**291.9**
Northern Africa	5.6	6.4	15.1	16.0	6.4	7.4	17.6	19.0	7.0	8.1	18.2	21.1
Sub-Saharan Africa	20.3	22.9	224.3	254.0	20.3	23.9	231.0	272.8	21.7	23.2	253.5	270.9
Eastern Africa	26.4	29.8	118.3	134.0	26.0	30.6	119.8	141.5	27.1	29.4	128.1	139.0
Middle Africa	26.0	29.2	47.7	54.0	29.2	30.7	49.5	58.5	29.0	29.4	56.8	57.6
Southern Africa	8.9	10.0	6.0	6.8	9.1	10.7	6.2	7.3	10.8	11.5	7.4	7.9
Western Africa	12.9	14.5	52.3	59.2	13.3	15.6	55.5	65.6	14.2	15.5	61.1	66.3
ASIA	**8.0**	**9.0**	**370.8**	**420.1**	**8.1**	**9.5**	**378.0**	**446.6**	**7.9**	**9.1**	**372.2**	**431.0**
Central Asia	3.1	3.5	2.3	2.6	2.9	3.4	2.2	2.6	3.0	3.5	2.3	2.7
Eastern Asia	<2.5	<2.5	n.r.	n.r.	<2.5	<2.5	n.r.	n.r.	<2.5	<2.5	n.r.	n.r.
South-eastern Asia	4.9	5.6	32.9	37.3	4.9	5.7	32.9	38.8	4.9	5.3	33.2	36.2
Southern Asia	14.7	16.5	288.0	326.3	15.0	17.6	297.6	351.6	14.3	16.9	286.9	338.7
Western Asia	9.8	11.1	28.0	31.8	9.3	11.0	27.0	31.9	10.4	11.2	30.4	32.9
Western Asia and Northern Africa	*7.9*	*8.9*	*42.2*	*47.8*	*7.9*	*9.3*	*43.1*	*50.9*	*8.8*	*9.8*	*48.6*	*54.0*
LATIN AMERICA AND THE CARIBBEAN	**6.1**	**6.9**	**39.6**	**44.8**	**6.3**	**7.5**	**41.6**	**49.2**	**5.8**	**7.7**	**38.5**	**51.0**
Caribbean	14.3	16.1	6.3	7.1	13.4	15.8	5.9	7.0	17.1	18.0	7.6	8.0
Latin America	5.5	6.2	33.3	37.8	5.8	6.9	35.7	42.2	5.0	7.0	30.9	43.0
Central America	4.6	5.1	8.0	9.1	4.6	5.4	9.1	9.6	4.9	5.3	8.9	9.5
South America	5.9	6.6	25.3	28.7	6.4	7.5	27.6	32.6	5.1	7.7	22.1	33.5
OCEANIA	**5.7**	**6.4**	**2.5**	**2.8**	**6.0**	**7.1**	**2.7**	**3.2**	**6.9**	**7.2**	**3.1**	**3.2**
NORTHERN AMERICA AND EUROPE	**<2.5**	**<2.5**	**n.r.**	**n.r.**	**<2.5**	**<2.5**	**n.r.**	**n.r.**	**<2.5**	**<2.5**	**n.r.**	**n.r.**

NOTES: n.r. = not reported, as the prevalence is less than 2.5 percent. For NoU, regional totals may differ from the sum of subregions, due to rounding and non-reported values. For country compositions of each regional/subregional aggregate, see Notes on geographic regions in statistical tables at the end of the report.
SOURCE: Authors' (FAO) own elaboration.

changes in the PoU was used to produce the mid-point of the estimated series, reflecting what would be a "back-to-normal" situation (see **Annex 1B**). Then, additional values of 50, 67 and 100 percent were used, separately for each country, reflecting possible different assumptions about the way in which CV|y might have contributed to PoU in 2022. Note however that, contrary to what was the case in 2020 and 2021, when FIES-based estimates revealed food insecurity worsening practically everywhere, the implications of assuming greater contribution of changes in the CV towards changes in the PoU are somehow opposite for the 2022 value. Considering that estimates of the prevalence of severe food insecurity showed an improvement for many countries from 2021 to 2022, for those countries we project a reduction, rather than an increase in CV|y. Combining the set of all lowest and the set of all highest country estimates, we obtain, respectively, lower and upper bounds for the global and regional series. Overall, the result is a slightly narrower range of global PoU and NoU estimates in 2022 compared to the previous two years (Table A2.1).

Table A2.1 presents the lower and upper bounds of the PoU in 2020, 2021 and 2022 at the global, regional and subregional levels.

B. Methodology for projections of PoU to 2030

To project PoU values to 2030, we project the three fundamental variables that enter in the PoU formula (DEC, CV and MDER) separately, based on different inputs, depending on the scenario considered.

The main source of information is the output of the MIRAGRODEP recursive, dynamic computable general equilibrium model, which provides series of projected values, at the country level, for:

- real per capita GDP (GDP_Vol_pc);
- income Gini coefficient (gini_income);
- an index of real food price (Prices_Real_Food);
- extreme poverty headcount rate (that is, the percentage of the population with real daily income below USD 2.15 (x215_ALL); and
- daily per capita food consumption (DES_Kcal).

The MIRAGRODEP model was calibrated to the pre-pandemic situation of the world economy in 2018 and was used to generate projections of macroeconomic fundamentals into 2019–2030 under three scenarios: 1) "before COVID-19", which aims to capture the implications for food availability and access (and therefore the PoU) of the world economic prospects as seen before the eruption of the pandemic by the IMF *World Economic Outlook* published in October 2019; 2) "before the war in Ukraine", which does the same but considering the *World Economic Outlook* published in October 2021; and 3) "current prospects", which is based on the latest *World Economic Outlook* published in April 2023.[17] A more detailed description of the MIRAGRODEP model, as well as the assumptions used to build the various scenarios, can be found in Laborde and Torero (2023).[18]

In addition, we use the median variant projections of total population (both sexes), its composition by gender and age, and the crude birth rate as provided by the 2022 revision of the UN DESA *World Population Prospects*.[4]

Projections of DEC

To project the series of DEC we use the following formula:

$$DEC_t = DES_\mathrm{T} \times \frac{\widehat{DES\_Kcal_t}}{\widehat{DES\_Kcal_\mathrm{T}}} \times (1 - WASTE_t), \forall t > T$$

where T = 2019 for "before COVID-19", T = 2021 for "before the war in Ukraine", and T = 2022 for "current prospects".

In other words, we take the model projected series of DES_Kcal and adjust its level so that the value for year T matches the actual value. (This is necessary as the MIRAGRODEP model has been calibrated to an older FBS series.)

Projections of MDER

To project the MDER, we simply compute it based on the data on the composition of the population by sex and age as projected by the 2019 *World Population Prospects*[4] (medium variant).

Projections of the CV

As explained in the methodological note on the PoU in **Annex 1B**, the total CV is computed as $CV = \sqrt{(CV|y)^2 + (CV|r)^2}$, where the two components refer to variability in the per capita habitual dietary energy consumption due to differences across households in terms of income level and variability across individuals based on differences in sex, age, body mass and physical activity level. The projected values for CV in 2025 and 2030 are obtained by applying the formula above to the CV|r and CV|y projected separately. Projected CV|r is computed based on the projected population structures by sex and age as provided by the World Population Prospects (similarly to what we do for the MDER), while the projected CV|y is computed as a linear combination of relevant projected macroeconomic and demographic variables as follows:

$$\widehat{CV|y_t} = \alpha + \beta_1 GDP\_vol\_pc_t + \beta_2\, gini\_income_t + \beta_3\, x215\_ALL_t + \beta_4\, Prices\_Real\_Food_t + \beta_5\, cbr_t + \beta_6\, pop_t$$

To estimate the coefficients used in the above formula, in this edition of the report we considered alternative models that represent an improvement compared to the model used in 2022. As summarized in Table A2.2, the coefficients in the three alternative models are very similar and therefore generate very similar predictions when fed with the same series of projected independent variables obtained from the MIRAGRODEP model and from the *World Population Prospects*, 2022 revision.[4]

While the estimation strategy, based on a random-effects linear regression, remains the same as in previous years, the main differences compared to the model used to generate

TABLE A2.2 REGRESSION COEFFICIENTS FROM THREE ALTERNATIVE MODELS ESTIMATED ON HISTORICAL CV|y VALUES (2000–2018) AND COMPARISON WITH THE MODEL USED IN 2022

		Regression model coefficients (standard error in parentheses)			
Regressors	Variable used to project	Model used in 2022	Model 1	Model 2	Model 3
Real GDP per capita	GDP_vol_pc	−0.0625 (0.0654)	−0.1809 (0.1003)	−0.2503 (0.0979)	−0.2572 (0.0994)
Income Gini coefficient	gini_income	0.1523 (0.0839)	0.2489 (0.1183)	0.3277 (0.1200)	0.3286 (0.1210)
Poverty headcount	X215_ALL	0.1630 (0.1387)	0.1839 (0.2798)	0.1231 (0.1341)	0.0904 (0.1205)
Real food CPI	Prices_Real_Food	0.0611 (0.0568)	0.0723 (0.0865)	0.0819 (0.0705)	0.0786 (0.0700)
Crude birth rate	cbr	0.4102 (0.1481)	0.4545 (0.2474)	0.5376 (0.1552)	0.5634 (0.1552)
Total population	pop	−0.1626 (0.0851)	−0.2647 (0.0546)	−0.2564 (0.0539)	−0.2557 (0.0539)
Constant		−0.0254 (0.1033)	−0.0155 (0.1055)	−0.0113 (0.0995)	−0.0102 (0.0997)
N		119	69	75	75
r^2		0.4589	0.499	0.5854	0.5845
r^2_between		0.5044	0.5623	0.5908	0.5877

SOURCE: Authors' (FAO) own elaboration.

projections of CV|y in 2022 reside in the set of historical data used to feed the estimation model.

First, this year we used the new series of historical values of CV|y that inform the current series of PoU estimates presented in Table 1 and Table A1 of this report, which include a revision of some estimates obtained from data from food consumption surveys that had been used before but that have been reprocessed by considering improved and updated food composition tables, and values derived from the brand new analysis of 14 additional surveys (see the methodological note for the PoU in **Annex 1B**).

Most importantly, though, this year we use newly sourced series of historical data on real GDP per capita, income Gini coefficient, real food consumer price index (CPI), poverty headcount, crude birth rate and total population. For poverty headcount and income Gini we restricted our sample to household survey-based estimates that are published on the new Poverty and Inequality Platform (PIP) of the World Bank, which replaces both PovcalNet and the Poverty and Equity Data Portal that were phased out in March 2022. The major consequence of relying only on the household survey-based values in the series sourced from the PIP is a reduction in the number of country/year combinations for which direct estimates of income Gini and poverty headcount are available. That brings the number of data points we can use to estimate our model down to 75 from the 119 used in 2022.

In addition, all economic series available through PIP and IMF *World Economic Outlook* have been updated to reflect the 2017-based revision of purchasing power parity (PPP) published by the International Comparison Program (ICP).[19]

As there have been various data updates and the differences in the estimated coefficients between the model used in 2022 and the model used this year (Model 3) are quite relevant, leading to slightly different and more optimistic projections of reductions in CV|y, we estimated two additional intermediate models to disentangle the reasons for the different results. We first estimated a model (Model 1 in Table A2.2) using the old set of data for both dependent and independent variables but limited to the 69 country/year combinations that overlap between the 119 used in 2022 and the 75 used this year. Then, we moved to using the newly sourced data from PIP but keeping the poverty headcount values from the 2011-based PPP (Model 2), before adopting all new versions of the variables in the model we ultimately use for our projections (Model 3).

By comparing the values of the estimated coefficients in columns 3–6 of Table A2.2, we note that the main impact derives from having dropped country/year combinations that relied on interpolated or modelled poverty headcount and income Gini coefficients: when moving from the model used in 2022 to Model 1, the coefficients of real GDP per capita and of income Gini increase, both in absolute value and in the level of their statistical significance. Another noticeable effect can be linked to the updates of data to their 2023 version and the addition of six more country/year combinations: the coefficients of real GDP per capita, income Gini and of real food CPI further increase, while the one on the poverty headcount decreases in Model 2 compared to Model 1. Finally, updating the poverty headcount to the 2017-based PPP has overall negligible effects as the coefficients in Model 2 and Model 3 are very close to each other for all variables (with the partial exception of the poverty headcount, whose contribution to explaining CV|y drops further).

Our overall assessment is that CV|y projections this year are more robust. The newly estimated coefficients point to contributions of the explanatory variables in predicting the CV|y in the same direction as estimated before but the same model now fits the data considerably better, as captured by the increased r^2 coefficient and increased ratios between estimated coefficients and standard errors, especially for real GDP per capita and income Gini.

The series of CV|y values predicted by the formula separately for each country for the years $T + 1$ to 2030 is then calibrated to the value for year T, similarly to what is done for the DES:

$$CV|y_t = CV|y_T \times \left(\frac{\widehat{CV|y_t}}{\widehat{CV|y_T}}\right), \forall t > T$$

where T = 2019 for "before COVID-19", T = 2021 for "before the war in Ukraine", and T = 2022 for "current prospects".

C. Methodology for the analysis of food insecurity by degree of urbanization and by gender

The prevalence of food insecurity can be disaggregated by respondent/household characteristics when the data are collected directly from individual respondents in nationally representative samples. In **Chapter 2**, food insecurity estimates are presented disaggregated by sex of the respondent (adult men or women) and by Degree of Urbanization (DEGURBA) (i.e. urban, peri-urban or rural residency).

The methodology to disaggregate the indicator by any individual or household characteristics is as follows:

- The cross-country comparable probability of food insecurity for each respondent is computed at two levels of severity: moderate or severe, and severe only. The probabilities are aggregated for each category of the characteristic of interest, by computing the weighted average (using sampling weights) across all respondents in that category, obtaining the prevalence of food insecurity within that group (for example, among female respondents).
- The prevalence of food insecurity in a given category is weighted by the corresponding population (for example, the number of female adults in the country) to obtain the subregional/regional/global estimate (for example, the prevalence of food insecurity in the female adult population in Northern Africa), if reliable population data are available and if there is sufficient geographical coverage in terms of percentage of the population.

The computation of the prevalence of food insecurity by sex is possible because data are collected from individual respondents (adults aged 15 years or older) by FAO via data collection service providers (see **Annex 1B**). For countries for which national government survey data are used to calculate the prevalence estimates of food insecurity (see **Annex 1B**), it is generally not possible to disaggregate the indicator by sex, as data are collected at the household level. This year, for the first time, a protocol was developed to address this issue. Thus, in such cases, the same relative difference by sex estimated based on data collected by FAO is applied to the prevalence of food insecurity in the total population based on national data. This is an approximation, as the difference in the FAO data applies to adult respondents, and not to the whole population. However, the benefit is that the statistics by sex are consistent in terms of levels and trends with those of the overall population. The entire series was revised in this edition of the report resulting in minor updates to the levels of the prevalence of food insecurity by sex at the regional and global levels compared to the 2022 edition.

The disaggregation by DEGURBA is possible for the first time this year because Gallup® began to georeference each interview in countries collected using face-to-face mode in 2021. In 2022, countries covered by telephone interviews were also georeferenced, providing enough geographical representation to produce subregional/regional/global food insecurity estimates by DEGURBA.

Within each country, it is possible to link each georeferenced observation to the DEGURBA dataset, defining whether the observation (respondent) is located in a city, town or rural area, based on population density and size, according to internationally comparable criteria developed by EUROSTAT, ILO, FAO, OECD, UN-Habitat and the World Bank and approved at the 51st session of the UN Statistical Commission in March 2020.[20] The prevalence of food insecurity is computed for each category of urbanization and then aggregated at the subregional/regional/global level using the 2020 updated DEGURBA population distribution published by EUROSTAT.[21] For countries where official food insecurity statistics are informed by national data, the same approximation method described for the disaggregation by sex is applied.

As no FIES data were collected by FAO in China in 2022, and the data collected in 2021 were not georeferenced, the estimates of food insecurity by DEGURBA in China were approximated as follows: the prevalence of food insecurity for 2021 was disaggregated by area of residence as defined in the Gallup® World Poll, where respondents report if they live in: a rural area or on a farm; a small town or village; a large city or the suburb of a large city. Then, these categories were mapped to the DEGURBA by considering people living in a rural area or on a farm as part of the "rural" population, those living in a small town or village as part of the "peri-urban" population and those living in a large city and in the suburb of a large city as "urban" residents. This mapping was justified with the rationale that DEGURBA classifies areas with increasing urbanization based on population density and size. To ensure that no significant bias was induced by this approach, the same mapping was validated as accurate for other Asian countries where data were collected in 2022.

D. Methodology for the cost and affordability of a healthy diet

FAO with support from the World Bank Data Group systematically monitors the cost and affordability of a healthy diet (CoAHD) indicators and recently began to disseminate the updated series on the FAOSTAT database.[22] Estimates are updated for 2021 (see sections below, *Updating the cost of a healthy diet* and *Updating the affordability of a healthy diet*). In addition, periodic revisions of the entire data series are carried out by FAO to continuously improve the methodology and provide robust estimates on the CoAHD indicators.

The cost of a healthy diet

The cost of a healthy diet is defined as the cost of the least expensive locally available foods to meet requirements for energy and food-based dietary guidelines (FBDGs) for a representative person within an energy balance of 2 330 kcal/day. The FBDGs analysed explicitly recommend food quantities for each food group and provide a wide regional representation. Although it is not selected based on nutrient content but is determined by FBDGs, this diet meets on average nearly 95 percent of nutrient needs, so it can therefore almost always be considered as nutrient adequate.

The availability and prices of items in each food group needed for a healthy diet were obtained from the World Bank-led ICP as national averages for 2017. Item definitions are internationally standardized, allowing classification by food group and calculation of the least costs to reach FBDG requirements in each country, representing an average across markets and throughout the year.[19] The cost of a healthy diet indicator is calculated using a standard basket, called the Healthy Diet Basket, which consists of six food groups and reflects the commonalities across ten identified FBDGs. For a detailed description of the healthy diet and related methodology, see Herforth *et al*. (2020, 2022).[23, 24]

Affordability of a healthy diet

In this report, to determine affordability, the cost of a healthy diet is compared with country-specific income distributions that are derived from the World Bank's PIP.[25] The resulting measures of affordability include the percentage and number of people unable to afford a healthy diet in a given country, in 2021. A healthy diet is considered unaffordable when its cost exceeds 52 percent of the income in a country. This percentage accounts for a portion of income that can be credibly reserved for food, based on observations that the population in low-income countries spend, on average, 52 percent of their income on food, as derived from the 2017 ICP national accounts household expenditure data.

Based on this threshold and comparing the cost of the diet with country income distributions, we obtain the percentage of people for whom the cost of the diet is unaffordable. These proportions are then multiplied by the 2021 population in each country using the world development indicators (WDI) of the World Bank,[26] to obtain the number of people unable to afford a healthy diet in a given country. For a detailed description of the affordability indicators and related methodology, see Annex 3 of FAO, IFAD, UNICEF, WFP and WHO (2020).[27]

Updating the cost of a healthy diet

The ICP is currently the only source of retail food price data for internationally standardized items, as part of a larger effort to compute PPP exchange rates across all countries of the world. However, these data are only available once every three to five years, which does not allow for yearly global monitoring of diet costs to guide programmes and policies. In the absence of updated food price data, in this report, the method of updating the cost indicator between ICP publication years relies on consumer price indices (CPIs) published by FAO. This dataset tracks change in monthly general and food CPIs at the national level with reference to a base year of 2015. The annual CPIs are computed as simple averages of the 12 monthly CPIs within a year. In particular, CPI data for food and non-alcoholic beverages are used to update the cost of a healthy diet in 2021 for all countries except the Central African Republic and Guyana, for which the general CPI is used. The cost of a healthy diet is estimated for the complete series (2018–2021) by multiplying each country's 2017 actual cost, expressed in local currency units (LCU), with the CPI ratio and finally dividing by purchasing power parities:

$$\text{Diet cost (PPP dollars)}_t = \frac{\text{Diet cost (LCU)}_{2017} \times \text{(f)CPI ratio}_t}{\text{PPP}_t}$$

where $t = 2018, \ldots, 2021$ and $(f)CPI\ ratio_t = \left(\frac{(f)CPI_t}{(f)CPI_{2017}}\right)$.

The cost of the healthy diet is first updated in LCU and then converted into international dollars using the WDI PPP for private consumption conversion factors,[28] to compare the cost across countries and political entities. For a detailed description of the methodology, see Bai *et al.* (forthcoming).[29]

The cost of the healthy diet was computed for 169 countries and territories in 2017 and updated for 2018–2021 for all of them except Anguilla, Montserrat, and Taiwan Province of China that have information neither on CPIs nor on PPPs. Out of the remaining 166 countries and territories, there are 24 countries with missing PPP data in any year between 2018 and 2021,[bg] and one territory with missing CPI data (Turks and Caicos Islands). For the 24 countries, PPP imputations were applied using an Autoregressive Integrated Moving Average with External Explanatory Variable (ARIMAX) model. In line with the World Bank's WDI methodology for PPP extrapolations, the ratio between a country's general CPI and the CPI for the base country (in this case the United States of America) is included in the model specification as a key predictor of PPP values. Furthermore, per capita GDP and per capita household consumption expenditure are also added as external covariates, and the Holt-Winter smoothing methodology is applied to both the series to fill the gaps, if needed. The ARIMAX approach allows to estimate, for each

bg The 24 countries and territories for which PPPs were imputed are the following: Argentina, Aruba, Bermuda, British Virgin Islands, Cayman Islands, Curaçao, Democratic Republic of the Congo, Djibouti, Dominica, Equatorial Guinea, Eswatini, Gabon, Kazakhstan, Liberia, Malawi, Myanmar, Sao Tome and Principe, Senegal, Seychelles, Sint Maarten (Dutch part), Suriname, Tajikistan, United Arab Emirates and Zimbabwe.

country, several model specifications that include an autoregressive component, an integration component, a moving average, and a combination of the three. The best specification is selected when at least the estimated coefficient of the CPI ratio is statistically significant, followed by the statistical significance of the ARIMAX parameters. For countries and territories showing abnormal PPP series over time, the CPI ratio is found to be the only statistically significant coefficient to affect the variability of the PPP values. On the contrary, for countries and territories with a less volatile PPP series, the historical PPP trend plays also a role in predicting PPP values, as well as the coefficient estimates of per capita GDP and/or per capita expenditure. The ARIMAX computes the predicted values on the best specification selected for each country/territory.

For one territory with missing information on CPIs (Turks and Caicos Islands), cost imputations were applied using the average diet cost in the corresponding subregion:

$$\text{Imputed Cost (PPP dollars)}_t = \left(\frac{\text{Imputed Cost}}{\text{Average Cost}}\right)_{t-1} \times \text{Average Cost}_t$$

Subregional cost averages were computed excluding the Turks and Caicos Islands.

A limitation of this method used to update the cost of a healthy diet in 2018–2021 is that changes in the cost depend on (food) CPIs and do not reflect item-specific changes in food prices, nor any differential changes in the price of different food groups, due to the lack of new item-level food price data for more nutritious food items. FAO is exploring how to expand reporting of item-level prices to allow more frequent and robust monitoring of the cost of a healthy diet.

Updating the affordability of a healthy diet

In this report, affordability was updated for the years 2018 to 2021. Of the 169 countries and territories with cost information in 2017, the affordability indicators were estimated for 143 with income distributions available in the PIP database. This information was updated for all countries and territories for 2018–2021, except Taiwan Province of China for which food CPIs are not available.

Through continuous updates based on incoming national surveys and data imputations, the income distributions in the PIP database[25] are now available and updated for the years 2020 and 2021 in many countries and territories. To update affordability in these years, distributions in the PIP database were used for 78 of the 142 countries/territories in 2020, and for 27 in 2021. For the remaining ones (64 in 2020; 115 in 2021), affordability was estimated by the PIP team using projected distributions,[30] obtained by applying the World Bank's standard methods for nowcasting poverty.[31] Finally, the proportion of people unable to afford a healthy diet, estimated using both methods, was multiplied by each country/territory's population using the WDI of the World Bank, to obtain the number of people who could not afford a healthy diet. The latest estimates of the affordability indicators were performed on 26 April 2023. As the PIP database is currently undergoing continuous updates of income distributions, affordability estimations after this date may marginally change.

In this year's edition, a revision of the methodology involves the affordability data series. Following the recent release of new PPP for 2017, the World Bank adopted these latest conversion factors to express its collection of monetary indicators in 2017 PPP terms, including income distributions in the PIP database.[25] It implies that the indicators of affordability are no longer expressed in 2011 PPP as in previous years but rather in 2017 PPP. Shifting the base year has led to considerable variations in affordability for certain countries. Nonetheless, this change is associated with improvements in the quality of PPPs and better reflects the current economic situations worldwide.[32] Specifically, for seven countries, the share of people unable to afford a healthy diet was at least 7 percentage points lower in 2021 when expressed in 2017 PPP instead of 2011 PPP (Angola, Plurinational State of Bolivia, Egypt, Iraq, Jordan, Sao Tome and Principe, and Suriname). Conversely, it was 14 and 7 percentage points higher in Ghana and Belize, respectively. The World Bank has also acknowledged large changes to the measure of poverty rates for the same countries listed, following the adoption of 2017 PPP. These were carefully evaluated and found to reflect improvements in the quality of the PPPs.[32] In some of these countries, the 2017 PPPs are based on price data from a broader list of items than in the 2011 PPP round; in other countries, price data were collected for the first time in 2017, overcoming the limitation of imputed PPPs prior to this round. In the case of upper-middle-income countries such as Ghana and Belize, the cost thresholds have risen between 2011 and 2017, and hence the share and number of the population whose income falls below the thresholds (i.e. are unable to afford a healthy diet) is larger.[33]

E. Methodology for the rural–urban analysis of nutrition outcomes

A rural–urban analysis in **Section 2.3** was carried out according to urban and rural residence as applied to four nutrition indicators using regional estimates with their confidence intervals. The analysis was performed across regions based on data availability for countries within each region.

The weighted analysis was applied using the latest available data from national surveys between 2015 and 2021. The list of countries contributing to each region is presented in Table A2.3; data sources are included in table notes.

The regional urban and rural results presented are based on a population-weighted analysis of a subset of countries with disaggregated data available by place of residence using the latest available data from national surveys between 2015 and 2021 for exclusive breastfeeding and between 2016 and 2022 for stunting, wasting and overweight. The regional rural and urban estimates are presented only when the regional estimate by residence has a population coverage of 50 percent or more by rural or urban residence. Population coverage is calculated by dividing the sum of the population of children under five years for countries with at least one data point from household surveys within the specified year range by the total population of children under five years for all countries in the region.

F. Methodology for assessment of progress against nutrition targets at the regional and global levels

These methodological notes pertain to results presented in Table 6 in **Section 2.3** of the report which depicts the regional and subregional assessment of progress towards the 2030 nutrition targets. Progress was assessed against the 2030 nutrition targets established by UNICEF/WHO[34] and an adapted version of rules from the WHO-UNICEF Technical Expert Advisory Group on Nutrition Monitoring[35] for all indicators where 2030 targets or progress assessment rules have not been established.

To determine which progress assessment category to use for each indicator and each region, first, two distinct average annual rates of reduction (AARR)[bh] were calculated: i) the AARR required for the region to reach the 2030 target; and ii) the actual AARR that the region has experienced to date. The value of the actual AARR experienced to date is then used to determine which progress assessment category the region is assigned, while also considering the required AARR. See **Table A2.4** for AARR ranges and prevalence thresholds applied for each category and for each indicator, briefly:

- **On track:** regions with an **actual AARR that is greater than the required AARR** are categorized as being **"on track" (green)** to achieve the target. A static threshold for the latest prevalence, as noted for each indicator in Table A2.4, is also used to categorize regions as being "on track"; for example, any region for which the most recent overweight prevalence is below 3 percent is considered "on track", even if their actual AARR is less than their required AARR.
- **Off track:** regions with an **actual AARR that is less than the required AARR** and for which the latest prevalence is above the "on track" static threshold noted in Table A2.4 are considered **"off track"**. The "off track" category is broken down into different subcategories depending on the indicator. For the indicators of child stunting, child overweight and child

bh See technical note on how to calculate AARR at: https://data.unicef.org/resources/technical-note-calculate-average-annual-rate-reduction-aarr-underweight-prevalence

TABLE A2.3 COUNTRIES AND TERRITORIES WITH NUTRITION OUTCOME DATA FROM NATIONAL SURVEYS BETWEEN 2015 AND 2021 FOR EXCLUSIVE BREASTFEEDING AND BETWEEN 2016 AND 2022 FOR STUNTING, WASTING AND OVERWEIGHT THAT CONTRIBUTED TO THE RURAL–URBAN ANALYSIS

Region	Exclusive breastfeeding (82)	Stunting (89)	Wasting (89)	Overweight (89)
Africa	Algeria, Angola, Benin, Burundi, Cameroon, Central African Republic, Chad, Côte d'Ivoire, Democratic Republic of the Congo, Ethiopia, Gambia, Ghana, Guinea, Guinea-Bissau, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Nigeria, Rwanda, Sao Tome and Principe, Senegal, Sierra Leone, South Africa, Togo, Tunisia, Uganda, United Republic of Tanzania, Zambia, Zimbabwe	Algeria, Benin, Burundi, Cameroon, Central African Republic, Chad, Côte d'Ivoire, Democratic Republic of the Congo, Djibouti, Ethiopia, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Morocco, Mozambique, Niger, Nigeria, Rwanda, Sao Tome and Principe, Senegal, Sierra Leone, South Africa, Togo, Tunisia, Uganda, United Republic of Tanzania, Zambia, Zimbabwe	Algeria, Benin, Burundi, Cameroon, Central African Republic, Chad, Côte d'Ivoire, Democratic Republic of the Congo, Djibouti, Ethiopia, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Morocco, Mozambique, Niger, Nigeria, Rwanda, Sao Tome and Principe, Senegal, Sierra Leone, South Africa, Togo, Tunisia, Uganda, United Republic of Tanzania, Zambia, Zimbabwe	Algeria, Benin, Burundi, Cameroon, Central African Republic, Chad, Côte d'Ivoire, Democratic Republic of the Congo, Djibouti, Ethiopia, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Morocco, Mozambique, Niger, Nigeria, Rwanda, Sao Tome and Principe, Senegal, Sierra Leone, South Africa, Togo, Tunisia, Uganda, United Republic of Tanzania, Zambia, Zimbabwe
Asia	Armenia, Bangladesh, Bhutan, Georgia, India, Indonesia, Iraq, Jordan, Kazakhstan, Kyrgyzstan, Lao People's Democratic Republic, Malaysia, Maldives, Mongolia, Myanmar, Nepal, Pakistan, Palestine, Sri Lanka, Tajikistan, Thailand, Timor-Leste, Turkmenistan, Uzbekistan, Viet Nam	Afghanistan, Armenia, Bangladesh, Cambodia, Georgia, India, Indonesia, Iraq, Jordan, Kyrgyzstan, Lao People's Democratic Republic, Malaysia, Maldives, Mongolia, Myanmar, Nepal, Pakistan, Palestine, Republic of Korea, Sri Lanka, Tajikistan, Thailand, Timor-Leste, Türkiye, Turkmenistan, Uzbekistan	Afghanistan, Armenia, Bangladesh, Cambodia, Georgia, India, Indonesia, Iraq, Jordan, Kyrgyzstan, Lao People's Democratic Republic, Malaysia, Maldives, Mongolia, Myanmar, Nepal, Pakistan, Palestine, Republic of Korea, Sri Lanka, Tajikistan, Thailand, Timor-Leste, Türkiye, Turkmenistan, Uzbekistan	Afghanistan, Armenia, Bangladesh, Cambodia, Georgia, India, Indonesia, Iraq, Jordan, Kyrgyzstan, Lao People's Democratic Republic, Malaysia, Maldives, Mongolia, Myanmar, Nepal, Pakistan, Palestine, Republic of Korea, Sri Lanka, Tajikistan, Thailand, Timor-Leste, Türkiye, Turkmenistan, Uzbekistan
Latin America and the Caribbean	Belize, Bolivia (Plurinational State of), Brazil, Colombia, Costa Rica, Cuba, Dominican Republic, Guatemala, Haiti, Honduras, Mexico, Paraguay, Peru, Suriname	Bolivia (Plurinational State of), Costa Rica, Cuba, Dominican Republic, Ecuador, Guyana, Haiti, Honduras, Jamaica, Mexico, Panama, Paraguay, Peru, Suriname, Turks and Caicos Islands	Bolivia (Plurinational State of), Costa Rica, Cuba, Dominican Republic, Ecuador, Guyana, Haiti, Honduras, Jamaica, Mexico, Panama, Paraguay, Peru, Suriname, Turks and Caicos Islands	Bolivia (Plurinational State of), Costa Rica, Cuba, Dominican Republic, Ecuador, Guyana, Haiti, Honduras, Jamaica, Mexico, Panama, Paraguay, Peru, Suriname, Turks and Caicos Islands
Northern America, Europe, Australia and New Zealand	Belarus, Montenegro, North Macedonia, Serbia	Albania, Germany, Latvia, Montenegro, North Macedonia, Serbia	Albania, Germany, Latvia, Montenegro, North Macedonia, Serbia	Albania, Germany, Latvia, Montenegro, North Macedonia, Serbia
Oceania excluding Australia and New Zealand	Fiji, Kiribati, Marshall Islands, Papua New Guinea, Samoa, Tonga, Tuvalu	Fiji, Kiribati, Marshall Islands, Samoa, Tonga, Tuvalu	Fiji, Kiribati, Marshall Islands, Samoa, Tonga, Tuvalu	Fiji, Kiribati, Marshall Islands, Samoa, Tonga, Tuvalu

SOURCES: Data for stunting, wasting and overweight are based on UNICEF, WHO & World Bank. 2023. *UNICEF-WHO-World Bank: Joint child malnutrition estimates - Levels and trends (2023 edition).* [Cited 27 April 2023]. https://data.unicef.org/resources/jme-report-2023, www.who.int/teams/nutrition-and-food-safety/monitoring-nutritional-status-and-food-safety-and-events/joint-child-malnutrition-estimates, https://datatopics.worldbank.org/child-malnutrition; data for exclusive breastfeeding are based on UNICEF. 2022. Infant and young child feeding. In: *UNICEF*. [Cited 6 April 2023]. https://data.unicef.org/topic/nutrition/infant-and-young-child-feeding

TABLE A2.4 RULES FOR PROGRESS ASSESSMENT AGAINST THE GLOBAL NUTRITION TARGETS

Indicator	Stunting (<5 years)	Overweight (<5 years)	Wasting (<5 years)	Low birthweight[1]	Non-exclusive breastfeeding[1,2] (<6 months)
2030 target	Reduce the number of children <5 years who are stunted by 50%	Reduce and maintain childhood overweight to less than 3%	Reduce and maintain childhood wasting to less than 3%	Reduce low birthweight prevalence by 30%	Reduce non-exclusive breastfeeding prevalence (<6 months) to 30%
On track	AARR > required[3] or prevalence <3%[4]	AARR > required[5] or prevalence <3%[6]	AARR > required[5] or prevalence <3%[6]	AARR > required (i.e. 1.96)[7] or prevalence <5%[8]	AARR > required[9] or prevalence <30%[10]
Off track – some progress	AARR < required, but >0.5	AARR < required, but >1.5	AARR < required, but >2.0	AARR <1.96 but >0.5	AARR < required, but >0.8
Off track – no progress	-0.5 ≤ AARR <0.5	-1.5 ≤ AARR <1.5	-2.0 ≤ AARR <2.0	AARR <0.5	AARR <0.8
Off track – worsening	AARR <-0.5	AARR <-1.5	AARR <-2.0		
Assessment not possible	*For regions*: assessment possible for all regions[11] *For countries*: assessment not possible when data are insufficient[12]	*For regions*: assessment possible for all regions[11] *For countries*: assessment not possible when data are insufficient[12]	*For regions*: assessment not possible when regional population coverage <50%[13] *For countries*: assessment not possible when data are insufficient[14]	*For regions*: assessment possible for all regions[11] *For countries*: not applicable	*For regions*: assessment not possible when regional population coverage <50%[15] *For countries*: not applicable

NOTES:
1. For low birthweight and exclusive breastfeeding, the categories of "off track – no progress" and "off track – worsening" are combined into one category of "off track – no progress or worsening" because there is insufficient variation in current progress to split these categories for these indicators.
2. For exclusive breastfeeding, the actual target is to increase the prevalence of exclusive breastfeeding (under six months) to 70 percent by 2030; however, it has been revised here to reflect the prevalence of non-exclusive breastfeeding so that the concept of the AARR can be applied as it is for the other six targets.
3. The required AARR is based on the change in stunting prevalence corresponding to a 50 percent reduction in the number of children affected by stunting between 2012 and 2030, considering the population growth estimated by the United Nations *World Population Prospects*. Actual AARR is calculated using all years of data between 2012 and 2022.
4. Regions considered on track are those where the stunting prevalence point estimate or the lower 95 percent confidence interval for 2022 is below 3 percent.
5. The required AARR is based on the required change in overweight or wasting prevalence to reduce from the baseline (2012) prevalence to 3 percent by 2030. Actual AARR is calculated using all years of data between 2012 and 2022. Note that for wasting, unpublished trend estimates from the JME are used to generate the actual AARR.
6. Regions where the overweight or wasting prevalence point estimate for 2022 is below 3 percent are considered on track.
7. The required AARR is based on the change required to reduce the low birthweight prevalence by 30 percent between 2012 (baseline year) and 2030. The same AARR of 1.96 is required for all regions since the target requires a relative change (reduction by 30 percent) in the baseline value. Actual AARR is calculated using all years of data between 2012 and 2020.
8. Regions where the low birthweight prevalence point estimate for 2020 is below 5 percent are considered on track.
9. The required AARR is based on the required change to decrease the non-exclusive breastfeeding prevalence to 30 percent between 2012 (baseline year) and 2030. Actual AARR is calculated using only two estimates for the years of 2012 and 2021, where the regional averages are population weighted using the most recent estimate for each country between 2005 and 2012 for the 2012 estimate, and between 2016 to 2021 for the 2021 estimate.
10. Regions where the non-exclusive breastfeeding prevalence point estimate for 2021 is below 30 percent (i.e. where exclusive breastfeeding is ≥70 percent) are considered on track.
11. The global databases for the indicators of stunting, overweight and low birthweight are based on country-level models which provide annual estimates for all countries for generation of regional and global estimates (i.e. annual estimates are even available for countries without any household survey data, even in cases where country-modelled estimates are not released to the public and used only for generation of global and regional estimates), thus making progress assessment possible for all regions.
12. Progress assessment against the child stunting and child overweight targets is not conducted for countries which did not have any input data (e.g. household survey data) to use in the country model which were more recent than 2022, or for which modelled estimates remain pending final review.
13. Progress assessment is not possible for wasting for regions where population coverage is less than 50 percent. Population coverage is calculated by dividing the sum of the population of children under five years for countries with at least one data point from household surveys between 1990 and 2020 by the total population of children under five years for all countries in the region. Since wasting estimates are generated with a subregional model, even one year of data between 1990 and 2020 counts towards the regional population coverage.
14. Progress assessment against the child wasting target is not conducted for countries which do not have at least two data points (e.g. household surveys) between 2005 and 2022, with at least one point being more recent than 2012.
15. Progress assessment is not possible for exclusive breastfeeding where the population coverage of country survey data for the region is less than 50 percent for the 2012 and/or the 2021 estimate. For 2012, population coverage is calculated by dividing the sum of the population of children under five years for countries with at least one data point from household surveys between 2005 and 2012 by the total population of children under five years for all countries in the region. For 2021, population coverage is calculated by dividing the sum of the population of children under five years for countries with at least one data point from household surveys between 2016 and 2021.
SOURCE: Elaborated using information from: WHO & UNICEF. 2017. *Methodology for monitoring progress towards the global nutrition targets for 2025 – technical report*; and WHO & UNICEF. 2017. *The extension of the 2025 Maternal, Infant and Young Child nutrition targets to 2030*. WHO and UNICEF.

wasting, there are three off track subcategories: "off track – some progress" (yellow), "off track – no progress" (light red) and "off track – worsening" (dark red). For low birthweight and exclusive breastfeeding, the categories of "off track – no progress" (light red) and "off track – worsening" (dark red) are combined into one category of "off track – no progress or worsening" which is represented with an orange colour, because there is insufficient variation in the progress to date to use the two categories for these indicators.

- **Assessment not possible**: For the indicators based on country-modelled data (child stunting, child overweight, low birthweight), an assessment is possible for all regions because a modelled estimate exists for all countries meaning there are enough data to generate representative estimates for all regions and for all years. For indicators where country-modelled estimates are not available (child wasting and exclusive breastfeeding), assessment is not possible for regions where population coverage is less than 50 percent (see footnotes 16 and 17 to Table A2.4).

The years of data used to calculate the actual AARR experienced to date at the regional level vary by indicator as specified in the footnotes for Table A2.4. The actual AARRs for each region are calculated using a trend line comprising all estimates available between 2012 (baseline) and the latest estimate for each indicator, except for exclusive breastfeeding for which modelled estimates are not available and which is calculated using only two estimates: the baseline (2012) and the latest year available (2019). The required AARR is calculated using the baseline prevalence for the region in 2012 and the target prevalence as noted in the 2030 Maternal Infant and Young Child Nutrition targets[34] (e.g. for child overweight, the required is AARR is 3.41 percent per year at the global level, which is the annual rate of change needed to go from the 2012 baseline prevalence of 5.6 percent to the targeted 3.0 percent in 2030). ■

ANNEX 3
UPDATED DATA SERIES OF THE COST AND AFFORDABILITY OF A HEALTHY DIET, 2017–2021

The cost and affordability of a healthy diet, and the change of these indicators from 2019 to 2021, are reported in Table 5 by region, subregion and country income group, following the World Bank classification of countries by income level for 2022, based on per capita gross national income in 2021. Income classification is provided for all countries and territories except Anguilla and Montserrat.

Cost and affordability are also reported at the country level in Table A3.1 for the reference year 2017 when the ICP data were released, as well as for 2018–2021 when the two indicators are updated using the methodology described in **Annex 2, Section D**. In 2018–2021, the cost indicator was updated for 166 of the 169 countries and territories with information available in 2017, while affordability was updated for 142 of the 143 countries and territories. For Argentina and Zimbabwe, cost and affordability in 2018–2021 are used to estimate aggregate indicators shown in Table 5 but are not reported in Table A3.1. To update the costs in 2018–2021, PPP exchange rates for both countries are imputed, but they may not thoroughly reflect the severe currency devaluation and/or economic instability that the countries have experienced. Table A3.2 provides ranges of the affordability indicators globally, as well as by region, subregion and country income group, which show the percentage and number of people unable to afford a healthy diet in 2021. Lower-bound estimates assume that 80 percent of income is allocated to food, as this represents the largest expenditure share on food observed in the ICP 2017 data (in Guinea-Bissau). Upper-bound estimates assume that the share of income reserved for food varies by country income group. Following ICP 2017 national accounts data, food expenditures represent, on average, 14 percent, 27 percent, 38 percent and 52 percent of total expenditures in high-income countries, upper-middle-income countries, lower-middle-income countries and low-income countries, respectively. For a full description of the methodology used to determine these ranges, see Herforth *et al.* (2020).[23] ■

TABLE A3.1 THE COST AND AFFORDABILITY OF A HEALTHY DIET BY REGION, SUBREGION, COUNTRY AND COUNTRY INCOME GROUP, 2017–2021

Regions/ subregions/ countries/ territories	Cost of a healthy diet					People unable to afford a healthy diet									
	2017	2018	2019	2020	2021	2017	2018	2019	2020	2021	2017	2018	2019	2020	2021
	(PPP dollars per person per day)					(%)					(millions)				
WORLD	**3.295**	**3.355**	**3.431**	**3.511**	**3.662**	**43.8**	**41.8**	**41.2**	**43.3**	**42.2**	**3 124.9**	**3 019.1**	**3 005.5**	**3 191.9**	**3 139.5**
Low-income countries	**3.084**	**3.110**	**3.138**	**3.217**	**3.369**	**88.8**	**87.5**	**86.7**	**86.9**	**86.1**	**440.9**	**447.6**	**456.8**	**471.0**	**480.0**
Lower-middle-income countries	**3.397**	**3.478**	**3.549**	**3.652**	**3.879**	**72.3**	**69.3**	**68.3**	**71.0**	**70.2**	**2 246.4**	**2 184.3**	**2 180.7**	**2 296.8**	**2 299.6**
Upper-middle-income countries	**3.498**	**3.555**	**3.648**	**3.721**	**3.912**	**17.3**	**15.2**	**14.4**	**16.6**	**14.1**	**416.1**	**368.2**	**350.5**	**406.4**	**345.5**
High-income countries	**3.152**	**3.210**	**3.294**	**3.363**	**3.432**	**1.9**	**1.7**	**1.5**	**1.5**	**1.3**	**21.4**	**18.9**	**17.4**	**17.6**	**14.3**
AFRICA	**3.222**	**3.274**	**3.309**	**3.383**	**3.571**	**78.5**	**78.0**	**77.4**	**77.9**	**77.5**	**954.6**	**973.4**	**989.4**	**1 020.7**	**1 040.5**
Northern Africa	**3.416**	**3.512**	**3.598**	**3.575**	**3.474**	**54.6**	**56.0**	**54.7**	**54.0**	**51.7**	**126.1**	**131.8**	**131.3**	**131.9**	**128.5**
Algeria	3.763	3.822	3.796	3.760	4.043	32.5	31.2	29.2	31.1	32.4	13.4	13.1	12.5	13.5	14.3
Egypt	3.457	3.507	3.503	3.369	3.506	67.4	70.1	67.2	63.2	61.6	68.6	72.7	70.9	67.9	67.3
Morocco	2.710	2.752	2.759	2.797	2.905	17.7	16.8	15.7	17.7	15.5	6.3	6.0	5.7	6.5	5.7
Sudan	3.674	3.921	4.306	4.308	3.081	88.4	90.9	93.6	94.1	85.4	36.0	38.2	40.5	41.8	39.0
Tunisia	3.476	3.559	3.628	3.639	3.833	15.5	14.9	14.4	18.0	17.1	1.8	1.8	1.7	2.2	2.1
Sub-Saharan Africa	**3.199**	**3.246**	**3.275**	**3.361**	**3.582**	**84.1**	**83.2**	**82.6**	**83.3**	**83.4**	**828.5**	**841.7**	**858.1**	**888.8**	**912.1**
Eastern Africa*	**2.932**	**2.974**	**3.006**	**3.088**	**3.294**	**85.6**	**84.7**	**84.2**	**84.7**	**84.6**	**328.8**	**334.2**	**341.3**	**352.7**	**361.9**
Burundi	2.988	2.804	2.783	2.943	3.138	95.8	95.0	95.0	95.7	95.9	10.7	10.9	11.3	11.7	12.0
Djibouti	2.797	2.866	2.985	3.112	3.250[a]	65.8	66.4	65.2	66.7	65.3	0.7	0.7	0.7	0.7	0.7
Ethiopia	3.108	3.147	3.290	3.407	3.706	85.8	84.1	83.4	83.3	83.8	92.9	93.4	95.2	97.6	100.8
Kenya	2.846	2.823	2.907	2.968	3.189	77.4	74.5	73.7	74.5	74.0	37.9	37.2	37.6	38.7	39.2
Madagascar	2.987	3.122	3.154	3.181	3.382	97.1	97.3	97.1	97.8	97.8	25.4	26.1	26.7	27.6	28.3
Malawi	2.724	2.809	2.989	3.149	3.365[a]	94.5	94.9	95.4	95.8	95.9	16.9	17.4	18.0	18.6	19.1
Mauritius	3.313	3.396	3.439	3.604	3.785	10.9	9.5	8.6	14.7	14.0	0.1	0.1	0.1	0.2	0.2
Mozambique	3.031	2.988	3.057	3.228	3.548	91.2	90.6	90.8	91.9	92.5	26.1	26.7	27.5	28.7	29.7
Rwanda	2.609	2.483	2.537	2.698	2.718	87.0	83.9	81.9	84.6	82.0	10.6	10.5	10.5	11.1	11.0
Seychelles	4.010	3.959	3.948	3.784	4.131[a]	9.1	7.8	7.2	7.5	7.3	0.0	0.0	0.0	0.0	0.0
Uganda	2.749	2.712	2.679	2.671	2.774	84.5	83.4	82.9	82.6	81.7	33.9	34.6	35.6	36.7	37.5
United Republic of Tanzania	2.598	2.648	2.681	2.736	2.866	85.9	85.5	84.8	85.1	85.0	48.3	49.7	50.8	52.5	54.1
Zambia	3.085	3.150	3.245	3.300	3.616	88.5	88.2	88.6	89.6	90.0	15.3	15.7	16.3	17.0	17.5
Zimbabwe	2.200	n.r.	n.r.	n.r.	n.r.	67.8	n.r.	n.r.	n.r.	n.r.	10.0	n.r.	n.r.	n.r.	n.r.
Middle Africa	**3.292**	**3.287**	**3.301**	**3.373**	**3.551**	**84.7**	**83.1**	**82.1**	**82.2**	**81.9**	**141.1**	**143.0**	**145.7**	**150.5**	**154.5**
Angola	4.327	4.293	4.352	4.585	5.031	81.4	82.7	83.9	86.7	88.1	24.6	25.8	27.1	29.0	30.4
Cameroon	2.616	2.684	2.744	2.808	2.997	59.2	58.8	58.7	59.8	60.5	14.4	14.7	15.1	15.8	16.5
Central African Republic	3.423	3.507	3.570	3.615	3.784	94.6	94.5	94.4	94.5	94.6	4.7	4.8	4.9	5.0	5.2
Chad	2.831	2.735	2.666	2.827	2.941	82.7	80.9	79.3	82.4	83.1	12.5	12.6	12.8	13.7	14.3
Congo	3.343	3.385	3.365	3.421	3.626	88.6	90.0	90.0	90.8	91.5	4.7	4.9	5.0	5.2	5.3
Democratic Republic of the Congo	2.921	2.580[a]	2.393[a]	2.242[a]	2.253[a]	94.2	91.0	88.9	87.1	85.5	79.4	79.3	79.9	80.9	82.0
Equatorial Guinea	3.526	3.599	3.635	3.676	3.751[a]	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Gabon	3.358	3.403	3.485	3.553	3.704[a]	28.5	28.6	28.4	29.9	29.9	0.6	0.6	0.6	0.7	0.7
Sao Tome and Principe	3.288	3.394	3.503[a]	3.634[a]	3.869[a]	76.6	76.3	76.7	77.3	78.2	0.2	0.2	0.2	0.2	0.2

TABLE A3.1 (Continued)

Regions/ subregions/ countries/ territories	Cost of a healthy diet (PPP dollars per person per day)					People unable to afford a healthy diet (%)					People unable to afford a healthy diet (millions)				
	2017	2018	2019	2020	2021	2017	2018	2019	2020	2021	2017	2018	2019	2020	2021
Southern Africa	**3.635**	**3.650**	**3.714**	**3.839**	**4.062**	**65.6**	**65.2**	**65.4**	**67.4**	**67.0**	**42.5**	**42.7**	**43.4**	**45.3**	**45.6**
Botswana	3.622	3.575	3.591	3.701	3.829	63.2	60.8	59.8	63.4	60.3	1.5	1.5	1.5	1.6	1.6
Eswatini	3.428	3.349	3.395	3.406[a]	3.537[a]	77.1	75.8	75.0	75.3	73.8	0.9	0.9	0.9	0.9	0.9
Lesotho	3.770	3.878	4.010	4.266	4.618	83.2	83.4	83.8	87.0	87.9	1.8	1.8	1.9	2.0	2.0
Namibia	3.255	3.300	3.378	3.520	3.761	55.4	55.2	56.6	59.0	59.5	1.3	1.3	1.4	1.5	1.5
South Africa	4.102	4.147	4.199	4.299	4.565	65.3	64.9	65.1	67.0	66.7	37.0	37.2	37.8	39.4	39.6
Western Africa	**3.247**	**3.340**	**3.365**	**3.448**	**3.710**	**85.5**	**84.7**	**84.1**	**85.1**	**85.4**	**316.1**	**321.7**	**327.6**	**340.3**	**350.1**
Benin	3.550	3.670	3.664	3.707	4.041	90.6	86.8	82.4	82.1	82.6	10.5	10.4	10.1	10.4	10.7
Burkina Faso	3.173	3.296	3.240	3.345	3.611	83.0	79.7	76.8	77.6	77.6	16.5	16.3	16.1	16.7	17.2
Cabo Verde	3.358	3.413	3.484	3.563	3.683	44.5	42.2	39.7	44.0	41.2	0.3	0.2	0.2	0.3	0.2
Côte d'Ivoire	3.273	3.357	3.506	3.610	3.909	77.7	73.4	72.0	72.8	72.9	19.3	18.7	18.8	19.5	20.0
Gambia	2.942	3.008	3.054	3.110	3.324	72.6	70.8	69.6	71.8	72.2	1.7	1.7	1.7	1.8	1.9
Ghana	3.767	3.860	3.942	4.036	4.237	80.0	78.6	77.0	78.1	77.4	24.2	24.3	24.3	25.1	25.4
Guinea	3.655	3.863	4.001	4.127	4.443	88.5	89.0	88.8	88.7	89.1	10.8	11.2	11.4	11.7	12.1
Guinea-Bissau	3.164	3.254	3.335	3.434	3.694	84.4	84.9	82.9	83.9	84.6	1.6	1.6	1.6	1.7	1.7
Liberia	4.018	4.032	3.852[a]	3.907[a]	4.447[a]	91.8	91.6	91.4	91.6	92.8	4.4	4.5	4.6	4.7	4.8
Mali	2.900	3.035	2.960	3.053	3.230	77.3	74.5	69.7	71.4	72.0	14.9	14.9	14.3	15.2	15.8
Mauritania	3.451	3.574	3.654	3.692	3.948	61.7	61.1	59.7	60.9	62.4	2.6	2.6	2.6	2.7	2.9
Niger	2.850	2.812	2.792	2.902	3.155	92.9	91.4	90.4	90.9	92.0	20.2	20.6	21.2	22.1	23.2
Nigeria	3.565	3.724	3.870	4.016	4.325	90.2	91.1	91.8	93.1	93.5	174.6	180.6	186.7	194.0	199.5
Senegal	2.190	2.250	2.278	2.330	2.443[a]	53.5	48.0	45.9	46.2	45.0	8.1	7.5	7.3	7.6	7.6
Sierra Leone	2.842	2.952	2.847	2.893	3.167	84.2	84.2	81.3	82.5	83.5	6.5	6.6	6.5	6.8	7.0
ASIA	**3.412**	**3.482**	**3.572**	**3.705**	**3.897**	**47.3**	**44.2**	**43.2**	**46.4**	**44.2**	**2 021.3**	**1 905.8**	**1 877.4**	**2 031.4**	**1 949.9**
Central Asia	**2.796**	**2.796**	**2.907**	**3.102**	**3.324**	**25.3**	**21.9**	**21.3**	**24.6**	**24.4**	**8.4**	**7.4**	**7.3**	**8.6**	**8.7**
Kazakhstan	2.391	2.426	2.537	2.657	2.852[a]	2.5	1.7	1.6	2.6	2.3	0.5	0.3	0.3	0.5	0.4
Kyrgyzstan	2.970	2.931	2.991	3.180	3.510	56.3	47.2	45.0	55.3	58.2	3.5	3.0	2.9	3.6	3.9
Tajikistan	3.027	3.030[a]	3.194[a]	3.468[a]	3.610[a]	49.8	44.6	44.0	46.8	44.3	4.4	4.1	4.1	4.5	4.3
Eastern Asia	**4.168**	**4.343**	**4.447**	**4.674**	**4.866**	**15.1**	**12.4**	**11.2**	**14.5**	**10.0**	**238.7**	**197.0**	**177.8**	**230.9**	**159.4**
China, mainland	2.571	2.630	2.792	2.983	2.960	16.6	13.6	12.2	15.9	10.9	232.2	190.8	171.9	224.4	153.9
Taiwan Province of China	3.990	n.a.	n.a.	n.a.	n.a.	0.2	n.a.	n.a.	n.a.	n.a.	0.1	n.a.	n.a.	n.a.	n.a.
China, Hong Kong SAR	3.659	3.819	4.147	4.513	4.718	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Japan	5.529	5.701	5.565	5.647	5.638	2.7	2.7	2.5	2.7	2.0	3.4	3.4	3.1	3.4	2.5
Mongolia	4.544	4.666	4.900	5.115	5.676	58.5	55.2	55.0	60.0	64.1	1.8	1.7	1.8	2.0	2.1
Republic of Korea	4.712	4.900	4.831	5.111	5.340	2.2	2.0	1.7	2.2	1.5	1.2	1.0	0.9	1.2	0.8
South-eastern Asia	**3.676**	**3.775**	**3.855**	**3.994**	**4.185**	**55.6**	**54.1**	**52.3**	**54.0**	**54.9**	**348.6**	**343.0**	**335.1**	**349.0**	**357.4**
Brunei Darussalam	4.126	4.263	4.327	4.405	4.641	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Cambodia	3.618	3.706	3.778	3.888	4.064	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Indonesia	4.129	4.273	4.268	4.466	4.729	72.8	71.0	69.5	70.2	70.8	192.5	189.6	187.4	190.9	193.7
Lao People's Democratic Republic	3.776	3.838	3.959	4.141	4.305	75.3	73.6	72.7	74.7	74.0	5.3	5.2	5.2	5.5	5.5
Malaysia	3.224	3.319	3.412	3.538	3.679	3.0	2.5	2.1	2.8	2.5	1.0	0.8	0.7	0.9	0.8
Myanmar	3.706	3.786	3.861	3.925[a]	4.206[a]	71.0	66.6	63.3	62.3	73.8	37.1	35.1	33.5	33.3	39.7
Philippines	3.843	3.995	4.054	4.118	4.364	70.1	70.0	68.4	74.2	74.0	74.8	76.0	75.5	83.2	84.3
Singapore	2.775	2.867	2.936	3.064	3.186	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

TABLE A3.1 (Continued)

Regions/ subregions/ countries/ territories	Cost of a healthy diet (PPP dollars per person per day)					People unable to afford a healthy diet (%)					People unable to afford a healthy diet (millions)				
	2017	2018	2019	2020	2021	2017	2018	2019	2020	2021	2017	2018	2019	2020	2021
Thailand	3.971	4.042	4.181	4.321	4.463	20.5	21.0	19.1	19.8	18.0	14.5	15.0	13.6	14.1	12.9
Viet Nam	3.586	3.663	3.776	4.072	4.216	24.9	22.4	19.8	21.8	21.0	23.4	21.3	19.0	21.1	20.5
Southern Asia	**3.489**	**3.565**	**3.663**	**3.816**	**4.081**	**75.6**	**71.1**	**70.2**	**73.8**	**72.2**	**1 411.3**	**1 343.9**	**1 340.6**	**1 425.9**	**1 408.5**
Bangladesh	2.882	2.971	3.024	3.064	3.201	75.3	72.5	70.8	68.7	66.1	121.8	118.7	117.1	115.0	111.9
Bhutan	4.383	4.587	4.712	5.020	5.339	51.2	45.5	42.3	45.7	45.2	0.4	0.3	0.3	0.4	0.4
India	2.824	2.830	2.877	2.970	3.066	78.8	73.2	71.4	76.2	74.1	1 066.8	1 001.9	986.9	1 064.0	1 043.0
Iran (Islamic Republic of)	3.005	3.212	3.642	3.605	4.167	14.4	16.6	25.7	25.5	30.0	12.2	14.3	22.2	22.3	26.4
Maldives	3.581	3.634	3.662	3.861	4.095	3.4	2.0	1.1	5.3	1.2	0.0	0.0	0.0	0.0	0.0
Nepal	4.127	4.184	4.262	4.403	4.621	80.3	77.2	75.0	77.1	76.4	22.6	22.0	21.6	22.6	22.9
Pakistan	3.408	3.395	3.460	3.685	3.893	81.0	79.8	81.4	83.5	82.8	175.3	175.4	181.8	189.7	191.6
Sri Lanka	3.702	3.705	3.667	3.923	4.268	56.6	52.0	48.5	54.0	55.5	12.1	11.3	10.6	11.8	12.3
Western Asia	**2.989**	**3.064**	**3.148**	**3.218**	**3.363**	**8.5**	**8.6**	**9.7**	**9.7**	**9.0**	**14.3**	**14.6**	**16.7**	**17.0**	**15.9**
Armenia	3.096	3.166	3.237	3.247	3.527	37.1	37.9	40.0	39.0	41.4	1.1	1.1	1.1	1.1	1.2
Azerbaijan	2.348	2.399	2.459	2.533	2.690	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bahrain	3.379	3.463	3.573	3.835	4.036	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Cyprus	2.846	2.880	2.947	2.991	2.955	0.1	0.1	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Iraq	3.378	3.464	3.534	3.540	3.665	16.8	16.8	15.5	19.2	18.4	6.7	6.8	6.4	8.2	8.0
Israel	2.436	2.500	2.482	2.473	2.524	1.9	1.2	1.2	1.2	1.2	0.2	0.1	0.1	0.1	0.1
Jordan	3.412	3.454	3.500	3.614	3.737	6.1	5.7	6.5	7.4	7.1	0.6	0.6	0.7	0.8	0.8
Kuwait	3.344	3.407	3.468	3.606	3.997	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Oman	2.815	2.838	2.921	3.021	3.141	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Palestine	3.342	3.398	3.493	3.356	3.285	18.0	18.4	18.0	20.0	15.4	0.8	0.8	0.8	1.0	0.8
Qatar	2.375	2.426	2.484	2.577	2.708	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Saudi Arabia	3.441	3.663	3.888	4.148	4.441	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Türkiye	2.873	2.997	3.189	2.997	3.109	6.1	6.2	8.9	6.9	6.0	5.0	5.1	7.5	5.8	5.1
United Arab Emirates	2.755	2.835	2.902	3.111	3.269[a]	0.1	0.1	0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.0
LATIN AMERICA AND THE CARIBBEAN	**3.619**	**3.692**	**3.775**	**3.876**	**4.081**	**22.0**	**20.9**	**20.8**	**20.9**	**22.7**	**124.5**	**119.5**	**120.0**	**121.9**	**133.4**
Caribbean	**3.837**	**3.953**	**4.064**	**4.200**	**4.411**	**52.4**	**51.1**	**51.6**	**55.2**	**57.0**	**13.6**	**13.4**	**13.7**	**14.8**	**15.4**
Antigua and Barbuda	4.112	4.302	4.391	4.504	4.684	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Aruba	3.418	3.620	3.907	4.007[a]	4.116[a]	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Bahamas	4.276	4.387	4.364	4.488	4.661	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
British Virgin Islands	3.235	3.087[a]	3.281[a]	3.220[a]	3.425[a]	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Cayman Islands	2.928	2.866[a]	2.701[a]	2.910[a]	3.050[a]	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Curaçao	2.866	2.988	3.144	3.236[a]	3.495[a]	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Dominica	4.000	4.146	4.236	4.345	4.561[a]	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Dominican Republic	3.521	3.608	3.744	3.884	4.128	24.9	21.7	20.6	25.0	25.8	2.6	2.3	2.2	2.7	2.9
Grenada	5.382	5.536	5.625	5.796	6.097	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Haiti	3.930	4.075	4.275	4.490	4.814	84.7	84.7	86.9	88.9	92.6	9.2	9.3	9.7	10.1	10.6
Jamaica	5.975	6.141	6.398	6.681	7.033	57.9	57.1	57.9	64.0	62.6	1.6	1.6	1.6	1.8	1.8
Saint Kitts and Nevis	2.998	3.179	3.310	3.405	3.526	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Saint Lucia	3.263	3.400	3.517	3.595	3.673	20.9	20.6	21.2	31.6	27.2	0.0	0.0	0.0	0.1	0.0

TABLE A3.1 (Continued)

Regions/ subregions/ countries/ territories	Cost of a healthy diet (PPP dollars per person per day) 2017	2018	2019	2020	2021	People unable to afford a healthy diet (%) 2017	2018	2019	2020	2021	People unable to afford a healthy diet (millions) 2017	2018	2019	2020	2021
Saint Vincent and the Grenadines	4.131	4.232	4.293	4.454	4.697	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Sint Maarten (Dutch part)	4.462	4.713[a]	4.835[a]	5.094[a]	5.273[a]	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Trinidad and Tobago	3.928	4.028	4.083	4.224	4.524	6.5	7.0	7.1	9.1	9.9	0.1	0.1	0.1	0.1	0.2
Turks and Caicos Islands	2.809	2.893	2.974	3.075	3.229	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Central America	**3.368**	**3.419**	**3.454**	**3.482**	**3.625**	**25.8**	**24.9**	**23.6**	**25.4**	**22.2**	**38.3**	**37.3**	**35.7**	**38.7**	**34.2**
Belize	2.476	2.517	2.574	2.632	2.797	50.9	50.7	49.4	57.0	53.0	0.2	0.2	0.2	0.2	0.2
Costa Rica	3.961	4.000	4.048	3.889	3.925	16.0	16.3	16.3	21.0	14.2	0.8	0.8	0.8	1.1	0.7
Honduras	3.360	3.415	3.404	3.486	3.595	48.5	48.0	46.5	49.7	44.8	4.7	4.7	4.6	5.0	4.6
Mexico	2.993	3.071	3.039	3.074	3.205	24.3	23.1	21.6	23.1	20.2	29.9	28.7	27.0	29.1	25.6
Nicaragua	3.191	3.245	3.279	3.335	3.540	32.3	34.4	35.6	37.0	34.2	2.1	2.3	2.4	2.5	2.3
Panama	4.225	4.268	4.382	4.476	4.687	17.5	15.5	15.2	18.9	17.0	0.7	0.6	0.6	0.8	0.7
South America**	**3.417**	**3.439**	**3.504**	**3.589**	**3.818**	**18.6**	**17.4**	**17.7**	**17.0**	**20.6**	**72.5**	**68.8**	**70.6**	**68.4**	**83.8**
Argentina	3.341	n.r.	n.r.	n.r.	n.r.	6.8	n.r.	n.r.	n.r.	n.r.	3.0	n.r.	n.r.	n.r.	n.r.
Bolivia (Plurinational State of)	3.551	3.648	3.769	3.755	3.927	20.9	19.1	16.0	17.2	15.1	2.4	2.2	1.9	2.1	1.8
Brazil	2.809	2.800	2.882	3.084	3.350	19.6	18.5	18.8	12.7	22.4	41.0	38.9	39.9	27.1	48.1
Chile	3.053	3.180	3.276	3.349	3.387	4.6	4.5	4.7	5.9	3.5	0.8	0.8	0.9	1.1	0.7
Colombia	2.863	2.893	2.932	3.080	3.301	24.8	24.3	25.4	33.7	31.3	12.0	12.0	12.7	17.2	16.1
Ecuador	2.788	2.816	2.861	2.928	3.035	17.6	18.3	19.8	25.1	19.7	2.9	3.1	3.4	4.4	3.5
Guyana	4.629	4.742	4.828	4.887	5.117	45.0	44.5	42.0	24.9	18.5	0.3	0.3	0.3	0.2	0.1
Paraguay	3.430	3.511	3.519	3.543	3.867	19.9	18.3	17.7	20.3	20.4	1.3	1.2	1.2	1.3	1.4
Peru	3.084	3.062	3.098	3.133	3.334	26.6	23.5	21.4	34.2	25.7	8.4	7.6	7.0	11.4	8.6
Suriname	4.969	5.311[a]	5.337	5.739	6.090	44.5	45.0	43.9	54.3	58.6	0.3	0.3	0.3	0.3	0.4
Uruguay	3.073	3.170	3.254	3.414	3.543	2.8	3.0	3.3	5.3	5.2	0.1	0.1	0.1	0.2	0.2
Oceania	**2.847**	**2.850**	**2.958**	**3.040**	**3.197**	**2.3**	**2.3**	**2.6**	**2.7**	**2.9**	**0.6**	**0.6**	**0.7**	**0.7**	**0.8**
Australia	2.259	2.283	2.296	2.389	2.437	0.7	0.7	0.7	0.7	0.7	0.2	0.2	0.2	0.2	0.2
Fiji	3.612	3.677	3.858	3.914	4.358	44.9	45.8	52.9	56.8	63.7	0.4	0.4	0.5	0.5	0.6
New Zealand	2.671	2.589	2.722	2.817	2.797	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
NORTHERN AMERICA AND EUROPE	**3.026**	**3.086**	**3.186**	**3.204**	**3.224**	**2.3**	**1.9**	**1.7**	**1.6**	**1.4**	**23.9**	**19.7**	**18.1**	**17.2**	**14.9**
Northern America	**3.386**	**3.313**	**3.343**	**3.373**	**3.320**	**1.9**	**1.6**	**1.4**	**1.2**	**1.1**	**6.8**	**6.0**	**5.2**	**4.4**	**4.1**
Bermuda	4.072	3.789[a]	3.834[a]	3.718[a]	3.395[a]	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Canada	2.863	2.911	2.927	3.017	3.065	0.7	0.7	0.7	0.7	0.4	0.3	0.3	0.3	0.3	0.2
United States of America	3.225	3.240	3.268	3.383	3.500	2.0	1.7	1.5	1.2	1.2	6.5	5.7	4.9	4.1	4.0
Europe	**2.998**	**3.068**	**3.174**	**3.190**	**3.217**	**2.5**	**2.0**	**1.8**	**1.8**	**1.5**	**17.2**	**13.7**	**12.9**	**12.7**	**10.7**
Eastern Europe	**3.068**	**3.137**	**3.261**	**3.312**	**3.368**	**3.6**	**3.0**	**2.8**	**2.8**	**2.5**	**9.0**	**7.4**	**6.8**	**7.0**	**6.0**
Belarus	3.177	3.228	3.310	3.310	3.471	2.1	1.1	1.4	0.7	0.5	0.2	0.1	0.1	0.1	0.0
Bulgaria	3.780	3.876	4.036	4.129	4.151	10.6	8.6	8.1	5.8	4.2	0.8	0.6	0.6	0.4	0.3
Czechia	2.899	2.921	3.025	3.003	2.985	0.2	0.1	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0
Hungary	3.302	3.383	3.490	3.507	3.418	3.7	2.4	2.2	2.0	1.5	0.4	0.2	0.2	0.2	0.1
Poland	2.909	2.986	3.162	3.210	3.155	1.0	1.5	1.1	1.3	0.5	0.4	0.6	0.4	0.5	0.2
Republic of Moldova	2.460	2.571	2.687	2.814	2.998	3.5	2.8	3.3	7.0	3.8	0.1	0.1	0.1	0.2	0.1

TABLE A3.1 (Continued)

Regions/ subregions/ countries/ territories	Cost of a healthy diet (PPP dollars per person per day)					People unable to afford a healthy diet (%)					People unable to afford a healthy diet (millions)				
	2017	2018	2019	2020	2021	2017	2018	2019	2020	2021	2017	2018	2019	2020	2021
Romania	2.921	2.970	3.133	3.207	3.253	11.9	7.2	8.8	8.4	7.2	2.3	1.4	1.7	1.6	1.4
Russian Federation	3.149	3.197	3.264	3.420	3.678	3.3	2.9	2.5	2.8	2.6	4.7	4.2	3.6	4.0	3.7
Slovakia	3.013	3.102	3.242	3.211	3.198	2.1	2.8	1.4	1.4	2.3	0.1	0.2	0.1	0.1	0.1
Northern Europe	**2.702**	**2.748**	**2.822**	**2.832**	**2.802**	**0.6**	**0.6**	**0.5**	**0.5**	**0.4**	**0.6**	**0.6**	**0.5**	**0.6**	**0.4**
Denmark	2.376	2.440	2.491	2.508	2.500	0.2	0.2	0.4	0.3	0.2	0.0	0.0	0.0	0.0	0.0
Estonia	3.125	3.188	3.284	3.350	3.290	1.0	0.8	1.3	1.1	0.8	0.0	0.0	0.0	0.0	0.0
Finland	2.545	2.624	2.704	2.732	2.716	0.1	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Iceland	2.213	2.247	2.314	2.420	2.416	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Ireland	2.397	2.341	2.340	2.204	2.150	0.4	0.1	0.1	0.2	0.1	0.0	0.0	0.0	0.0	0.0
Latvia	3.124	3.130	3.245	3.269	3.254	3.4	2.4	1.9	1.9	1.5	0.1	0.0	0.0	0.0	0.0
Lithuania	3.003	3.042	3.148	3.132	3.108	3.3	2.3	1.2	1.1	0.7	0.1	0.1	0.0	0.0	0.0
Norway	3.325	3.432	3.479	3.488	3.361	0.6	0.4	0.4	0.5	0.3	0.0	0.0	0.0	0.0	0.0
Sweden	3.086	3.164	3.274	3.309	3.279	0.6	1.2	0.6	0.8	0.6	0.1	0.1	0.1	0.1	0.1
United Kingdom of Great Britain and Northern Ireland	1.822	1.873	1.937	1.911	1.950	0.5	0.5	0.5	0.5	0.4	0.3	0.3	0.3	0.3	0.3
Southern Europe	**3.348**	**3.423**	**3.560**	**3.537**	**3.604**	**4.5**	**3.5**	**3.3**	**3.1**	**2.6**	**6.7**	**5.3**	**4.9**	**4.6**	**3.9**
Albania	3.952	4.069	4.262	4.280	4.388	31.3	23.0	22.2	19.9	15.9	0.9	0.7	0.6	0.6	0.4
Bosnia and Herzegovina	3.847	3.907	4.043	3.961	4.105	4.7	4.0	3.9	3.0	3.0	0.2	0.1	0.1	0.1	0.1
Croatia	4.168	4.220	4.273	4.301	4.290	6.2	4.1	3.4	3.3	1.8	0.3	0.2	0.1	0.1	0.1
Greece	3.037	3.102	3.167	3.140	3.174	3.8	2.1	2.9	2.7	2.2	0.4	0.2	0.3	0.3	0.2
Italy	2.885	2.979	3.121	3.154	3.168	2.8	2.8	2.1	1.8	1.5	1.7	1.7	1.2	1.1	0.9
Malta	3.494	3.645	3.866	3.824	3.917	0.3	0.3	0.7	0.8	0.8	0.0	0.0	0.0	0.0	0.0
Montenegro	3.397	3.428	3.644	3.511	3.673	15.9	17.2	17.4	17.3	14.9	0.1	0.1	0.1	0.1	0.1
North Macedonia	3.318	3.324	3.464	3.427	3.616	20.1	17.7	16.6	17.5	15.5	0.4	0.4	0.3	0.4	0.3
Portugal	2.513	2.596	2.673	2.642	2.651	1.1	1.1	0.5	1.4	1.2	0.1	0.1	0.1	0.1	0.1
Serbia	4.070	4.166	4.334	4.268	4.346	27.2	13.1	16.2	13.0	10.9	1.9	0.9	1.1	0.9	0.7
Slovenia	2.798	2.902	3.023	3.095	3.038	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Spain	2.699	2.741	2.845	2.841	2.879	1.7	1.9	1.8	2.0	1.8	0.8	0.9	0.8	1.0	0.9
Western Europe	**2.731**	**2.826**	**2.904**	**2.951**	**2.951**	**0.4**	**0.2**	**0.3**	**0.3**	**0.2**	**0.8**	**0.4**	**0.6**	**0.6**	**0.4**
Austria	2.772	2.848	2.915	3.004	3.027	0.6	0.8	0.8	1.0	0.9	0.1	0.1	0.1	0.1	0.1
Belgium	2.862	2.962	3.047	3.159	3.125	0.3	0.2	0.2	0.2	0.1	0.0	0.0	0.0	0.0	0.0
France	2.936	3.019	3.177	3.238	3.254	0.1	0.1	0.3	0.3	0.2	0.0	0.1	0.2	0.2	0.1
Germany	2.786	2.917	2.984	3.038	3.082	0.7	0.2	0.2	0.2	0.2	0.6	0.2	0.2	0.2	0.2
Luxembourg	2.492	2.627	2.619	2.576	2.590	0.4	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Netherlands (Kingdom of the)	2.743	2.821	2.932	3.000	2.963	0.4	0.3	0.2	0.2	0.1	0.1	0.0	0.0	0.0	0.0
Switzerland	2.523	2.591	2.654	2.639	2.619	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

NOTES: The table shows the cost and affordability of a healthy diet at the country level, as well as by region, subregion, and country income group in 2017–2021. For each region, subregion and country income group, the unaffordability estimated as the percentage of the population unable to afford a healthy diet is population weighted. The 2022 World Bank classification of countries by income group is used for all years from 2017 to 2021 and for all countries and territories except Anguilla and Montserrat, for which income classification is not provided.
n.a. = data not available. n.r. = data not reported because of insufficient or unreliable data to update cost and affordability. * Cost and affordability of a healthy diet include Zimbabwe. ** Cost and affordability of a healthy diet include Argentina. [a] PPP was imputed in this year.
SOURCE: FAO. 2023. FAOSTAT: Cost and Affordability of a Healthy Diet (CoAHD). In: *FAO*. [Cited 12 July 2023]. www.fao.org/faostat/en/#data/CAHD

TABLE A3.2 LOWER- AND UPPER-BOUND ESTIMATES OF THE PERCENTAGE AND NUMBER OF PEOPLE (IN MILLIONS) UNABLE TO AFFORD A HEALTHY DIET, BY REGION, SUBREGION AND COUNTRY INCOME GROUP IN 2021

	People unable to afford a healthy diet			
	Lower bound		Upper bound	
	(%)	Total number (millions)	(%)	Total number (millions)
WORLD	**25.8**	**1 915.5**	**60.2**	**4 471.1**
AFRICA	**59.1**	**793.9**	**84.4**	**1 132.9**
Northern Africa	24.5	60.8	68.5	170.1
Sub-Saharan Africa	67.0	733.1	88.0	962.7
Eastern Africa	68.0	290.9	87.6	374.6
Middle Africa	66.4	125.3	85.4	161.2
Southern Africa	52.2	35.5	82.6	56.2
Western Africa	68.7	281.4	90.5	370.8
ASIA	**23.7**	**1 045.6**	**65.9**	**2 903.4**
Central Asia	9.7	3.5	53.6	19.0
Eastern Asia	1.4	22.8	43.8	697.3
South-eastern Asia	33.3	216.7	71.7	467.3
Southern Asia	41.0	799.4	85.0	1 658.1
Western Asia	1.8	3.3	34.8	61.7
LATIN AMERICA AND THE CARIBBEAN	**11.8**	**69.5**	**51.1**	**299.8**
Caribbean	42.1	11.4	80.9	21.9
Latin America	10.4	58.1	49.6	277.8
Central America	10.0	15.4	53.1	81.6
South America	10.5	42.7	48.3	196.3
OCEANIA	**1.5**	**0.4**	**5.6**	**1.5**
NORTHERN AMERICA AND EUROPE	**0.6**	**6.1**	**12.5**	**133.6**
COUNTRY INCOME GROUP				
Low-income countries	69.6	388.2	86.1	480.0
Lower-middle-income countries	42.9	1 404.5	82.8	2 714.3
Upper-middle-income countries	4.7	115.3	45.0	1 103.7
High-income countries	0.7	7.5	15.1	173.1

SOURCE: Authors' (FAO) own elaboration.

ANNEX 4
DATA AND DEFINITIONS FOR CHAPTER 3

A. URCA data definitions and framework

The Urban Rural Catchment Areas (URCA) is a publicly available global geospatial dataset which provides a global mapping of the rural–urban continuum.[36, 37] It is based on the Global Human Settlement Layer[21] and places urban centres on a gradient based on population size and density. As shown in **Chapter 3** (Figure A of Box 2) rural locations are assigned a gradient of their own, using the shortest travel time to urban centres of various sizes. Thus, the URCA disaggregates rural areas into multiple categories, distinguishing, for example, between locations that are less than 1 hour from an urban centre and those that are farther away. In **Chapter 4**, the URCA dataset is combined with household survey data for the country case studies.

The URCA approach builds upon the central place theory, which is a set of assumptions and propositions that explain why hierarchically tiered centres are found at certain favoured locations on the economic landscape. For example, retail trade and service activities often tend to cluster. The URCA approach assumes that city size is a proxy for the breadth of services and opportunities provided by an urban centre. It uses travel time to locations as a proxy for cost and adopts an urban hierarchy based on city size to classify rural locations as gravitating around a specific urban centre. This approach allows for: i) capturing the urban hierarchy that exists between urban centres of different sizes in terms of access to services and employment opportunities for rural locations; ii) defining urban–rural catchment areas (URCAs) in terms of the interconnection between urban centres (of different sizes) and their surrounding rural areas; and iii) adopting a gridded approach that is easily comparable across countries, developing a dataset for the whole world.

Additionally, the URCA approach allows for the identification of the share of the population that falls in a specific category of the rural–urban continuum within an administrative unit, rather than placing all the population in one territory or functional area. This categorization allows for more detailed analyses regarding consumption and production across the continuum. Table A4.1 describes the basic urban URCA categories; consequently, different categories of rural are attributed to urban areas of different sizes, e.g. rural areas less than 1 hour travel to a city of more than 5 million people.

In defining the rural URCA categories based on travel time to an urban agglomerations, the time interval is to be considered as a closed interval on the right. In particular, for the URCA categories used in the report it means that:

- "<1 hour" to any urban centre includes areas located 1 hour or less to a city of any size or town: areas ≤1 hour.
- "1–2 hours" to any urban centre includes areas located more than 1 hour but less or equal to 2 hours to a city of any size or town: 1 hour < area ≤2 hours.
- ">2 hours" to any urban centre includes areas located more than 2 hour to a city of any size or town: areas >2 hours.

Note that for improved readability of the text and figures in **Chapter 4**, this degree of specificity applies, but is not written at this level of detail.

TABLE A4.1 URCA DEFINITION OF CATEGORIES ACROSS THE RURAL–URBAN CONTINUUM

RURAL				URBAN						
Hours travel time to one of seven urban agglomerations				Agglomerations based on population size						
>3 hours*	3–2 hours	2–1 hours	<1 hour	>5 million people	1–5 million people	0.5–1 million people	250–500 thousand people	100–250 thousand people	50–100 thousand people	20–50 thousand people

NOTE: * Considered as either hinterland or dispersed towns, being that they do not gravitate around any urban agglomeration, and are hence not part of the rural–urban continuum.
SOURCE: FAO. 2021. Global Urban Rural Catchment Areas (URCA) Grid – 2021. In: *FAO*. [Cited 4 May 2023].
https://data.apps.fao.org/?share=g-3c88219e20d55c7ce70c8b3b0459001a

B. Methodological approach and tool for the systematic structural literature review

The systematic review of evidence from scientific studies used for **Chapter 3**, designed following the Preferred Reporting Items for Systematic Reviews and Meta-analysis (PRISMA),[4] was implemented using an integrated research tool, Expert Search Semantic ENriChmEnt (Essence), developed by the FAO Data Lab.

Essence is based on a web application that offers the possibility of automatically querying scientific articles from multiple data sources (Google Scholar, World Bank, International Monetary Fund, etc.). These articles, including their full text, are then stored and made available for review through a semantic search engine utilizing the Apache Solr database at its core. This allows for the aggregation and filtering of results by selecting values automatically identified when the documents are downloaded or by exploiting annotations added collaboratively.

Advanced methods were used from the tool's web interface, which permitted the filtering of downloaded documents through an algorithm based on an artificial intelligence method that learns and extends user selections of relevant articles. The approach relies on the manual revision of a small subset of documents that are identified as relevant, or not, by the users to be used as a source of ground truth. A preliminary text pre-processing and learning step was then executed directly from the web interface, in order to estimate and generalize the linking function between the content (i.e. terms) of the reviewed documents and their relevance status. The learning step was based on linear logistic regression, which is a classification algorithm used to solve binary classification problems. The logistic regression classifier uses a weighted combination of the input features (the terms in the Tf-idf matrix) and passes them through a sigmoid function that transforms any real number input to a number between 0 and 1. The weights of the combinations are then estimated to minimize the distance between the output of the function and the user's specification of the relevance of the reviewed documents. After this step, the resulting function was applied to all the documents that were downloaded (and also those not reviewed), which were associated to a "score of relevance." A threshold made it possible to classify all the documents that were downloaded and not manually reviewed as "relevant".

Through this iterative process, it was possible to revise the literature in few passages and rely on the features available directly from the Essence Web interface. This is because the proposed relevance score for the non-user-evaluated documents becomes a filter, permitting users to quickly identify and review the most likely relevant documents and add new examples that could help the algorithm to better identify those that are relevant to the set of documents used in the learning step. This iterative process helps users filter out the most relevant documents and helps improve the accuracy of the model so that it is better able to make predictions on the relevance of a document.

For a full description of the implementation of the PRISMA protocol, and the methodological approach for the systematic structural literature review, see de Bruin and Holleman (2023).[18] ■

ANNEX 5
DATA AND DEFINITIONS FOR CHAPTER 4

A. Household surveys

The demand analysis conducted in **Section 4.1** and the estimation of subnational cost of a healthy diet in **Section 4.2** use georeferenced data from national representative LSMS surveys (Table A5.1). The surveys capture apparent household food consumption using quantitative seven-day recalls. The same surveys contain a separate module with eight questions regarding people's access to adequate food, which was used for the estimation of the prevalence of moderate or severe food insecurity in **Section 4.2.**

Finally, malnutrition indicators among children under five years of age assessed in **Section 4.2** were derived using georeferenced data from national representative demographic and health surveys (Table A5.1).

B. URCA categories used in the rural–urban continuum analysis

For the analyses conducted in **Chapter 4**, the URCA categories were simplified and grouped into ten categories, with a further aggregation to urban, peri-urban and rural categories (see Table 9 in **Chapter 4**). This aggregation allowed for a sufficient number of observations in almost all URCAs to conduct the analyses. For more details on the URCA categories, see Box 2 and Box 3 in **Chapter 3**. Table A5.2 reports the number of households interviewed in each URCA and the number of households for which georeferenced variables were not available, and for which it was thus not possible to assign to any URCA.

The surveys are all nationally representative, but they are not meant to be representative at the URCA level. For this reason, the distribution of population surveyed across URCAs was compared with the actual population distribution (estimated based on the 2020 Global Human Settlement Population [GHS-POP] dataset and the URCA dataset), and it was found to be sufficiently similar so as to exclude that any catchment area was under- or overrepresented in each survey.

The URCA dataset was developed based on i) the GHS Settlement Model (GHS-SMOD) grid to identify cities and towns; ii) the GHS-POP grid for 2015 to calculate the urban population in each city; and iii) travel time classifications based on Nelson *et al.* (2019)[38] with updated cost surface from Weiss *et al.* (2020).[39] Accordingly, the matching between the URCA dataset and surveys in Table A5.1 presents some time inconsistencies,

TABLE A5.1 HOUSEHOLD SURVEYS USED IN CHAPTER 4

Country	Year	Survey	Sections where surveys are used
Benin	2018/19	Harmonized Survey on Households Living Standards	Demand analysis (Section 4.1), cost and affordability of healthy diet (Section 4.2), food insecurity based on FIES (Section 4.2)
Burkina Faso	2018/19	Harmonized Survey on Households Living Standards	
Côte d'Ivoire	2018/19	Harmonized Survey on Households Living Standards	
Ethiopia	2018/19	Socioeconomic Survey Panel II	
Guinea-Bissau	2018/19	Harmonized Survey on Households Living Standards	
Malawi	2019/20	Fifth Integrated Household Survey	
Mali	2018/19	Harmonized Survey on Households Living Standards	
Niger	2018/19	Harmonized Survey on Households Living Standards	
Nigeria	2018/19	General Household Survey-Panel, Wave 4	
Senegal	2018/19	Harmonized Survey on Households Living Standards	
Togo	2018/19	Harmonized Survey on Households Living Standards	
Benin	2017/18	Demographic and Health Survey in Benin	Malnutrition estimations (Section 4.2)
Nigeria	2018	Nigeria Demographic and Health Survey	
Senegal	2018	Senegal: Continuous Demographic and Health Survey	

SOURCES: World Bank. 2023. Living Standards Measurement Study (LSMS). In: *World Bank*. [Cited 19 May 2023]. www.worldbank.org/en/programs/lsms; USAID (United States Agency for International Development). 2023. *The Demographic and Health Surveys (DHS) Program*. [Cited 19 May 2023]. https://dhsprogram.com

as surveys are for a one-year period and were conducted between 2018 and 2019 (except Malawi, conducted between 2019 and 2020). However, the information on road and infrastructure used in the URCA dataset was the most updated at the time the dataset was developed, which is around the same time the surveys were conducted. Thus, we expect that the travel time in the URCA dataset does not diverge significantly from the travel time faced by the households in the surveys analysed.

To identify the urban centres in the URCA dataset, the 2015 GHS-POP was used. Accordingly, it is possible that some peri-urban areas are misclassified in the analysis of **Chapter 4** (i.e. if a city has expanded, some areas that were in 2015 classified as "less than 1 hour from the city" could have become part of the city in 2018/19). This is however only the case if the city had expanded geographically and not just in population size. In addition, it is possible that an urban centre may have grown in population size between 2015 and 2018/19 and made the jump from small to intermediate city, or from intermediate to large city.

C. Food processing and food group aggregates used in food demand analyses

Explanatory note on processed foods and food processing classification systems

The term "food processing" involves applying scientific and technological principles to preserve foods by slowing down or stopping the natural processes of decay.[40] Purposes of food processing include converting inedible into edible foods, increasing the digestibility of raw foods (e.g. through cooking), altering the shelf-life (e.g. through fermentation, canning or freezing), simplifying meal preparation, or increasing the palatability of food products (e.g. through the addition of flavourings). The degree of food processing can vary from unprocessed raw foods (e.g. fresh fruit eaten as such) to food products whose ingredients are derived from food but contain little or no whole food (e.g. extruded cereals).[41] Certain food processing

TABLE A5.2 HOUSEHOLD SAMPLE SIZES BY URCA FOR THE SURVEYS USED IN CHAPTER 4

	Large city (>1 million people)	Intermediate city (0.25–1 million people)	Small city (50–250 thousand people)	Town (20–50 thousand people)	<1 hour to a large city	<1 hour to an intermediate city	<1 hour to a small city	<1 hour to a town	1–2 hours to a city or town	>2 hours to a city or town	Missing georeferenced information
	(number)										
High-food-budget countries	3 894	2 081	3 763	1 473	3 444	4 031	8 452	1 222	7 064	1 155	2 057
Senegal	1 079	743	991	394	636	948	1 188	24	780	60	313
Ethiopia	704	517	837	158	362	944	1 770	58	752	411	257
Côte d'Ivoire	671	348	828	468	635	815	3 806	492	3 442	84	1 403
Mali	810	120	720	312	480	216	816	612	1 870	562	84
Nigeria	630	353	387	141	1 331	1 108	872	36	220	38	0
Low-food-budget countries	3 168	2 818	3 213	1 295	3 468	6 044	11 393	644	8 782	2 350	827
Guinea-Bissau		1 066	236	24	118	637	611	36	1 527	965	131
Benin	1 167	497	552	360	1 361	442	2 866	96	659	12	0
Togo	1 093	60	706	141	729	192	2 579	24	567	24	56
Burkina Faso	588	275	969	324	755	443	2 050	84	1 031	132	359
Malawi		637	285	302	194	3 662	2 136	320	3 666	80	152
Niger	320	283	465	144	311	668	1 151	84	1 332	1 137	129

SOURCE: Adapted from Dolislager, M.J, Holleman, C., Liverpool-Tasie, L.S.O. & Reardon, T. (forthcoming). *Evidence and analysis of food demand and supply across the rural–urban continuum in selected countries in Africa.* Background paper for *The State of Food Security and Nutrition in the World 2023.* FAO Agricultural Development Economics Technical Study. Rome, FAO.

methods can help to increase food availability by allowing transport of foods across the globe, thus extending seasonal availability beyond what is produced locally in a specific season, and also making food safer to eat.[42] Foods and food products processed in industrial settings differ from those prepared by hand at home or in artisanal settings; they employ different ingredients and methods.[41]

During the last two decades, numerous classification systems, taking into account various degrees of food processing, have been developed. Among them are food classification systems that emphasize industrial food processing, whereby foods are categorized according to processing-related criteria, each employing different criteria and metrics. They have been used to describe and monitor levels of consumption of different types of processed foods, their impact on overall diet quality and disease outcomes (in several countries), the places where these foods are purchased, or their availability in urban food environments in particular.[41, 43]

The NOVA food classification is one of the available food processing classification systems that has been considered in different scenarios for public health, nutrition and epidemiological research. However, there are important limitations in this classification. The definition of levels of food processing, as proposed by NOVA, is complex and multidimensional, which increases the risk of misclassification of food items.[43] In addition, the first category combines unprocessed and minimally processed foods, which makes it difficult to unambiguously interpret the findings. It has been suggested that there may be few advantages from using the

TABLE A5.3 NOVA FOOD GROUPS WITH DESCRIPTIONS AND EXAMPLES

NOVA food group	Description	Examples
1. Unprocessed and minimally processed foods	Unprocessed foods are of plant origin (leaves, stems, roots, tubers, fruits, nuts, seeds), or animal origin (meat, other flesh, tissue and organs, eggs, milk), consumed shortly after harvesting, gathering, slaughter or husbanding. Minimally processed foods are unprocessed foods altered in ways that do not add or introduce any substance, but that may involve subtracting parts of the food. Minimal processes include cleaning, scrubbing, washing; winnowing, hulling, peeling, grinding, grating, squeezing, flaking; skinning, boning, carving, portioning, scaling, filleting; pressing; drying, skimming, fat reduction; pasteurizing, sterilizing; chilling, refrigerating, freezing; sealing, bottling (as such); simple wrapping, vacuum- and gas-packing. Malting, which adds water, is a minimal process, as is fermenting, which adds living organisms, when it does not generate alcohol. The main aim of these processes is to extend the life of unprocessed foods, enabling their storage for longer use, or to make them edible, and, often, to make their preparation easier or more diverse.	Fresh, chilled, frozen, vacuum-packed vegetables and fruits; grains (cereals) including all types of rice; fresh, frozen and dried beans and other legumes (pulses), roots and tubers; fungi; dried fruits and freshly prepared or pasteurized non-reconstituted fruit juices; unsalted nuts and seeds; fresh, dried, chilled, frozen meats, poultry, fish, seafood; dried, fresh, pasteurized full-fat, low-fat, skimmed milk, fermented milk such as plain yoghurt; eggs; flours, "raw" pastas made from flour and water, teas, coffee, herb infusions; tap, filtered, spring, mineral water. Also includes foods made from two or more items in this group, such as dried mixed fruits, granola made from cereals, nuts and dried fruits with no added sugars, honey or oils; pasta, couscous and polenta made with flours, flakes or grits and water; and foods with vitamins and minerals added generally to replace nutrients lost during processing, such as wheat or cornflour fortified with iron and folic acid.
2. Processed culinary ingredients	Processed culinary ingredients are food products extracted and purified by industry from constituents of foods, or else obtained from nature, such as salt. Stabilizing or "purifying" agents and other additives may also be used. They may contain additives that prolong product duration, protect original properties or prevent proliferation of microorganisms.	Vegetable oils crushed from seeds, nuts or fruits (notably olives); butter and lard obtained from milk and pork; sugar and molasses obtained from cane or beet; honey extracted from combs and syrup from maple trees; starches extracted from corn and other plants, and salt mined or from seawater, vegetable oils with added antioxidants, and table salt with added drying agents. Includes products consisting of two group 2 items, such as salted butter, and group 2 items with added vitamins or minerals, such as iodized salt.
3. Processed foods	These foods are manufactured by adding salt or sugars (or other substance of culinary use such as oils or vinegar) to whole foods, to make them more durable and sometimes also to modify their palatability. They are directly derived from foods and recognizable as versions of the original foods. They are generally produced to be consumed as part of meals or dishes, or may be used, together with highly processed products, to replace food-based freshly prepared dishes and meals. Processes include canning and bottling using oils, sugars or salt, and methods of preservation such as salting, salt pickling, smoking, curing. Processes and ingredients here are designed to increase the durability of group 1 foods and make them more enjoyable by modifying or enhancing their sensory qualities. They may contain additives that prolong product duration, protect original properties, or prevent proliferation of microorganisms. When alcoholic drinks are identified as foods, those produced by fermentation of group 1 foods such as beer, cider and wine, are classified here in group 3.	Canned or bottled vegetables and legumes (pulses) preserved in brine; peeled or sliced fruits preserved in syrup; tinned whole or pieces of fish preserved in oil; salted nuts; un-reconstituted processed meat and fish such as ham, bacon, smoked fish; cheese; and fresh unpackaged breads when made from wheat flour (or other cereal flours), water, ferments and salt.

TABLE A5.3 (Continued)

NOVA food group	Description	Examples
4. Ultra-processed foods and drink products	These products are formulated mostly or entirely from substances derived from foods or other organic sources, and typically contain little or no whole foods. They are durable, convenient, accessible, highly or ultra-palatable, and often habit-forming. These foods are typically not recognizable as versions of foods, although may imitate the appearance, shape and sensory qualities of foods. Many ingredients are not available in retail outlets. Some ingredients are directly derived from foods, such as oils, fats, flours, starches and sugars; others are obtained by further processing of food constituents or synthesized from other organic sources. Numerically the majority of ingredients are preservatives; stabilizers, emulsifiers, solvents, binders, bulkers; sweeteners, sensory enhancers, colours and flavours; processing aids and other additives; bulk may come from added air or water. Micronutrients may "fortify" the products. Most are designed to be consumed by themselves or in combination as snacks. Processes include hydrogenation, hydrolysis; extruding, moulding, re-shaping; pre-processing by frying, baking. Processes and ingredients used to manufacture highly processed foods are designed to create highly profitable products (low-cost ingredients, long shelf-life, emphatic branding), convenience (ready-to-consume) hyper-palatable products liable to displace freshly prepared dishes and meals made from all other NOVA food groups. When alcoholic drinks are identified as foods, those produced by fermentation of group 1 foods followed by distillation of the resulting alcohol, such as whisky, gin, rum, vodka, are classified here in group 4.	Chips (crisps), many types of sweet, fatty or salty snack products; ice cream, chocolates, candies (confectionery); French fries (chips), burgers and hot dogs; poultry and fish "nuggets" or "sticks" ("fingers"); mass manufactured breads, buns, cookies (biscuits); breakfast cereals; pastries, cakes, cake mixes; "energy" bars; preserves (jams); margarines; desserts; canned, bottled, dehydrated, packaged soups, noodles; sauces; meat, yeast extracts; soft, carbonated, cola, "energy" drinks; sugared, sweetened milk drinks, condensed milk, sweetened including "fruit" yoghurts; fruit and "fruit nectar" drinks; instant coffee, cocoa drinks; no-alcohol wine or beer; pre-prepared meat, fish, vegetable, cheese, pizza, pasta dishes; infant formulas, follow-on milks, other baby products; "health", "slimming" products such as powdered or "fortified" meal and dish substitutes.

SOURCES: Monteiro C.A., Cannon, G., Levy, R.B., Moubarac, J-C., Iouzada, M.L.C., Rauber, F., Khandpur, N., Cediel, G. Neri, D., Martinez-Steele, E., Baraldi, L.G. & Jaime, P.C. 2019. Ultra-processed foods: what they are and how to identify them. *Public Health Nutrition*, 22(5): 936-941. https://doi.org/10.1017/s1368980018003762; Monteiro, C.A, Cannon, G., Jaime, P., Canella, D., Louzada, M.L., Calixto, G., Machado, P. *et al.* 2016. Food classification. Public health NOVA. The star shines bright. *World Nutrition*. 7(1–3). https://worldnutritionjournal.org/index.php/wn/article/view/5/4; FAO. 2015. *Guidelines on the collection of information on food processing through food consumption surveys.* Rome. www.fao.org/3/i4690e/i4690e.pdf

NOVA classification compared with the current epidemiologic approach, which relies on the linkage of nutrient intakes to chronic disease, with subsequent identification of foods that merit consideration in public health nutrition strategies.[44] Therefore, results presented in **Chapter 4** should be interpreted with these limitations and considerations in mind.

Food processing and food group classifications used in Section 4.1

The NOVA classification system was developed by researchers from the University of São Paulo, Brazil.[45] The system was published more than ten years ago and has been used in different settings and populations since.[46] For the food demand analyses by level of food processing, a food classification system adapted from NOVA was used, whereby all foods were classified according to the nature, extent and purpose of the industrial processing they undergo. These processes involve physical, biological and/or chemical methods used during the food manufacturing process.[41, 45]

According to the NOVA classification, methods used in households and similar places such as restaurants or artisanal settings where fresh culinary preparations are prepared from scratch by hand or with simple tools, are by definition not industrial processing methods. Home-prepared and artisanal preparations of all types should as far as possible be disaggregated into their components so that each can then be classified into one of the four groups.

NOVA classifies all food items into four main groups: 1) unprocessed and minimally processed foods; 2) processed culinary ingredients; 3) processed foods; and 4) highly processed foods and drink products.[45, 46] The four main

TABLE A5.4 FOOD PROCESSING LEVEL AGGREGATES USED IN SECTION 4.1 ADAPTED FROM NOVA

NOVA food group	Used in this report	Food items – example					
1. Unprocessed and minimally processed	**Unprocessed and minimally processed**	**Fresh/raw:** cereals, roots, tubers, plantains, pulses, seeds, nuts, animal proteins, vegetables, fruits	**Dried:** cereals (rice, maize, wheat, barley, millet, sorghum), pulses (groundnut, soybean, cowpea), tubers, vegetables, fruits	**Flour from starches:** wheat, maize, cassava	**Unsweetened drinks:** bottled water, tea, coffee, fruit juice, milk (fresh, fermented, tinned, powder)		
2. Processed culinary ingredients **3. Processed foods**	**Low processed**	**Fats and oils:** cooking oil, butter, margarine, ghee, shea butter, groundnut oil, coconut oil	**Seasonings:** spices, salt, sugars, honey	**Pastes and purees:** groundnut, tomato, sesame	**Dried/smoked:** fish (including tinned)	**Flour-based goods:** bread, chapati, pasta	Beer and wine
4. Ultra-processed	**Highly processed**	**Sweets and confectionary:** biscuits, cakes, pastries, jams	**Industrial products:** modern bread, breakfast cereals, infant formula	**Canned/processed meats:** sausage	**Other drinks:** soft drinks, spirits	Meals at restaurants	

SOURCE: Dolislager, M.J, Holleman, C., Liverpool-Tasie, L.S.O. & Reardon, T. (forthcoming). *Evidence and analysis of food demand and supply across the rural–urban continuum in selected countries in Africa.* Background paper for *The State of Food Security and Nutrition in the World 2023.* FAO Agricultural Development Economics Technical Study. Rome, FAO.

TABLE A5.5 FAO/WHO GIFT FOOD GROUP LEVEL AGGREGATES

Food groups				
Cereals and their products	Roots, tubers, plantains and their products	Pulses, seeds, nuts and their products	Vegetables and their products	Fruits and their products
Milk and milk products	Eggs and their products	Fish, shellfish and their products	Meat and meat products	Insects, grubs and their products
Fats and oils	Sweets and sugars	Spices and condiments	Beverages	Foods for particular nutritional uses
Food supplements	Food additives	Composite dishes	Savoury snacks	

NOTE: The following FAO/WHO GIFT food group level aggregates have a negligible presence in the LSMS data: insects, grubs and their products; foods for particular nutritional uses; food supplements; food additives; and composite dishes.
SOURCE: FAO. 2022. *FAO/WHO Global Individual Food consumption data Tool (FAO/WHO GIFT): methodological document*. Rome. www.fao.org/3/cb8809en/cb8809en.pdf

groups and their descriptions are given in Table A5.3. For the analysis in **Section 4.1**, food items were classified according to the four NOVA groups;[45, 46] but for the purposes of presentation, these were reduced to three groups, with groups 2 and 3 combined as one group. The three main groups (with food item examples in each) and the names used in this report are shown in Table A5.4.

For the purpose of the analysis in **Section 4.1**, the FAO/WHO Global Individual Food consumption data Tool (GIFT) food grouping (Table A5.5)[47] was adapted to form eight food groups as shown in Table A5.6. For simplicity of presentation, a number of the food groups were combined into broader groups. For instance, the group "staple foods" includes the subgroups "cereals and their products" and "roots, tubers, plantains and their products". The group "animal source foods" is composed of the subgroups "milk and milk products", "eggs and their products", "fish, shellfish and their products", "meat and meat products" and "insects, grubs and their products" and so forth. The group "sweets, condiments and beverages" is composed of the subgroups "sweets and sugars", "spices and condiments" and "beverages". "Food away from home" comprises prepared foods consumed away from home, which is specifically identified in household surveys. Table A5.6 shows the food group aggregates used in **Section 4.1**, along with their food group names which are simplified for presentation purposes in figures and tables.

TABLE A5.6 SUMMARY OF FOOD GROUP AGGREGATES AND TERMINOLOGY OF FOOD GROUPS USED IN SECTION 4.1

Food groups used in figures and tables in Chapter 4	Staple foods	Pulses, seeds and nuts	Animal source foods	Vegetables	Fruits	Fats and oils	Sweets, condiments and beverages	Food away from home
Food item examples	Cereals (rice, wheat, maize, maize flour, sorghum, millet, bread, pasta) Roots, tubers and plantains (potato, cassava, taro, yam, plantains, other)	Soybean, groundnut, cowpea, sesame	Fresh milk, powdered milk, cheese, eggs, fish, shellfish, chicken, beef, pork, mutton	Cabbage, lettuce, tomato, okra, onion	Mango, orange, papaya, sweet banana, avocado, apple, coconut	Palm oil, vegetable oils, cottonseed oil, butter	Pastries, cakes, biscuits, sweets, jams, sugars, salt, ginger, mayonnaise, beer, wine, water, soft drinks, coffee, tea, juices	Savoury snacks, full meals

NOTE: The food demand analysis in **Chapter 4** uses a food grouping originally adapted from the FAO/WHO GIFT classification, but is further aggregated for presentation purposes.
SOURCE: Dolislager, M.J, Holleman, C., Liverpool-Tasie, L.S.O. & Reardon, T. (forthcoming). *Evidence and analysis of food demand and supply across the rural–urban continuum in selected countries in Africa.* Background paper for *The State of Food Security and Nutrition in the World 2023.* FAO Agricultural Development Economics Technical Study. Rome, FAO.

D. Data and methodology behind analysis in Box 6

The analysis of moderate or severe food insecurity based on the FIES across the rural–urban continuum (URCA) is based on data collected by IFAD between 2019 and 2021 on small-scale producer households and communities including beneficiaries as well as non-beneficiaries (that are used as counterfactual groups) in *ex post* rural project impact assessments.[bi] The data are comprehensive household-level data with detailed GPS coordinates collected from 21 rural development projects implemented in countries from most regions of the world.

The projects are selected for impact assessments to be representative of IFAD's overall project portfolio. Sample sizes range between 1 500 and 3 000 households and around 150 to 300 communities per project. They consist of detailed information related to sociodemographic, economic, and social capital variables, including information on household dietary diversity and food insecurity experiences as captured by the FIES,[48] which were available for 21 countries.[bj] The FIES survey module was used, composed of eight questions about respondents' experiences facing constrained access to food during the 12 months preceding data collection. Respondents were classified into three categories: 1) food secure or only mildly food insecure; 2) moderately food insecure; and 3) severely food insecure, following standard methodology.[49] ■

bi Data from IFAD's Impact Assessment (2019–2021) are collected using the CAPI approach with Survey Solutions and cover sociodemographic, economic, and social capital variables, as well as a large set of variables that determine agricultural and non-agricultural production and incomes. More information about these datasets can be found on the following webpage: www.ifad.org/ifad-impact-assessment-report-2021/index.html

bj The projects represented include: Asia and the Pacific Region (APR) (1) the Post-Tsunami Sustainable Livelihoods Programme for the Coastal Communities of Tamil Nadu (PTSLP) in India, (2) the Productive Partnerships in Agriculture Project (PPAP) in Papua New Guinea, (3) the Second Cordillera Highland Agricultural Resource Management Project (CHARMP2) in the Philippines, (4) the Rural Development Programme – Phase II (RDP II) in Solomon Islands, (5) the Project for Adaption to Climate Change in the Mekong Delta in Ben Tre and Tra Vinh Provinces in Viet Nam; Eastern and Southern Africa Region (ESA) (1) the Rural Financial Intermediation Programme II (RUFIP II) in Ethiopia, (2) the Upper Tana Catchment Natural Resource Management Project (UTaNRMP) in Kenya, (3) the Smallholder Agriculture Development Project (SADP) in Lesotho, (4) the Sustainable Agricultural Production Programme (SAPP) in Malawi, (5) the Marketing Infrastructure, Value Addition and Rural Finance Support Programme (MIVARF) in the United Republic of Tanzania, (6) the Smallholder Productivity Promotion Programme (S3P) in Zambia; Latin America and the Caribbean Region (LAC) (1) the Inclusive Rural Development Programme (PRODERI) in Argentina, (2) the Economic Inclusion Programme for Families and Rural Communities (ACCESOS) in the Territory of the Plurinational State of Bolivia, (3) the Adapting to Markets and Climate Change Project (NICADAPTA) in Nicaragua, (4) the Strengthening Local Development in the Highlands and High Rainforest Areas Project (PSSA) in Peru; Near East, North Africa, Europe and Central Asia Region (NEN) (1) the Programme to Reduce Vulnerability in Coastal Fishing Areas (PRAREV-Pêche) in Djibouti, (2) the Livestock and Market Development Programme II (LMDP II) in Kyrgyzstan, (3) the Livestock and Pasture Development Project II (LPDP II) in Tajikistan, (4) the Agropastoral Development and Local Initiatives Promotion Programme for the South-East – Phase II (PRODESUD II) in Tunisia; West and Central Africa Region (WCA) (1) the Rural Enterprises Programme (REP) in Ghana, (2) the Poverty Reduction Project in Aftout South and Karakoro – Phase II (PASK II) in Mauritania, (3) the Value Chain Development Programme (VCDP) in Nigeria.

ANNEX 6
URCA MAPS SHOWING PATTERNS OF URBANIZATION FOR COUNTRIES ANALYSED IN CHAPTER 4

Figure A6.1 presents URCA maps for 9 of the 11 Western, Eastern and Southern African countries analysed in **Chapter 4**. The other two countries are presented in Figure 23 in **Chapter 4**. The maps show different patterns of urbanization, from a denser metropolitan urbanization pattern (example Senegal) to a small city or town dispersed urbanization pattern (example Ethiopia). For each figure, the top left map shows the overlay of all URCA categories and the top right map shows the location of urban centres. The bottom maps show, moving left to right, the areas that are less than 1 hour, 1 to 2 hours, and more than 2 hours travel to any urban centre.

FIGURE A6.1 URBAN–RURAL CATCHMENT AREAS

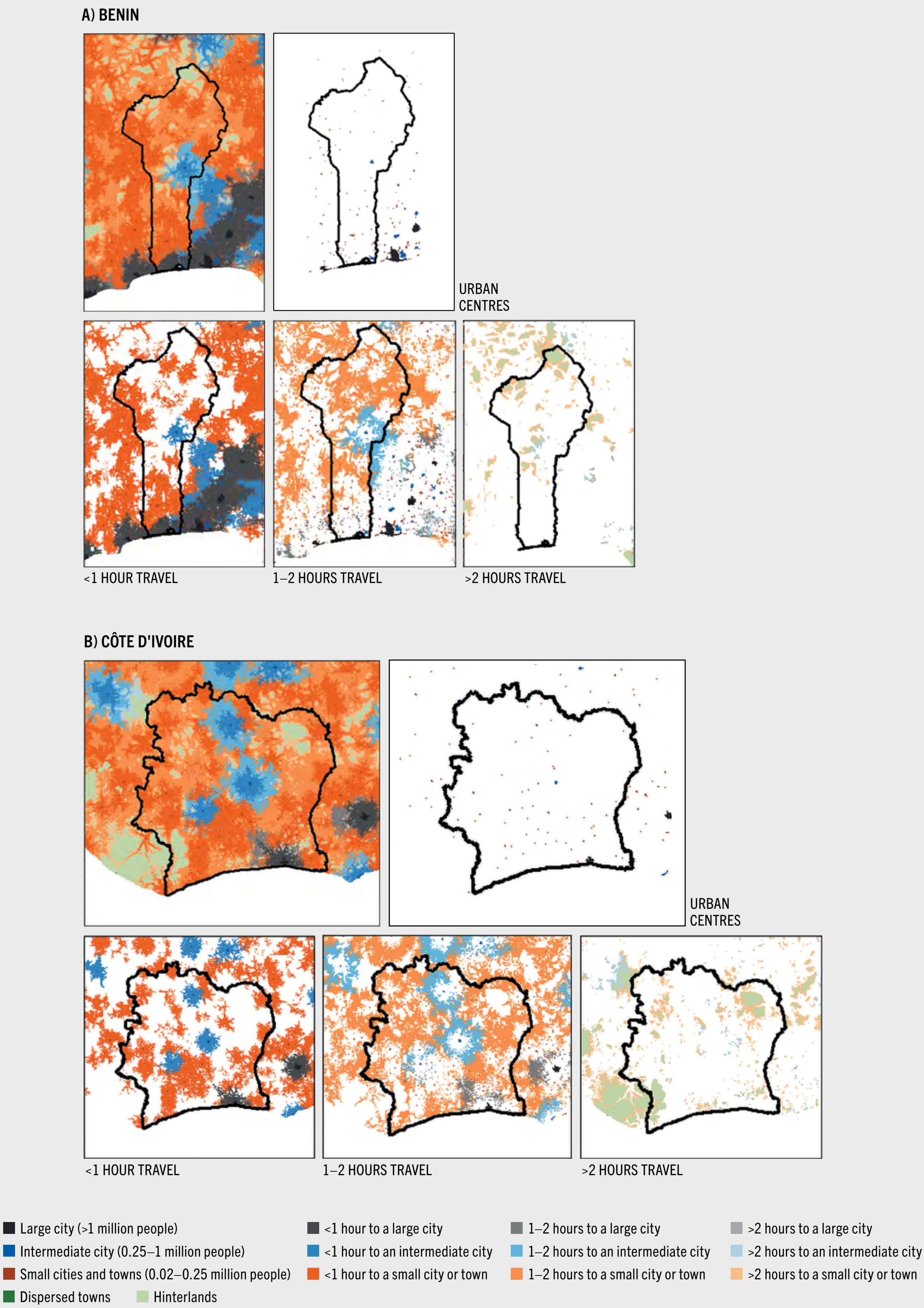
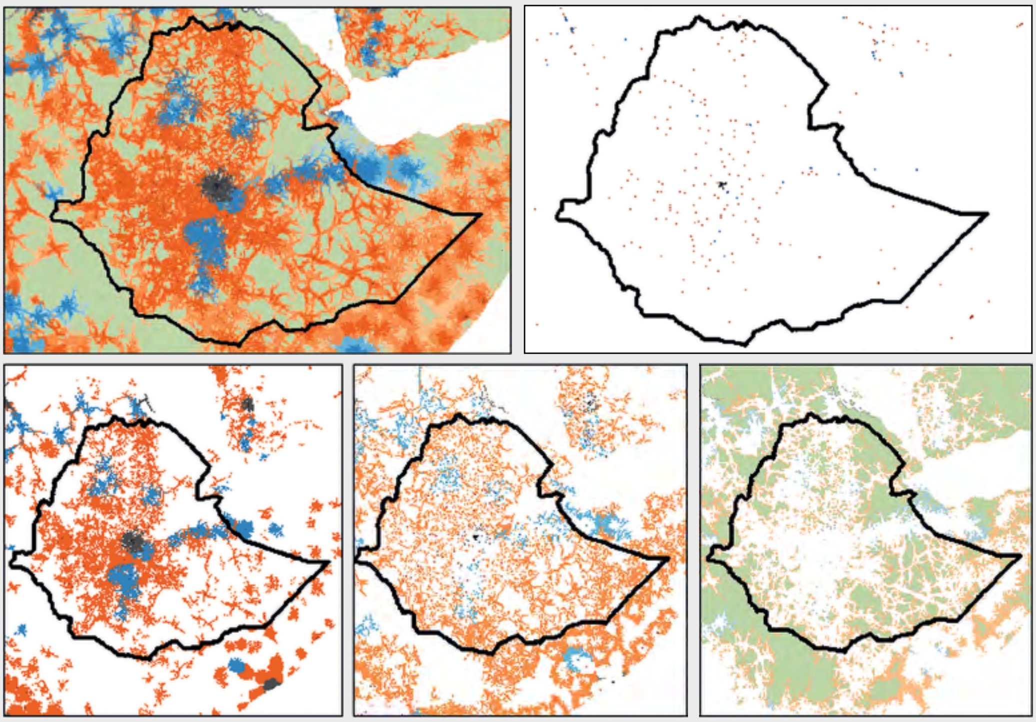


FIGURE A6.1 (Continued)

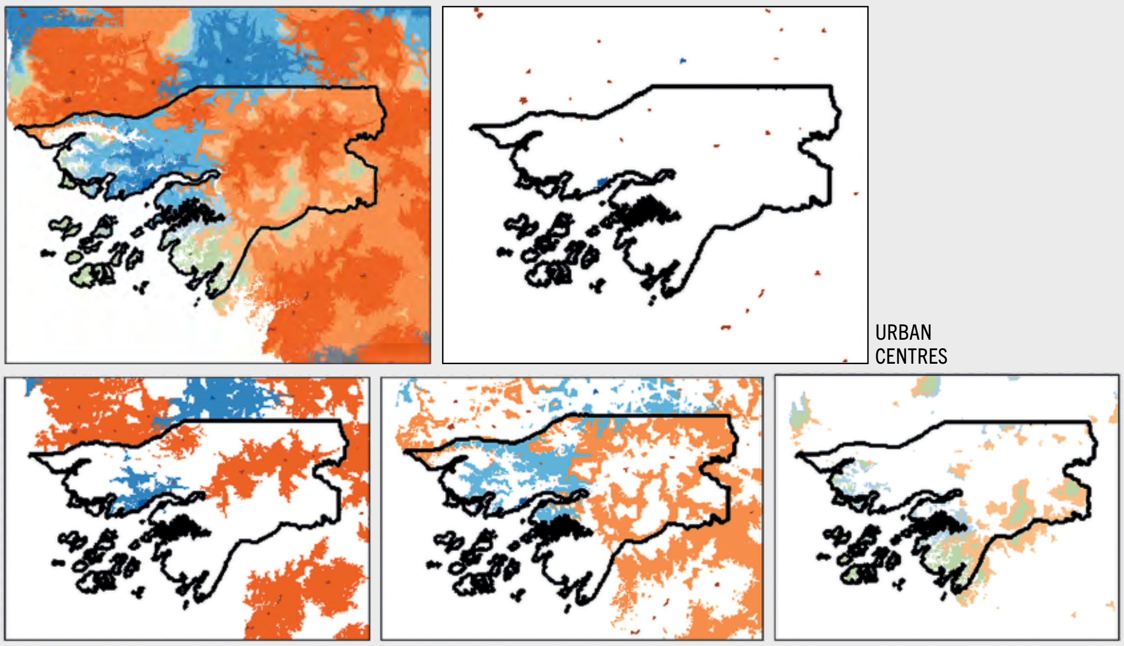
C) ETHIOPIA



URBAN CENTRES

<1 HOUR TRAVEL | 1–2 HOURS TRAVEL | >2 HOURS TRAVEL

D) GUINEA-BISSAU



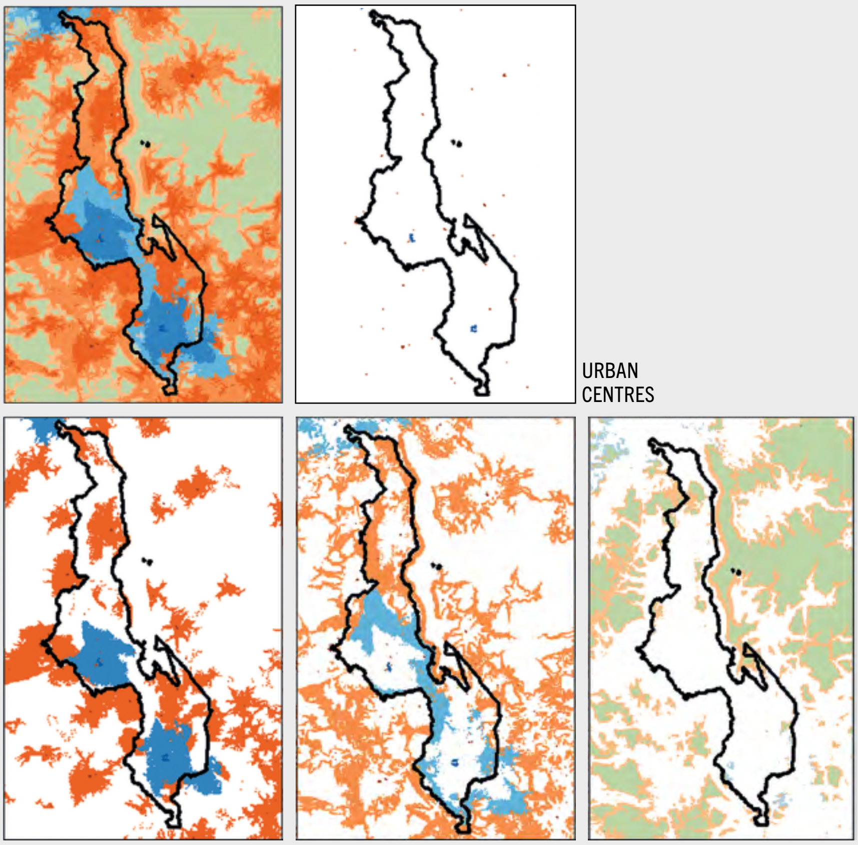
URBAN CENTRES

<1 HOUR TRAVEL | 1–2 HOURS TRAVEL | >2 HOURS TRAVEL

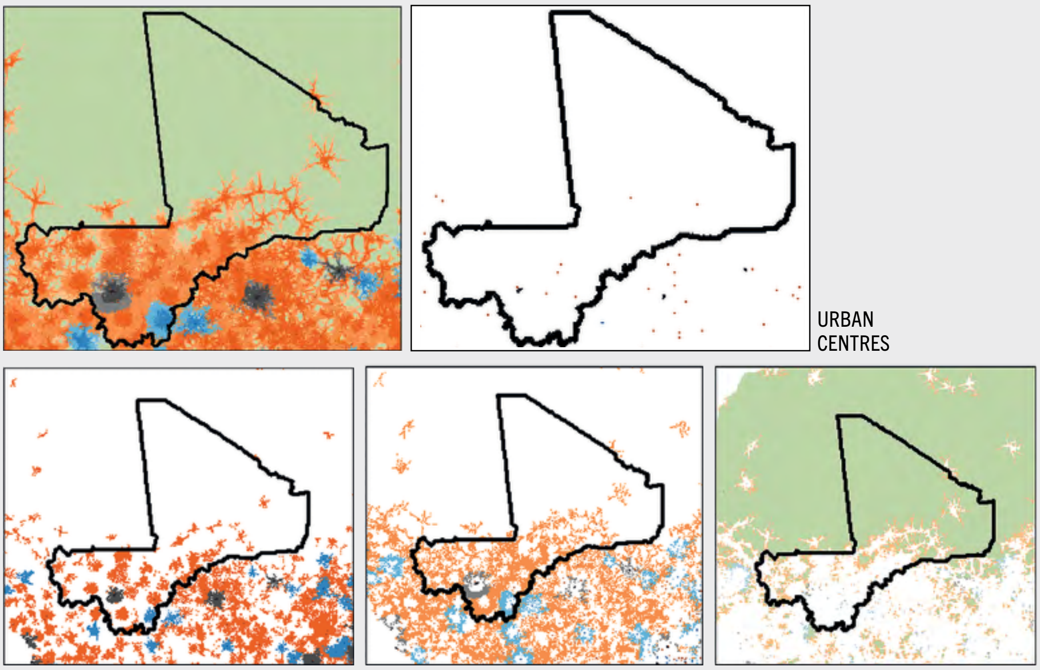
- Large city (>1 million people)
- Intermediate city (0.25–1 million people)
- Small cities and towns (0.02–0.25 million people)
- Dispersed towns
- Hinterlands
- <1 hour to a large city
- <1 hour to an intermediate city
- <1 hour to a small city or town
- 1–2 hours to a large city
- 1–2 hours to an intermediate city
- 1–2 hours to a small city or town
- >2 hours to a large city
- >2 hours to an intermediate city
- >2 hours to a small city or town

FIGURE A6.1 (Continued)

E) MALAWI



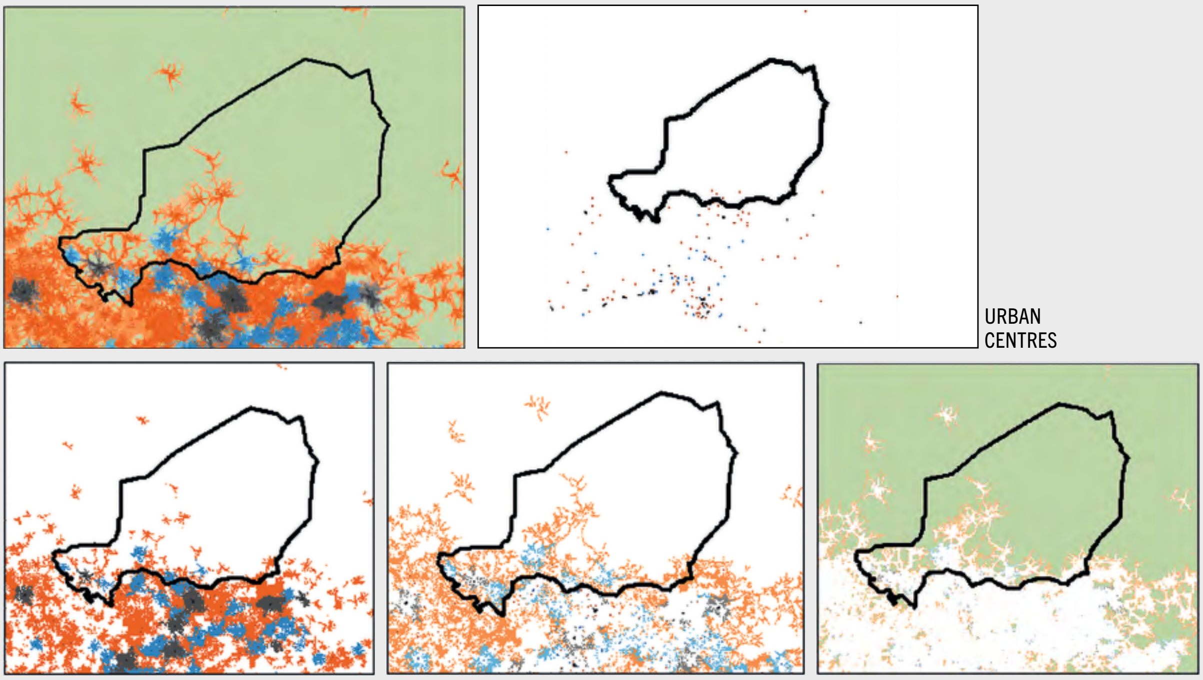
F) MALI



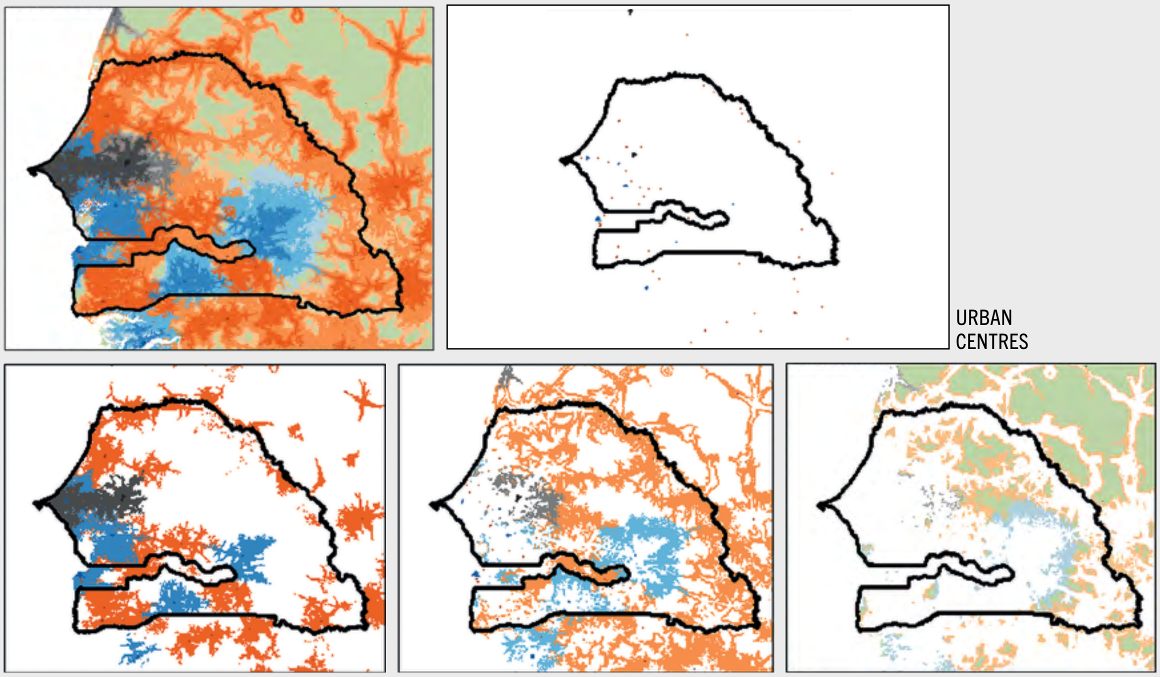
- Large city (>1 million people)
- Intermediate city (0.25–1 million people)
- Small cities and towns (0.02–0.25 million people)
- Dispersed towns
- Hinterlands
- <1 hour to a large city
- <1 hour to an intermediate city
- <1 hour to a small city or town
- 1–2 hours to a large city
- 1–2 hours to an intermediate city
- 1–2 hours to a small city or town
- >2 hours to a large city
- >2 hours to an intermediate city
- >2 hours to a small city or town

FIGURE A6.1 (Continued)

G) NIGER



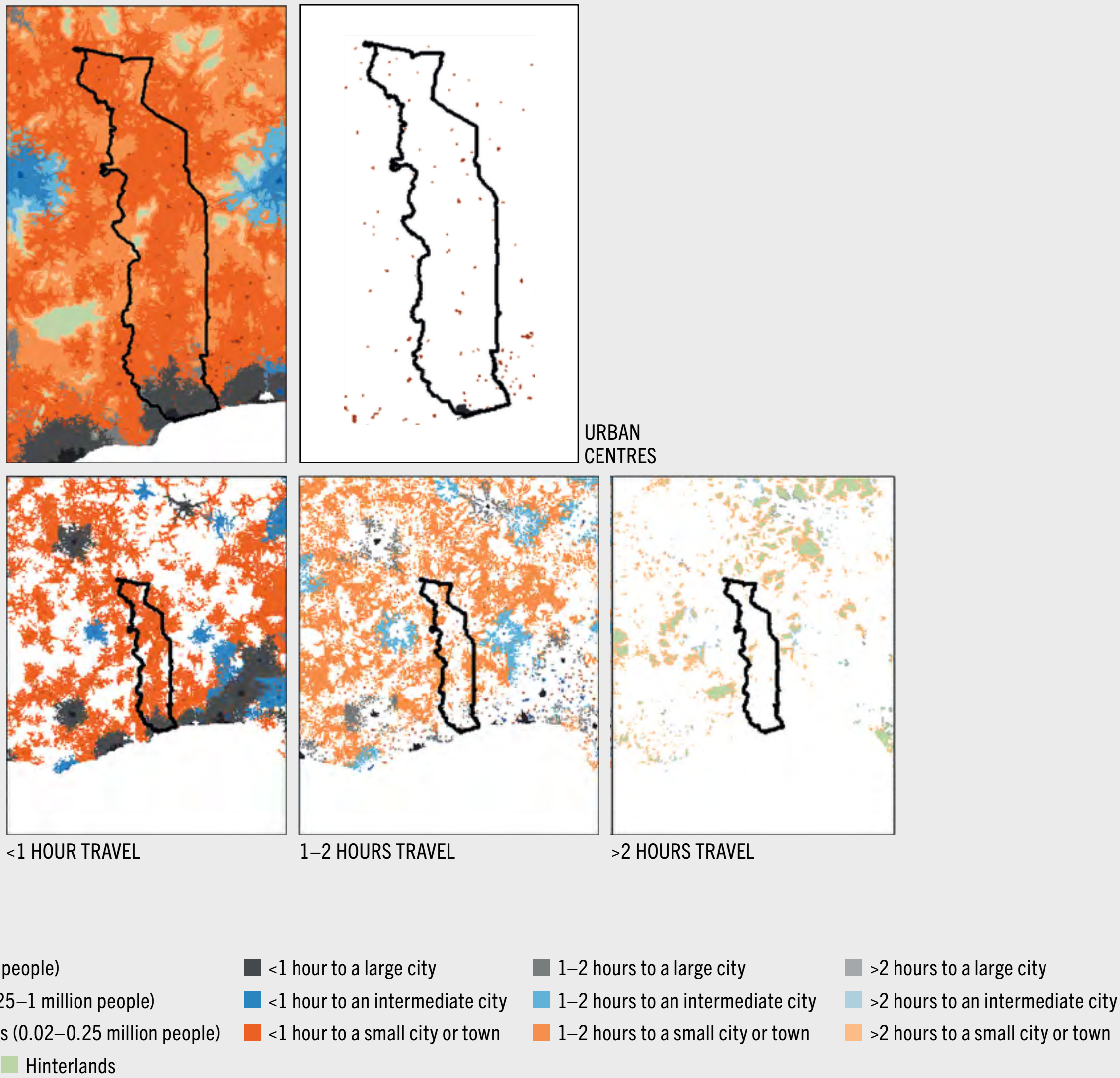
H) SENEGAL



- Large city (>1 million people)
- Intermediate city (0.25–1 million people)
- Small cities and towns (0.02–0.25 million people)
- Dispersed towns
- Hinterlands
- <1 hour to a large city
- <1 hour to an intermediate city
- <1 hour to a small city or town
- 1–2 hours to a large city
- 1–2 hours to an intermediate city
- 1–2 hours to a small city or town
- >2 hours to a large city
- >2 hours to an intermediate city
- >2 hours to a small city or town

FIGURE A6.1 (Continued)

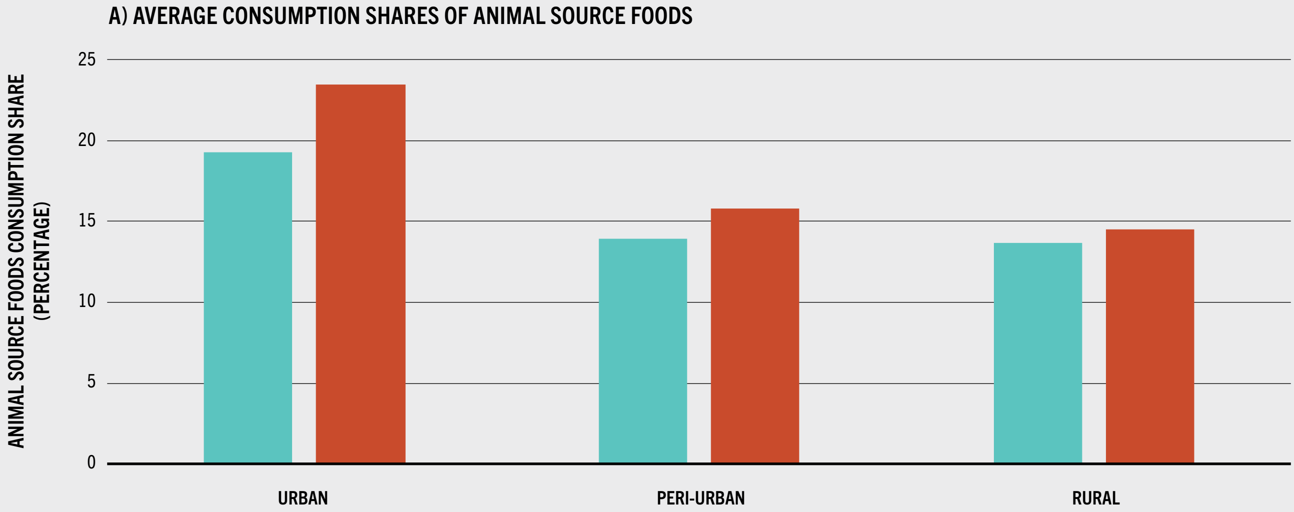
I) TOGO

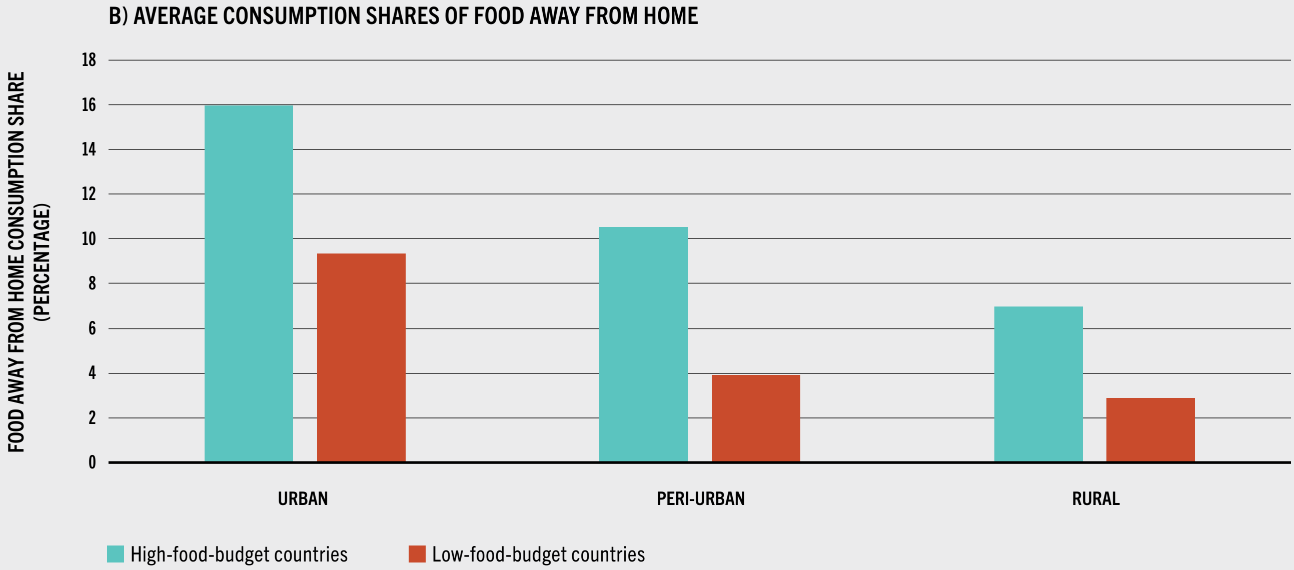


NOTES: In all panels, the top left map displays all urban–rural catchments areas. The top right map shows only the three categories of urban centres (large, intermediate and small city or town). The bottom left map displays areas 1 hour travel or less to any urban centre, roughly corresponding to what are defined as peri-urban areas in **Chapter 4**. The bottom centre map displays areas 1 to 2 hours travel to any urban centre, and the bottom right map displays areas more than 2 hours travel to any urban centre. The bottom centre and bottom right maps roughly correspond to what are defined as rural areas in **Chapter 4**.
SOURCE: Dolislager, M.J, Holleman, C., Liverpool-Tasie, L.S.O. & Reardon, T. (forthcoming). *Evidence and analysis of food demand and supply across the rural–urban continuum in selected countries in Africa.* Background paper for *The State of Food Security and Nutrition in the World 2023.* FAO Agricultural Development Economics Technical Study. Rome, FAO.

ANNEX 7
SUPPLEMENTARY RESULTS FROM SECTION 4.1

FIGURE A7.1 AVERAGE SHARES OF TOTAL HOUSEHOLD FOOD CONSUMPTION VALUES FOR ANIMAL SOURCE FOODS AND FOOD AWAY FROM HOME BY URBAN, PERI-URBAN AND RURAL AREA FOR SELECTED HIGH- AND LOW-FOOD-BUDGET COUNTRIES IN AFRICA





NOTES: Average consumption shares of animal source foods (Figure A) and food away from home (Figure B) as a percentage share of total household food consumption (at market value) in urban, peri-urban and rural areas by high- and low-food-budget country group. All surveys are for 2018/19, except Malawi (2019/20). See Table 9 for the definition of urban, peri-urban and rural areas, and Table 10 for the definition and list of high- and low-food-budget countries. See Table A5.6 for the definition of animal source foods and food away from home, and Table A5.1 for the list of 11 Western, Eastern and Southern African countries.
SOURCE: Dolislager, M.J, Holleman, C., Liverpool-Tasie, L.S.O. & Reardon, T. (forthcoming). *Evidence and analysis of food demand and supply across the rural–urban continuum in selected countries in Africa.* Background paper for *The State of Food Security and Nutrition in the World 2023.* FAO Agricultural Development Economics Technical Study. Rome, FAO.

Tables A7.1 to A7.5 present the econometric results showing the marginal effects[bk] of the determinants of the different food consumption shares of total food consumption (at market value) for: i) consumption shares of purchased food, for home consumption and food away from home (Table A7.1); ii) consumption shares of highly processed foods (Table A7.2); iii) consumption shares of animal source foods (Table A7.3); iv) consumption shares of food away from home (Table A7.4); and v) consumption shares of vegetables (Table A7.5).

Only statistically significant marginal effects (at 10 percent or lower) are presented. The effect of location across the rural–urban continuum is captured by the ten URCA categories defined in **Section 4.1**, with the omission of the town category to serve as a reference category to which the other URCA variables are compared, i.e. the marginal effect of the "large city" category is interpreted as relative to the omitted URCA town variable. The marginal effect of prices and home assets is not shown (see source for full presentation of results). Countries included in the analysis: Benin, Burkina Faso, Côte d'Ivoire, Ethiopia, Guinea-Bissau, Malawi, Mali, Niger, Nigeria, Senegal and Togo. All surveys are 2018/19, except Malawi (2019/20).

For the full details on the data sources, methodology and interpretation see Dolislager *et al.* (forthcoming).[52] ■

bk Marginal effects are partial derivatives of the regression equation with respect to each variable in the model for each unit in the data; average marginal effects are simply the mean of these unit-specific partial derivatives over some sample. In ordinary least squares regression with no interactions or higher-order term, the estimated slope coefficients are marginal effects.[50] Marginal effects tell us how a dependent variable (outcome) changes when a specific independent variable (explanatory variable) changes. Other covariates are assumed to be held constant. Marginal effects are often calculated when analysing regression analysis results.[51]

TABLE A7.1 THE NON-PRICE DETERMINANTS OF PURCHASED FOOD CONSUMPTION SHARES (FOR HOME CONSUMPTION AND FOOD AWAY FROM HOME) IN SELECTED HIGH- AND LOW-FOOD-BUDGET COUNTRIES IN AFRICA

		High-food-budget countries						Low-food-budget countries						
	All countries	High-food-budget countries	Senegal	Ethiopia	Côte d'Ivoire	Mali	Nigeria	Low-food-budget countries	Guinea-Bissau	Benin	Togo	Burkina Faso	Malawi	Niger
Large city (>1 million people)	0.096***	0.095***	0.054***	0.162**	0.113***	0.066***	0.074***	0.118***		0.136***	0.098***	0.177***		0.131***
Intermediate city (0.25–1 million people)	0.047***		0.034***		0.074***		0.040**	0.080***	0.103***			0.235***	0.196***	0.102***
Small city (50–250 thousand people)					0.045***	0.046***		0.034**	0.169***	0.058***		0.136***	0.229***	0.065***
<1 hour to a large city	–0.103***	–0.115***	0.016**	–0.163***	–0.032**		-0.081***	-0.061***			–0.049***	–0.059***	0.256***	
<1 hour to an intermediate city	–0.143***	–0.151***	–0.040***	–0.101**	–0.123***		-0.109***	-0.116***	–0.059*	–0.042**	–0.101***		0.057**	–0.114***
<1 hour to a small city	–0.153***	–0.149***	–0.027***	–0.160***	–0.104***	–0.152***	-0.065***	-0.155***		–0.069***	–0.180***	–0.046***		–0.081***
<1 hour to a town	–0.146***	–0.135***			–0.165***	–0.160***		–0.177***						
1–2 hours to a city or town	–0.193***	–0.202***	–0.027**	–0.140***	–0.136***	–0.172***	-0.119***	-0.149***	–0.098***	–0.140***	–0.157***	–0.056***		–0.108***
>2 hours to a city or town	–0.194***	–0.215***		–0.142***		–0.044*		–0.149***	–0.139***			–0.118***		–0.129***
Total income (log of annual per capita expenditure)	0.025***	0.015***	0.019***	–0.038***		0.047***	0.051***	0.040***	0.037***	0.046***	0.049***	0.086***	0.020***	0.043***
Male full-time non-farm employment	0.044***	0.040***	0.009***	0.068***	0.051***	0.008*	0.032***	0.052***	0.015***	0.046***	0.044***	0.032***	0.045***	0.063***
Female full-time non-farm employment	0.021***	0.018***			0.023***		0.017***	0.028***	–0.013***	0.026***	0.011**	0.034***	0.078***	
Primary schooling of household head	0.020***	0.017***							0.018**	0.031***	0.011*			
Secondary schooling of household head	0.030***	0.028***	0.022***		0.037***	0.049***	0.015**				0.026***	0.039**		
Female-headed households	0.015***	0.019***	0.017***	0.022**	0.023***				0.028***	0.048***	0.023***		–0.037***	0.051***
Household size (adult equivalents)	–0.004***	–0.005***	–0.002***	–0.024***	–0.011***		-0.004**	-0.005***		–0.007***	–0.008***	–0.007***	–0.004**	–0.006***
Dependency ratio				–0.037*	–0.022**		0.021*			0.042***				
Cultivated land (ha)	–0.015***	–0.029***	–0.005**	–0.079***	–0.015***	–0.034***	-0.035***	-0.006***	–0.001*	–0.002*	–0.026***	–0.028***	–0.173***	–0.017***
Tropical livestock units	–0.017***	–0.014***		–0.020***		–0.005**		–0.015***	–0.022***	–0.011***	–0.014***	–0.009***	–0.099***	–0.008**

NOTES: Regressions of the share of food purchases (for home consumption and food away from home) in total food consumption (at market value): marginal effects; significant results only (at 10 percent or lower); statistical significance is reported for *** p<0.01, ** p<0.05, * p<0.1. Marginal effects of prices and home assets are not shown (see source for full presentation of results). All surveys are 2018/19, except Malawi (2019/20). See Table A5.6 for the definition of food away from home, Table A5.1 for the list of 11 Western, Eastern and Southern African countries, and Table 10 for the definition of high- and low-food-budget countries.
SOURCE: Dolislager, M.J, Holleman, C., Liverpool-Tasie, L.S.O. & Reardon, T. (forthcoming). *Evidence and analysis of food demand and supply across the rural–urban continuum in selected countries in Africa.* Background paper for *The State of Food Security and Nutrition in the World 2023.* FAO Agricultural Development Economics Technical Study. Rome, FAO.

TABLE A7.2 THE NON-PRICE DETERMINANTS OF CONSUMPTION SHARES OF HIGHLY PROCESSED FOODS IN SELECTED HIGH- AND LOW-FOOD-BUDGET COUNTRIES IN AFRICA

		High-food-budget countries						Low-food-budget countries						
	All countries	High-food-budget countries	Senegal	Ethiopia	Côte d'Ivoire	Mali	Nigeria	Low-food-budget countries	Guinea-Bissau	Benin	Togo	Burkina Faso	Malawi	Niger
Large city (>1 million people)	0.006**	0.009***	0.009*		0.008*	0.015***		–0.004*	0	0.013***		0.027***		
Intermediate city (0.25–1 million people)	0.005*	0.008**							0.030***			0.018***		
Small city (50–250 thousand people)					0.011***				0.031**	0.016***		0.023***		
<1 hour to a large city			0.019***					–0.009***		0.007**	–0.008*	0.009**		–0.013***
<1 hour to an intermediate city	–0.011***	–0.010***	–0.020***					–0.015***		–0.009**			–0.007***	–0.023***
<1 hour to a small city	–0.011***	–0.012***				–0.009**		–0.007***				0.010***	–0.011***	–0.010**
<1 hour to a town	–0.008**	–0.009**			–0.011***	–0.010**		–0.014***					–0.008**	
1–2 hours to a city or town	–0.005**	–0.011***	–0.025***		–0.005*	–0.014***		–0.008***				0.012***	–0.012***	–0.020***
>2 hours to a city or town		–0.017***				–0.023***		0.018***	0.022**					–0.010**
Total income (log of annual per capita expenditure)	0.014***	0.014***	–0.006*	0.008***	0.009***	0.017***	0.004**	0.019***	0.047***	0.014***	0.006***	0.015***	0.027***	
Male full-time non-farm employment	0.005***	0.005***	0.003***	0.005***	0.005***	0.002**		0.004***		0.004***		0.003*	0.006***	0.005***
Female full-time non-farm employment	0.004***	0.005***	0.005***	0.002*		0.002**	0.002**				0.003**		0.005***	0.007***
Primary schooling of household head	0.004***	0.006***	0.012***	–0.004*				–0.003**			–0.009***		0.004**	0.006*
Secondary schooling of household head	–0.004***	–0.004***												
Female-headed households	0.002*	0.003**	0.017***	–0.003*	0.004**	0.006**	0.005**	–0.004***		0.007***			–0.007***	
Household size (adult equivalents)	–0.000**		–0.001*		–0.003***		–0.003***	0.000***	0.002***	–0.001**		–0.001***	0.003***	–0.003***
Dependency ratio	0.014***	0.013***	0.023***		0.009**	0.019***	0.012***	0.015***	0.028***	0.017***	0.006*	0.015***	0.007***	
Cultivated land (ha)	0.002***	0.004***	–0.005**		–0.001**							–0.005***	–0.012***	
Tropical livestock units	–0.005***	–0.006***		–0.002**		–0.001***			–0.003**		–0.003**			

NOTES: Regressions of the share of highly processed foods in total food consumption (at market value): marginal effects; significant results only (at 10 percent or lower); statistical significance is reported for *** p<0.01, ** p<0.05, * p<0.1. Marginal effects of prices and home assets are not shown (see source for full presentation of results). All surveys are 2018/19, except Malawi (2019/20). See Table A5.4 for full definition of highly processed foods, Table A5.1 for the list of 11 Western, Eastern and Southern African countries, and Table 10 for the definition of high- and low-food-budget countries.

SOURCE: Dolislager, M.J, Holleman, C., Liverpool-Tasie, L.S.O. & Reardon, T. (forthcoming). *Evidence and analysis of food demand and supply across the rural–urban continuum in selected countries in Africa.* Background paper for *The State of Food Security and Nutrition in the World 2023.* FAO Agricultural Development Economics Technical Study. Rome, FAO.

TABLE A7.3 THE NON-PRICE DETERMINANTS OF CONSUMPTION SHARES OF ANIMAL SOURCE FOODS IN SELECTED HIGH- AND LOW-FOOD-BUDGET COUNTRIES IN AFRICA

	All countries	High-food-budget countries						Low-food-budget countries						
		High-food-budget countries	Senegal	Ethiopia	Côte d'Ivoire	Mali	Nigeria	Low-food-budget countries	Guinea-Bissau	Benin	Togo	Burkina Faso	Malawi	Niger
Large city (>1 million people)	0.014**	0.017**	–0.014*			–0.028***				0.021**				–0.024*
Intermediate city (0.25–1 million people)										0.023**				
Small city (50–250 thousand people)						–0.017*	0.019*			0.018**				
<1 hour to a large city			–0.016**		0.024**		0.015*					–0.032***		
<1 hour to an intermediate city	0.013**	0.011*	–0.025***	0.030**		–0.024**	0.023**					0.025**	-0.026***	
<1 hour to a small city	0.010*	0.012*		0.039***			0.025**				–0.028***			
<1 hour to a town	0.038***	0.045***			–0.027***					0				
1–2 hours to a city or town	0.021***	0.028***				–0.018*	0.036**			0.020*				
>2 hours to a city or town	0.020***	0.064***						–0.015**		0				
Total income (log of annual per capita expenditure)	0.061***	0.056***	0.113***	0.051***	0.108***	0.112***	0.035***	0.081***	0.105***	0.069***	0.057***	0.058***	0.083***	0.123***
Male full-time non-farm employment	0.002*				0.006**								0.005**	
Female full-time non-farm employment	0.009***	0.009***	0.004**			–0.005*	0.005**	0.007***		0.005***	0.006**	0.008***	0.005*	
Primary schooling of household head	0.014***	0.012***						0.011***			0.009**			
Secondary schooling of household head							0.008**	0.006***	–0.010*	0.010**	–0.009*	0.015**		
Female-headed households			0.008**			–0.012*		–0.013***		–0.010**			–0.018***	–0.019***
Household size (adult equivalents)	0.003***	0.004***	0.004***	0.013***	0.007***	0.003***		0.002***	0.003***	0.002***	0.002**		0.008***	0.004***
Dependency ratio	0.043***	0.045***	0.073***	0.047***	0.076***	0.052***	0.016**	0.033***	0.022**	0.042***	0.048***	0.048***	0.026***	0.046***
Cultivated land (ha)	0.004***	0.009***	–0.007***	–0.034***		–0.005**							–0.024**	
Tropical livestock units	0.004***	0.004***		0.011***		0.008***		0.006***	0.003*	0.005***	0.011***	0.008***	0.023**	0.012***

NOTES: Regression of the share of animal products in total food consumption (at market value): marginal effects; significant results only (at 10 percent or lower); statistical significance is reported for *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Marginal effects of prices and home assets are not shown (see source for full presentation of results). All surveys are 2018/19, except Malawi (2019/20). See Table A5.6 for details on composition of animal source foods, see Table A5.1 for the list of 11 Western, Eastern and Southern African countries, and Table 10 for the definition of high- and low-food-budget countries.
SOURCE: Dolislager, M.J, Holleman, C., Liverpool-Tasie, L.S.O. & Reardon, T. (forthcoming). *Evidence and analysis of food demand and supply across the rural–urban continuum in selected countries in Africa.* Background paper for *The State of Food Security and Nutrition in the World 2023.* FAO Agricultural Development Economics Technical Study. Rome, FAO.

TABLE A7.4 THE NON-PRICE DETERMINANTS OF THE CONSUMPTION SHARES OF FOOD AWAY FROM HOME IN SELECTED HIGH- AND LOW-FOOD-BUDGET COUNTRIES IN AFRICA

	All countries	High-food-budget countries						Low-food-budget countries						
		High-food-budget countries	Senegal	Ethiopia	Côte d'Ivoire	Mali	Nigeria	Low-food-budget countries	Guinea-Bissau	Benin	Togo	Burkina Faso	Malawi	Niger
Large city (>1 million people)	0.022***	0.024**	0.044***		0.038***	0.008**		0.030***			0.035***	0.027***		0.057***
Intermediate city (0.25–1 million people)	0.020**	0.030**			0.016**				0.033**	0.036***		0.023**		
Small city (50–250 thousand people)				0.096**	0.014**				0.040*		–0.013*	0.015***		0.014**
<1 hour to a large city				0.070*	0.010*	0.013***					–0.012*	0.013**	0.024**	
<1 hour to an intermediate city				0.082***	–0.009*	0.012**	–0.029**	–0.021***			–0.032***	0.015*		
<1 hour to a small city	–0.013**			0.089***	–0.017***			–0.019***		–0.024***	–0.047***			–0.009***
<1 hour to a town	–0.033***	–0.036***		0	–0.033***			–0.018***						
1–2 hours to a city or town	–0.022***	–0.020**		0.219***	–0.023***			–0.024***		–0.028***	–0.040***			–0.009**
>2 hours to a city or town	–0.041***	–0.042***				–0.005*	0	–0.017***				–0.019*		–0.007*
Total income (log of annual per capita expenditure)	0.025***	0.026***	–0.017***	0.028***	–0.018***	0.012***	0.093***	0.002**	–0.014***	–0.014***	–0.014***	0.013***	0.010***	–0.010***
Male full-time non-farm employment	0.015***	0.016***	0.008***	0.013**	0.012***	0.004***	0.016***	0.009***	0.008***	0.010***	0.014***	0.011***	0.002**	0.007***
Female full-time non-farm employment				–0.011*	0.003**		–0.009***	0.004***						0.005***
Primary schooling of household head	0.031***	0.032***	0.007*		0.007***	0.003*		0.004***	0.011***	0.010***		0.007**		0.005**
Secondary schooling of household head					0.005*								–0.002*	
Female-headed households	–0.022***	–0.026***		–0.014***			–0.035***	–0.003***			–0.017***	–0.009***	–0.002***	0.006**
Household size (adult equivalents)	–0.004***	–0.005***	–0.006***	–0.004***	–0.007***	0.000**		–0.003***	–0.002***	–0.002***	–0.006***	–0.003***	–0.001***	–0.003***
Dependency ratio	–0.023***	–0.025***	–0.076***	–0.013*	–0.058***	–0.015***		–0.020***	–0.054***	–0.028***	–0.047***	–0.034***		–0.014***
Cultivated land (ha)	–0.003*	–0.007**			–0.003**		–0.017**				–0.012***	–0.011***	–0.015***	
Tropical livestock units	–0.014***	–0.017***		–0.005**		–0.001***				–0.006***				

NOTES: Regression of the share of food away from home in total food consumption (at market value): marginal effects; significant results only (at 10 percent or lower); statistical significance is reported for *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Marginal effects of prices and home assets are not shown (see source for full presentation of results). All surveys are 2018/19, except Malawi (2019/20). Food away from home is prepared food consumed away from home. See Table A5.6 for details on definition of food away from home, see Table A5.1 for the list of 11 Western, Eastern and Southern African countries, and Table 10 for the definition of high- and low-food-budget countries.
SOURCE: Dolislager, M.J, Holleman, C., Liverpool-Tasie, L.S.O. & Reardon, T. (forthcoming). *Evidence and analysis of food demand and supply across the rural–urban continuum in selected countries in Africa.* Background paper for *The State of Food Security and Nutrition in the World 2023.* FAO Agricultural Development Economics Technical Study. Rome, FAO.

TABLE A7.5 THE NON-PRICE DETERMINANTS OF THE CONSUMPTION SHARES OF VEGETABLES IN SELECTED HIGH- AND LOW-FOOD-BUDGET COUNTRIES IN AFRICA

		High-food-budget countries						Low-food-budget countries						
	All countries	High-food-budget countries	Senegal	Ethiopia	Côte d'Ivoire	Mali	Nigeria	Low-food-budget countries	Guinea-Bissau	Benin	Togo	Burkina Faso	Malawi	Niger
Large city (>1 million people)	0.025***	0.027***		0.096***		0.022***	0.031***	0.016***				0.027***		
Intermediate city (0.25–1 million people)	0.017***	0.015*					0.023***	0.020***	0.020*					0.036***
Small city (50–250 thousand people)	0.021***	0.024***				0.018***	0.027***	0.013***	0.031**			0.021***		
<1 hour to a large city	0.012**	0.019***					0.024***	0.009**	0.036***	0.006*		0.031***		0.026**
<1 hour to an intermediate city	0.013**	0.020***	0.008*			0.029***	0.023***					0.018*	0.021*	
<1 hour to a small city			–0.008**			0.012**								
<1 hour to a town					0.011*			–0.022***						
1–2 hours to a city or town			–0.020***					–0.009**		–0.017***				–0.014*
>2 hours to a city or town								–0.012***				0.039***		
Total income (log of annual per capita expenditure)	–0.016***	–0.012***		–0.033***	–0.013***	0.007**	–0.017***	–0.023***	0.009***	–0.015***	–0.023***		–0.059***	0.024***
Male full-time non-farm employment	–0.003***	–0.004***			–0.005***	0.004***	–0.004***							
Female full-time non-farm employment			0.002***			0.002*			0.002**	0.003***	0.003**			
Primary schooling of household head	–0.006***	–0.003*					0.007***		–0.006**					
Secondary schooling of household head	–0.006***	–0.004**						–0.007***						
Female-headed households	0.013***	0.012***		0.009***	0.007***		0.009***	0.017***	0.006**	0.011***	0.013***	0.014***	0.007***	0.017***
Household size (adult equivalents)	–0.004***	–0.003***	0.001***	–0.011***	–0.001***	–0.002***	–0.003***	–0.003***	–0.002***	–0.004***	–0.002***		–0.011***	
Dependency ratio			0.027***		0.013***	0.011*		–0.008***		–0.010***			–0.022***	0.016**
Cultivated land (ha)				0.019**		0.002**						0.005*	0.028***	
Tropical livestock units				–0.004*	–0.001***	–0.003***		–0.003***			–0.004***	–0.004***		–0.012***

NOTES: Regression of the share of vegetables in total food consumption (at market value): marginal effects; significant results only (at 10 percent or lower); statistical significance is reported for *** p<0.01, ** p<0.05, * p<0.1. Marginal effects of prices and home assets are not shown (see source for full presentation of results). All surveys are 2018/19, except Malawi (2019/20). See Table A5.6 for the definition of vegetables, see Table A5.1 for the list of 11 Western, Eastern and Southern African countries, and Table 10 for the definition of high- and low-food-budget countries.
SOURCE: Dolislager, M.J, Holleman, C., Liverpool-Tasie, L.S.O. & Reardon, T. (forthcoming). *Evidence and analysis of food demand and supply across the rural–urban continuum in selected countries in Africa.* Background paper for *The State of Food Security and Nutrition in the World 2023.* FAO Agricultural Development Economics Technical Study. Rome, FAO

ANNEX 8
METHODOLOGY USED FOR THE SUBNATIONAL ESTIMATION OF COST AND AFFORDABILITY OF A HEALTHY DIET USING HOUSEHOLD SURVEY DATA FOR SELECTED COUNTRIES IN AFRICA IN CHAPTER 4

The cost and affordability of a healthy diet in selected countries in Africa were estimated across URCAs applying the FAO Healthy Diet Basket (HDB) methodology, which comprises six food groups.[bl] However, results are not comparable with the global CoAHD indicators presented in **Chapter 2** (see Box A8.1). Food prices and income distributions were obtained from 11 household consumption and expenditure surveys conducted between 2018 and 2019 (Table A5.1).

The analysis took place in four stages. In the first stage, the household consumption and expenditure survey data were georeferenced using the URCA dataset. In the second stage, the prices of food items were derived from household food expenditure modules reporting the quantity bought and amount spent by households based on seven-day recall.[bm] Values were reported for specific food items, thus allowing for computing of the revealed price (i.e. the unit cost) by food item. The price for each food item was obtained as a geometric mean[bn] of the revealed prices in each URCA of each country. Note that food items not reported in a specific spatial unit were considered as not available in that area.

In the third stage, the food items for the subnational (i.e. at the URCA level) HDB were selected. The HDB composition was fixed in terms of daily caloric contribution of the six food groups, as per the HDB of the global CoAHD monitoring indicators, but the specific food items in the HDB were allowed to change across URCAs. More specifically, the least-cost item in each food group was selected in each URCA for each country. In this way, the composition of the HDB accounts for spatial variation in terms of prices and availability, as well as reflects items consumed by the population in each URCA.[bo] To compute the

bl For information on the HDB data and methodology and the HDB content by food group in terms of kcal, see FAO (2023).[53]

bm Expenditures were collected across different months, thus the effect of seasonality on the price level is averaged out. The least-cost items chosen for the HDB are therefore the least-cost items during the year.

bn Geometric mean was chosen because of the high fluctuation in the distribution of the unit costs of a food item across households in a specific URCA. Notice that high fluctuations for the same food item are not necessarily due to high volatility of market prices; rather, unit cost reflects price, quantity, and quality of a food item. In household surveys, items are not standardized as in the price data collection run by government, thus the quality and variety of a food item purchased likely change across households, reflecting access, availability and preferences.

bo For example, pork is selected as one of the two items in the animal source foods group in intermediate and small cities in Nigeria, but it is not in the baskets of peri-urban areas (<1 hour away) where "cheese *(wara)*" was picked.

BOX A8.1 METHODOLOGY – GLOBAL AND SUBNATIONAL ESTIMATION OF THE COAHD

The estimation of the global monitoring indicator of the cost and affordability of a healthy diet (CoAHD) (**Chapter 2**) and the subnational estimation by URCA in **Section 4.2** follow the same methodology. However, results are not comparable for three main reasons:

- **Food item prices.** In the global monitoring, prices from the World Bank International Comparison Program (ICP) are used, whereas prices used in the analysis presented in **Chapter 4** are computed from household surveys.
- **Income distribution.** In the global monitoring, the affordability indicator is computed using the estimated income distribution in a given country from the World Bank's Poverty and Inequality Platform (PIP); whereas total household expenditure used in the analysis presented in **Chapter 4** is computed from household survey data to estimate its distribution as a proxy for income distribution.
- **Percentage of income that can be credibly reserved for food.** In the global monitoring, this percentage is set equal to 52 percent – that is, the average percentage of income spent on food in low-income countries based on the national account expenditure data from the World Bank ICP. In the analysis of **Chapter 4**, on the other hand, the average food expenditure shares of households belonging to the lowest expenditure quintile in each URCA are applied.

cost of an item needed to meet the HDB caloric requirement, prices (as described above) and the nutrient conversion table developed for each survey (based mainly on the FAO/INFOODS Food Composition Table for Western Africa [2019]) were used.

In the final stage, the measure of affordability of a healthy diet was obtained by comparing the daily cost of the HDB with the daily per capita household income available for food. Total household expenditure, including value for own production, was used as a proxy for income. The share of expenditure that can be credibly reserved for food was set equal to the average food expenditure share of households belonging to the lowest quintile of the income distribution of each URCA. The choice i) aligns with the global CoAHD indicator methodology where the average food expenditure share of low-income countries is adopted, and ii) takes into account different levels of economic development across the rural–urban continuum.

When summary results are presented, averages across the rural–urban continuum URCA-defined categories are population weighted averages, while average across countries are simple averages, following the methodology used in **Chapter 2** for the calculation of regional CoAHD. ■

ANNEX 9
SUBNATIONAL COST AND AFFORDABILITY OF A HEALTHY DIET BY URBAN–RURAL CATCHMENT AREA IN SELECTED COUNTRIES IN AFRICA

Presented below are complementary results for the analysis of the cost and affordability of subnational healthy diet baskets in 11 Western, Eastern and Southern African countries (see Table A5.1 for list of countries).

Figure A9.1 shows the average share cost of each food group in a subnational healthy diet basket across ten URCA categories for high- and low-food-budget countries. ■

FIGURE A9.1 COST CONTRIBUTION OF EACH FOOD GROUP AS SHARE OF TOTAL COST OF A HEALTHY DIET IN SELECTED HIGH- AND LOW-FOOD-BUDGET COUNTRIES IN AFRICA ACROSS THE RURAL–URBAN CONTINUUM (URCA)

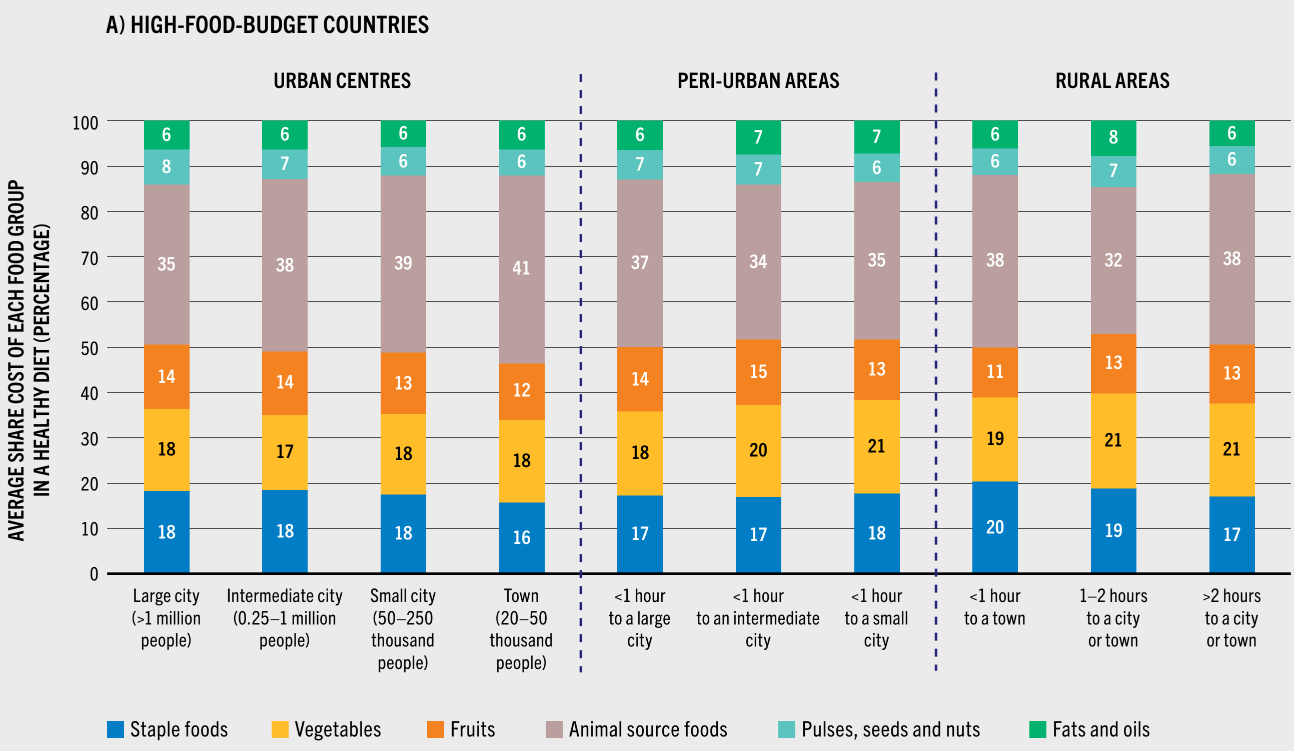
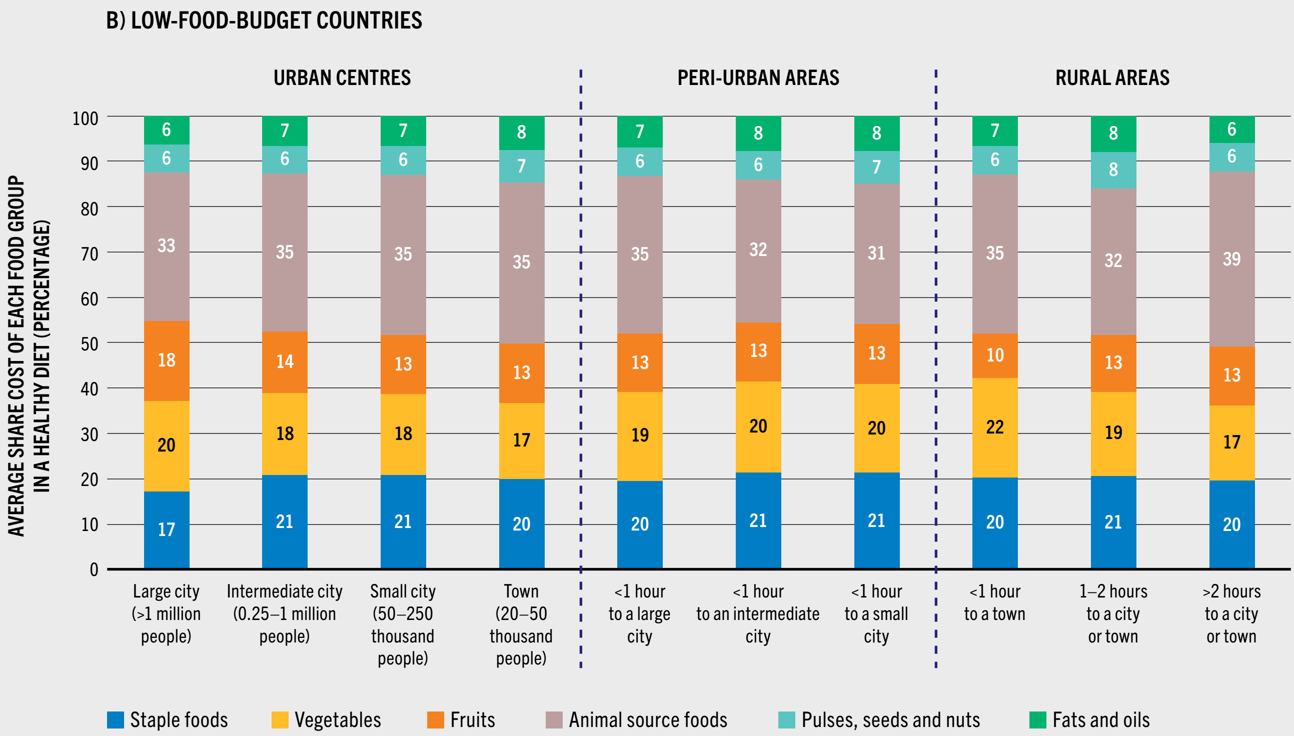


FIGURE A9.1 (Continued)



NOTES: All surveys are 2018/19, except Malawi (2019/20). See Table A5.1 for the list of 11 Western, Eastern and Southern African countries. See Table 10 for the definition and list of high- and low-food-budget countries.
SOURCE: Holleman, C. & Latino, L. (forthcoming). *Variations in the subnational cost and affordability of a heathy diet – Evidence from sub-Saharan Africa*. Background paper for *The State of Food Security and Nutrition in the World 2023*. FAO Agricultural Development Economics Working Paper. Rome, FAO.

TABLE A9.1 COMPARISON OF AVERAGE FOOD EXPENDITURE AND COST OF A HEALTHY DIET BASKET FOR SELECTED HIGH- AND LOW-FOOD-BUDGET COUNTRIES IN AFRICA

	Total household food consumption	Average cost of a healthy diet	Ratio of cost of a healthy diet to average food consumption
	(PPP dollars per person per day)		
HIGH-FOOD-BUDGET COUNTRIES	**2.34**	**2.00**	**0.86**
Senegal	2.57	1.89	0.74
Ethiopia	2.44	2.36	0.97
Côte d'Ivoire	2.29	1.94	0.85
Mali	2.29	1.98	0.86
Nigeria	2.26	1.83	0.81
LOW-FOOD-BUDGET COUNTRIES	**1.62**	**1.61**	**1.00**
Guinea-Bissau	2.06	1.75	0.85
Benin	2.00	1.16	0.58
Togo	1.69	1.31	0.77
Burkina Faso	1.57	2.15	1.37
Malawi	1.52	1.25	0.82
Niger	1.46	2.03	1.39

NOTES: Average household food consumption and average cost of a healthy diet by high- and low-food-budget country and by country, expressed in PPP dollars per person per day (PPP = purchasing power parity), and the ratio of the cost of a healthy diet and average household food consumption. A ratio greater than 1 shows how many times a healthy diet is more expensive than the average food expenditure. All surveys are 2018/19, except Malawi (2019/20). See Table 10 for the definition and list of high- and low-food-budget countries.
SOURCE: Holleman, C. & Latino, L. (forthcoming). *Variations in the subnational cost and affordability of a heathy diet – Evidence from sub-Saharan Africa*. Background paper for *The State of Food Security and Nutrition in the World 2023*. FAO Agricultural Development Economics Working Paper. Rome, FAO.

TABLE A9.2 SUBNATIONAL COST OF A HEALTHY DIET IN SELECTED HIGH- AND LOW-FOOD-BUDGET COUNTRIES IN AFRICA ACROSS THE RURAL–URBAN CONTINUUM (URCA)

	High-food-budget countries					Low-food-budget countries					
	Senegal	Ethiopia	Côte d'Ivoire	Mali	Nigeria	Guinea-Bissau	Benin	Togo	Burkina Faso	Malawi	Niger
	(PPP dollars per person per day)					(PPP dollars per person per day)					
URBAN	**2.06**	**3.15**	**2.07**	**2.23**	**2.15**	**1.84**	**1.44**	**1.72**	**2.50**	**1.72**	**2.20**
Large city (>1 million people)	2.19	3.24	2.18	2.23	2.23	–	1.62	1.84	2.74	–	1.84
Intermediate city (0.25–1 million people)	1.80	3.60	1.98	2.20	2.09	1.85	1.46	1.95	2.14	1.71	2.09
Small city (50–250 thousand people)	1.93	2.87	1.99	2.25	2.16	1.79	1.27	1.33	2.34	1.68	2.39
Town (20–50 thousand people)	1.98	3.03	1.87	2.13	2.00	–	1.05	1.58	2.20	1.76	2.19
PERI-URBAN	1.75	2.21	1.91	1.90	1.73	1.95	1.05	1.03	2.09	1.21	2.03
<1 hour to a large city	1.81	2.65	2.05	2.20	2.03	2.06	1.22	1.09	2.11	1.75	2.25
<1 hour to an intermediate city	1.62	2.13	1.82	2.40	1.62	2.10	1.01	1.51	2.08	1.21	1.91
<1 hour to a small city	1.84	2.19	1.90	1.69	1.53	1.83	0.98	0.96	2.09	1.18	2.07
RURAL	1.71	2.28	1.85	1.87	1.64	1.57	1.00	1.07	1.97	1.18	1.98
<1 hour to a town	–	–	1.76	2.22	2.04	2.59	1.05	–	2.40	1.79	1.86
1–2 hours to a city or town	1.67	2.09	1.85	1.74	1.57	1.54	0.99	1.07	1.96	1.12	1.93
>2 hours to a city or town	2.29	2.70	2.16	2.20	2.70	1.53	–	–	1.80	2.16	2.06

NOTES: PPP = purchasing power parity. Cost in URCAs with fewer than 30 observations is not shown. In Ethiopia, cost of heathy diet basket in areas 1 hour travel or less to a town was not computed for price unavailability. All surveys are for 2018/19, except Malawi (2019/20). See Table 10 for the definition and list of high- and low-food-budget countries.
SOURCE: Holleman, C. & Latino, L. (forthcoming). *Variations in the subnational cost and affordability of a heathy diet – Evidence from sub-Saharan Africa*. Background paper for *The State of Food Security and Nutrition in the World 2023*. FAO Agricultural Development Economics Working Paper. Rome, FAO.

TABLE A9.3 AFFORDABILITY OF A HEALTHY DIET IN SELECTED HIGH- AND LOW-FOOD-BUDGET COUNTRIES IN AFRICA ACROSS THE RURAL–URBAN CONTINUUM (URCA)

	High-food-budget countries					Low-food-budget countries					
	Senegal	Ethiopia	Côte d'Ivoire	Mali	Nigeria	Guinea-Bissau	Benin	Togo	Burkina Faso	Malawi	Niger
	(%)					(%)					
URBAN	**18.1**	**57.1**	**18.4**	**18.3**	**35.9**	**29.9**	**12.8**	**33.3**	**52.6**	**54.2**	**47.4**
Large city (>1 million people)	17.7	51.3	13.9	19.2	27.6	–	20.2	35.8	52.6	–	16.2
Intermediate city (0.25–1 million people)	14.9	73.4	23.6	14.9	47.9	30.5	7.4	46.8	55.0	51.1	37.3
Small city (50–250 thousand people)	21.3	45.8	21.9	18.6	32.5	26.2	6.7	23.8	48.6	52.9	58.0
Town (20–50 thousand people)	22.2	77.1	25.4	14.2	41.3	–	7.8	26.1	56.3	67.5	68.3
PERI-URBAN	41.5	72.2	39.7	33.8	48.4	53.6	10.9	25.6	79.2	68.8	76.7
<1 hour to a large city	35.9	61.2	27.9	32.7	39.7	47.1	13.9	26.7	79.4	67.1	63.1
<1 hour to an intermediate city	42.0	70.4	39.7	52.3	51.6	56.3	13.1	27.2	68.9	70.5	68.6
<1 hour to a small city	45.6	74.7	42.3	31.2	54.5	52.9	9.2	24.9	80.2	65.6	85.7
RURAL	45.3	70.1	40.8	38.5	46.0	40.3	16.4	33.5	74.9	67.8	84.9
<1 hour to a town	–	–	47.3	45.4	66.7	75.3	19.3	–	68.1	85.4	83.0
1–2 hours to a city or town	44.0	60.7	39.9	35.9	44.3	42.6	15.8	33.5	74.7	66.2	83.3
>2 hours to a city or town	64.7	91.0	47.1	46.0	51.6	28.6	–	–	79.4	95.3	87.5

NOTES: Cost in URCAs with fewer than 30 observations is not shown. In Ethiopia, cost of heathy diet basket in areas 1 hour travel or less to a town was not computed for price unavailability. All surveys are for 2018/19, except Malawi (2019/20). See Table 10 for the definition and list of high- and low-food-budget countries.

SOURCE: Holleman, C. & Latino, L. (forthcoming). *Variations in the subnational cost and affordability of a heathy diet – Evidence from sub-Saharan Africa*. Background paper for *The State of Food Security and Nutrition in the World 2023*. FAO Agricultural Development Economics Working Paper. Rome, FAO.

ANNEX 10
FOOD INSECURITY AND MALNUTRITION ACROSS THE RURAL–URBAN CONTINUUM (URCA) FOR SELECTED COUNTRIES IN AFRICA

TABLE A10.1 MODERATE OR SEVERE FOOD INSECURITY BASED ON THE FOOD INSECURITY EXPERIENCE SCALE ACROSS THE RURAL–URBAN CONTINUUM (URCA) FOR SELECTED HIGH- AND LOW-FOOD-BUDGET COUNTRIES IN AFRICA

	High-food-budget countries			Low-food-budget countries					
	Senegal	Côte d'Ivoire	Nigeria	Guinea-Bissau	Benin	Togo	Burkina Faso	Malawi	Niger
	(%)			(%)					
URBAN									
Large city (>1 million people)	36.2	43.3	52.6		64.5	50.8	44.4		37.8
	(±6.1)	(±7.2)	(±6.4)		(±5.0)	(±5.2)	(±6.3)		(±8.)
Intermediate city (0.25–1 million people)	45.0	36.8	44.7	51.7	74.8	56.6	37.4	55.9	42.2
	(±6.9)	(±8.8)	(±9.3)	(±5.0)	(±7.1)	(±21.2)	(±10.0)	(±6.6)	(±6.9)
Small city (50–250 thousand people)	37.1	36.9	34.2	54.5	63.1	61.3	33.9	57.4	48.2
	(±4.1)	(±7.2)	(±7.0)	(±10.0)	(±7.5)	(±6.7)	(±8.3)	(±9.7)	(±6.8)
Town (20–50 thousand people)	45.8	39.6	25.1	67.9	68.2	62.3	34.9	52.7	51.5
	(±6.2)	(±8.0)	(±14.0)		(±9.3)	(±14.7)	(±9.0)	(±11.7)	(±16.2)
PERI-URBAN									
<1 hour to a large city	35.1	40.2	43.6	64.1	67.7	62.2	36.2	60.6	50.4
	(±6.0)	(±8.3)	(±4.7)	(±15.1)	(±4.3)	(±6.3)	(±8.3)	(±14.6)	(±7.5)
<1 hour to an intermediate city	43.3	39.9	51.4	66.8	75.8	59.2	41.3	83.9	50.8
	(±6.1)	(±6.5)	(±5.2)	(±6.6)	(±9.9)	(±12.3)	(±10.2)	(±2.2)	(±7.6)
<1 hour to a small city	40.5	40.5	41.8	61.1	64.2	61.8	34.6	78.2	45.8
	(±5.2)	(±2.8)	(±6.4)	(±5.7)	(±3.0)	(±3.5)	(±4.0)	(±2.0)	(±6.3)
RURAL									
<1 hour to a town	18.8	41.0	61.4	73.5	65.1	56.6	45.5	79.2	62.5
		(±9.2)	(±15.8)		(±16.6)	(±31.8)	(±19.7)	(±6.8)	(±22.3)
1–2 hours to a city or town	40.4	40.4	37.8	66.5	70.8	66.0	41.9	81.2	42.5
	(±6.4)	(±2.9)	(±11.3)	(±4.9)	(±6.4)	(±8.1)	(±5.9)	(±1.5)	(±5.2)
>2 hours to a city or town	22.6	44.7	37.7	68.8	63.9	73.4	35.5	87.6	43.3
	(±16.4)	(±22.3)	(±16.5)	(±5.5)			(±17.5)		(±6.1)

NOTES: Margins of error are shown in parentheses and are not shown for sample size <100. They are not computed for sample size <30, except for Malawi, where the sample size is 80. All surveys are for 2018/19, except Malawi (2019/20). See Table 10 for the definition and list of high- and low-food-budget countries.
SOURCE: Authors' (FAO) own elaboration.

TABLE A10.2 SEVERE FOOD INSECURITY BASED ON THE FOOD INSECURITY EXPERIENCE SCALE ACROSS THE RURAL–URBAN CONTINUUM (URCA) IN SELECTED HIGH- AND LOW-FOOD-BUDGET COUNTRIES IN AFRICA

	High-food-budget countries			Low-food-budget countries					
	Senegal	Côte d'Ivoire	Nigeria	Guinea-Bissau	Benin	Togo	Burkina Faso	Malawi	Niger
	(%)			(%)					
URBAN									
Large city (>1 million people)	7.3	11.0	15.2		14.5	10.7	8		8.1
	(±2.6)	(±4.3)	(±4.0)		(±2.5)	(±2.6)	(±1.3)		(±2.9)
Intermediate city (0.25–1 million people)	9.1	6.3	13.8	6.4	23.4	14.8	5.7	29.2	9.3
	(±1.8)	(±5.4)	(±8.1)	(±2.7)	(±5.0)	(±17.5)	(±2.3)	(±5.1)	(±2.2)
Small city (50–250 thousand people)	7.2	8.0	6.5	6.5	13.5	16.4	6.5	31.9	8.4
	(±0.8)	(±2.9)	(±4.8)	(±6.0)	(±5.9)	(±2.5)	(±6.0)	(±9.5)	(±2.8)
Town (20–50 thousand people)	12.1	8.0	5.4	4.6	17.4	14.2	4.7	29.2	8.1
	(±1.3)	(±2.9)	(±5.9)		(±6.2)	(±4.8)	(±3.9)	(±11.2)	(±4.0)
PERI-URBAN									
<1 hour to a large city	7.5	11.2	12.3	6.6	16.2	14.0	4.8	37.9	9.6
	(±1.8)	(±3.9)	(±2.9)	(±4.8)	(±3.2)	(±4.0)	(±3.9)	(±13.1)	(±1.5)
<1 hour to an intermediate city	11.1	9.7	16.0	10.9	20.9	15.6	7.2	53.8	11.0
	(±2.3)	(±4.0)	(±4.5)	(±3.1)	(±4.3)	(±4.8)	(±4.9)	(±2.6)	(±3.3)
<1 hour to a small city	7.5	9.3	10.9	7.1	15.9	16.6	5.2	48.5	8.2
	(±2.4)	(±1.2)	(±5.8)	(±3.0)	(±2.3)	(±2.0)	(±1.9)	(±3.0)	(±2.0)
RURAL									
<1 hour to a town	3.6	11.4	20.1	8.5	14.8	17.1	9.7	51.3	17.2
		(±2.6)	(±7.3)		(±11.1)	(±10.2)	(±10.1)	(±8.0)	(±6.0)
1–2 hours to a city or town	9.5	9.1	13.9	10.9	18.9	17.9	6.9	51.0	8.2
	(±3.1)	(±1.5)	(±9.3)	(±4.0)	(±4.4)	(±3.5)	(±3.2)	(±2.9)	(±3.0)
>2 hours to a city or town	7.6	11.9	9.6	12.5	7.4	18.0	6.9	53.0	9.4
	(±13.8)	(±11.7)	(±8.0)	(±3.3)			(±4.3)		(±1.1)

NOTES: Margins of error are shown in parentheses and are not shown for sample size <100. They are not computed for sample size <30, except for Malawi, where the sample size is 80. All surveys are for 2018/19, except Malawi (2019/20). See Table 10 for the definition and list of high- and low-food-budget countries.
SOURCE: Authors' (FAO) own elaboration.

TABLE A10.3 PREVALENCE OF MALNUTRITION IN CHILDREN UNDER FIVE YEARS OF AGE ACROSS THE RURAL–URBAN CONTINUUM (URCA) FOR THREE COUNTRIES IN AFRICA

	Stunting			Wasting			Overweight		
	Senegal	Nigeria	Benin	Senegal	Nigeria	Benin	Senegal	Nigeria	Benin
	(%)			(%)			(%)		
URBAN									
Large city (>1 million people)	13.3	23.2	21.1	5.0	5.0	5.5	2.0	2.5	1.6
Intermediate city (0.25–1 million people)	12.5	25.2	23.6	7.5	3.8	4.7	1.8	2.3	1.9
Small city (50–250 thousand people)	15.8	28.9	21.9	7.0	6.5	5.3	2.7	2.6	2.9
Town (20–50 thousand people)	7.8	31.0	29.1	7.1	5.3	5.9	0.0	1.5	1.8
PERI-URBAN									
<1 hour to a large city	19.3	36.4	31.9	8.4	6.1	4.1	1.0	1.2	1.4
<1 hour to an intermediate city	24.7	39.5	35.5	7.1	7.5	5.0	1.7	2.4	1.4
<1 hour to a small city	21.4	50.1	35.4	8.1	9.4	4.5	1.2	2.0	1.9
RURAL									
<1 hour to a town	4.5	62.5	37.7	9.1	0.0	4.4	4.5	0.0	2.9
1–2 hours to a city or town	25.1	51.7	34.5	12.2	7.7	6.4	0.7	2.7	2.0
>2 hours to a city or town	23.2	44.2	53.1	11.6	3.1	2.0	1.3	0.0	0.0

NOTE: Prevalence of malnutrition in children under five years of age in three Western African countries, by URCA (2018).
SOURCE: Authors' (UNICEF) own elaboration.

ANNEX 11
GLOSSARY

Acute food insecurity
Food insecurity found in a specified area at a specific point in time and of a severity that threatens lives or livelihoods, or both, regardless of the causes, context or duration. Has relevance in providing strategic guidance to actions that focus on short-term objectives to prevent, mitigate or decrease severe food insecurity.[54]

Affordability
Affordability refers to the ability of people to buy foods in their local environment. In this report, cost refers to what people have to pay to secure a healthy diet, while affordability refers to the cost relative to a person's income, minus other required expenses. In **Section 2.2**, affordability is determined by comparing the cost of a healthy diet with income distributions available in the Poverty and Inequality Platform (PIP) of the World Bank. This allows to compute the percentage and number of people in each country who are not able to afford a healthy diet.[bp]

Agrifood systems
Agrifood systems, a term increasingly used in the context of transforming food systems for sustainability and inclusivity, are broader as they encompass both agricultural and food systems and focus on both food and non-food agricultural products, with clear overlaps. Agrifood systems encompass the entire range of actors and their interlinked value-adding activities involved in the production, aggregation, processing, distribution, consumption and disposal of food products. They comprise all food products that originate from crop and livestock production, forestry, fisheries and aquaculture, as well as the broader economic, societal and natural environments in which these diverse production systems are embedded.

Animal source foods
All types of meat, poultry, fish, shellfish, insects, grubs, eggs, milk, cheese, yoghurt and other milk products.[47, 55]

Catchment areas
In this report, catchment areas refer to rural locations that gravitate around a specific urban centre in terms of access to markets, services and employment opportunities. The concept is based on the Central Place Theory (CPT),[56] which incorporates the functional interdependence between a central place (i.e. a town or an urban centre) and its surrounding rural area along with the hierarchical level of the central place's goods and services.[36]

Climate
Climate in a narrow sense is usually defined as the average weather, or more rigorously, as the statistical description in terms of the mean and variability of relevant quantities over a period of time ranging from months to thousands or millions of years.[57]

Climate change
Climate change refers to a change in the state of the climate that can be identified (e.g. by using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer.[57]

Climate extreme (extreme weather or climate event)
The occurrence of a value of a weather or climate variable above (or below) a threshold value near the upper (or lower) ends of the range of observed values of the variable. For simplicity, both extreme weather events and extreme climate events are referred to collectively as "climate extremes".[58]

Climate shocks
Climate shocks include not only those disturbances in the usual pattern of rainfall and temperatures but also complex events like droughts and floods. Equivalent to the concept of a natural hazard or stress, they are exogenous events that can have a negative impact on food security and nutrition, depending on the vulnerability of an individual, a household, a community, or systems to the shock.[59, 60, 61, 62]

Climate variability
Refers to variations in the mean state and other statistics (standard deviations, the occurrence of extremes, etc.) of the climate on all spatial and temporal scales beyond that of individual weather events. Variability may be due to natural internal processes within the climate system (internal variability), or to variations in natural or anthropogenic external forcing (external variability).[57]

bp See **Annex 2**, **Section D** for the full description of the methodology.

Conflict
Conflict as used in this report is defined as struggles between interdependent groups that have either actual or perceived incompatibilities with respect to needs, values, goals, resources or intentions. This definition includes (but is broader than) armed conflict – that is, organized collective violent confrontations between at least two groups, either state or non-state actors.

Diet quality
Comprised of four key aspects: variety and/or diversity (within and across food groups), adequacy (sufficiency of nutrients or food groups compared to requirements), moderation (foods and nutrients that should be consumed with restraint) and overall balance (composition of macronutrient intake). Exposure to food safety hazards is another important quality aspect.

Dietary energy requirements
The amount of dietary energy, measured in kilojoules or kilocalories (often referred to as calories), required by an individual to maintain body functions, health and normal activity. Dietary energy requirements are dependent upon age, sex, body size and level of physical activity. Additional energy is required to support optimal growth and development in children and in women during pregnancy, and for milk production during lactation, consistent with the good health of mother and child.

Downstream food supply chains
Downstream food supply chains involve those segments more directly related to consumer purchases, that is marketing, retail and trade.

Drought
A period of abnormally dry weather lasting long enough to cause a serious hydrological imbalance.[57]

Economic downturn
Refers to a period of decline in economic activity or negative growth as measured by the growth rate in real GDP. It is a synonym for economic recession, a temporary or short-term downturn in economic growth, usually occurring over at least two consecutive quarters of decline. In the analyses and figures presented in this report, an economic downturn is identified using the year as a period of reference.

Economic shock
An unexpected or unpredictable event that is external to the specific economy and can either harm or boost it. A global financial crisis causing bank lending or credit to fall, or an economic downturn in a major trading partner of a country reflect demand-side shocks that can have multiple effects on spending and investment. A steep rise in oil and gas prices, natural disasters that result in sharp falls in production, or conflict that disrupts trade and production, are examples of supply-side shocks.

Economic slowdown
Refers to economic activity that is growing at a slower pace compared with the previous period. An economic slowdown occurs when real GDP growth declines from one period to another, but it is still positive. In the analyses and figures presented in this report, an economic slowdown is identified using the year as the period of reference, although it is usually measured in quarters of a year.

Energy-dense foods
Food with a high content of calories (energy) with respect to its mass or volume.

Extreme poverty
Refers to the percentage of people living on less than USD 2.15 a day (2017 PPP prices) in a country in a given year.[33]

Extreme weather or climate event
The occurrence of a value of a weather or climate variable above (or below) a threshold value near the upper (or lower) ends of the range of observed values of the variable. Many weather and climate extremes are the result of natural **climate variability**, and natural decadal or multi-decadal variations in the climate provide the backdrop for anthropogenic **climate changes**. Even if there were no anthropogenic changes in climate, a wide variety of natural weather and climate extremes would still occur.

Fiscal subsidies
Fiscal subsidies are budget transfers made by governments in the context of policy measures, projects and programmes to individual actors of the food and agriculture sector, such as farmers (fiscal subsidies to producers) or consumers

(fiscal subsidies to consumers). Fiscal subsidies to producers aim to reduce production costs or increase farm income and can be granted depending on output, input use or use of other factors of production. Fiscal subsidies to consumers include transfers under social protection programmes (given to final consumers) and food subsidies to lower the cost of food (provided to intermediaries such as processors, traders, transporters).

Flood

The overflowing of the normal confines of a stream or other body of water, or the accumulation of water over areas not normally submerged. Floods include river (fluvial) floods, flash floods, urban floods, pluvial floods, sewer floods, coastal floods and glacial lake outburst floods.[57]

Food and agricultural marketing

This includes collective schemes for post-production facilities and other services designed to improve the marketing environment for food and agriculture – it includes all the stages of a product value chain, from farm input supply to retail markets. For example, these services may include commodity grading schemes or agricultural machinery services. They may be services related to post-harvest losses, lower transaction costs, facilitating market exchange and trade, and strengthening or expanding supply networks.

Food away from home

Food away from home includes all meals (breakfast and brunch, lunch, dinner and snacks and non-alcoholic beverages) – including fast food, takeouts and deliveries – consumed at concession stands, buffets and cafeterias, and full-service restaurants, and meals purchased at vending machines or from mobile vendors. Also included are board (including at school); meals as pay; special catered events, such as weddings, bar mitzvahs and confirmations; school lunches; and meals away from home on trips.[bq]

bq Please see **Annex 5, Section C** for the definition of food away from home used in the analysis presented in **Chapter 4**.

Food environment

The food environment is the physical, economic, political and sociocultural context in which consumers engage with agrifood systems to make decisions about acquiring, preparing and consuming food.[63]

Food Insecurity Experience Scale (FIES)

An experience-based food security scale used to produce a measure of access to food at different levels of severity that can be compared across contexts. It relies on data obtained by asking people, directly in surveys, about the occurrence of conditions and behaviours that are known to reflect constrained access to food.

Food security

A situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life. Based on this definition, four food security dimensions can be identified: food availability, economic and physical access to food, food utilization and stability over time. The concept of food security is evolving to recognize the centrality of agency and sustainability. See below for the definition of these two additional elements.

Food security dimensions

In this report, food security dimensions refer to the four traditional dimensions of food security:

a. Availability – This dimension addresses whether or not food is actually or potentially physically present, including aspects of production, food reserves, markets and transportation, and wild foods.
b. Access – If food is actually or potentially physically present, the next question is whether or not households and individuals have sufficient physical and economic access to that food.
c. Utilization – If food is available and households have adequate access to it, the next question is whether or not households are maximizing the consumption of adequate nutrition and energy. Sufficient energy and nutrient intake by individuals is the result of good care and feeding practices, food preparation, dietary diversity and intra-household distribution of

food, and access to clean water, sanitation and healthcare. Combined with good biological utilization of food consumed, this determines the nutritional status of individuals.

d. Stability – If the dimensions of availability, access and utilization are sufficiently met, stability is the condition in which the whole system is stable, thus ensuring that households are food secure at all times. Stability issues can refer to short-term instability (which can lead to acute food insecurity) or medium- to long-term instability (which can lead to chronic food insecurity). Climatic, economic, social and political factors can all be a source of instability.

The report also refers to two additional dimensions of food security that are proposed by the High Level Panel of Experts (HLPE) of the Committee on World Food Security (CFS); however, they are not formally agreed upon by FAO or others, and there is not a negotiated agreed upon language. However, due to their relevance in the context of this report, they are included here. These two additional dimensions of food security are reinforced in conceptual and legal understandings of the right to food and are currently referred to and defined as follows:

e. Agency refers to the capacity of individuals or groups to make their own decisions about what foods they eat; what foods they produce; how that food is produced, processed and distributed within food systems; and their ability to engage in processes that shape food system policies and governance.[64]

f. Sustainability refers to the long-term ability of food systems to provide food security and nutrition in a way that does not compromise the economic, social and environmental bases that generate food security and nutrition for future generations.[64]

General services support (GSS)

Refers to public expenditure (or budget transfers) for the provision of public or collective goods and services that aim to create enabling and environmentally sustainable conditions for the food and agriculture sector. These services connect all economic actors of food supply chains and support the nexus between producers and consumers. The most common include research and development and knowledge transfer, inspection services, agricultural related infrastructure, public stockholding, and food and agricultural marketing, and promotion.

Governance

Governance refers to formal and informal rules, organizations, and processes through which public and private actors articulate their interests and make and implement decisions.[65]

Hazard

A process, phenomenon or human activity that may cause loss of life, injury or other health impacts, property damage, social and economic disruption or environmental degradation.[66]

Healthcare

The organized provision of medical care to individuals or a community. This includes services provided to individuals or communities by health service providers for the purpose of promoting, maintaining, monitoring or restoring health.

Healthy diets

Healthy diets: 1) start early in life with early initiation of breastfeeding, exclusive breastfeeding until six months of age, and continued breastfeeding until two years of age and beyond combined with appropriate complementary feeding; 2) are based on a great variety of unprocessed or minimally processed foods, balanced across food groups, while restricting highly processed food and drink products; 3) include wholegrains, legumes, nuts and an abundance and variety of fruits and vegetables; 4) can include moderate amounts of eggs, dairy, poultry and fish, and small amounts of red meat; 5) include safe and clean drinking water as the fluid of choice; 6) are adequate (i.e. reaching but not exceeding needs) in energy and nutrients for growth and development and meet the needs for an active and healthy life across the life cycle; 7) are consistent with WHO guidelines to reduce the risk of diet-related non-communicable diseases and ensure health and well-being for the general population; and 8) contain minimal levels or none, if possible, of pathogens, toxins and other agents that can cause foodborne disease. According to WHO, healthy diets include less than 30 percent of total energy intake from fats, with a shift in fat consumption away from saturated fats to unsaturated fats and the elimination of industrial trans fats; less than 10 percent of total energy intake from free sugars (preferably less than 5 percent); consumption of at least 400 g of fruits and vegetables per day; and not more than 5 g per day of salt (to be iodized).

Highly processed foods

Highly processed foods are foods that have been industrially prepared, including those from bakeries and catering outlets, and which require no or minimal domestic preparation apart from heating and cooking (such as bread, breakfast cereals, cheese, commercial sauces, canned foods including jams, commercial cakes, processed meats, biscuits and sauces).[41] Highly processed foods can contain very high quantities of salt, free sugars and saturated or trans fats and these products, when consumed in high amounts, can undermine diet quality.[br]

Hunger

Hunger is an uncomfortable or painful physical sensation caused by insufficient consumption of dietary energy. In this report, the term hunger is synonymous with chronic undernourishment and is measured by the prevalence of undernourishment (PoU).

Input subsidies

Government transfers to agricultural producers arising from policy measures based on farm use of inputs, or measures related to the provision of inputs.

Macronutrients

Macronutrients are needed in larger quantities (in gram range) and are the major source of energy and bulk (volume) in our diets. They include carbohydrates, protein and fats. They are a main source of dietary energy, which is measured in calories. Getting sufficient energy is essential for everyone in order to maintain body growth, development and good health. Carbohydrates, protein and fats, in addition to providing energy, each have very specific functions in the body and must be supplied in sufficient amounts to carry out those functions.

br For more details, please see **Annex 5, Section C**.

Malnutrition

An abnormal physiological condition caused by inadequate, unbalanced or excessive intake of macronutrients and/or micronutrients. Malnutrition includes undernutrition (child stunting and wasting, and vitamin and mineral deficiencies) as well as overweight and obesity.

Micronutrients

Micronutrients include vitamins and minerals and are required in very small (micro) but specific amounts. Vitamins and minerals in foods are necessary for the body to grow, develop and function properly, and are essential for our health and well-being. Our bodies require a number of different vitamins and minerals, each of which has a specific function in the body and must be supplied in different, sufficient amounts.

Midstream food supply chains

Midstream food supply chains comprise the post-farm gate activities related to the logistics, processing and wholesale of food. This includes cleaning, sorting, packaging, transportation, storage and wholesaling of agricultural and food products.

Moderate food insecurity

Refers to the level of severity of food insecurity, based on the Food Insecurity Experience Scale, at which people face uncertainties about their ability to obtain food and have been forced to reduce, at times during the year, the quality and/or quantity of food they consume due to lack of money or other resources. It thus refers to a lack of consistent access to food, which diminishes dietary quality, disrupts normal eating patterns, and can have negative consequences for nutrition, health and well-being.

Nutrition transition

As incomes rise and populations become more urban, diets high in complex carbohydrates and fibre give way to more energy-dense diets high in fats, sugars and/or salt. These global dietary trends are accompanied by a demographic transition with a shift towards increased life expectancy and reduced fertility rates. At the same time, disease patterns move away from infectious and nutrient-deficiency diseases towards higher rates of overweight and obesity and diet-related non-communicable diseases including coronary heart disease, stroke, diabetes and some types of cancer.

Nutritional status
The physiological state of an individual that results from the relationship between nutrient intake and requirements and the body's ability to digest, absorb and use these nutrients.

Nutritious foods
These are referred to as safe foods that contribute essential nutrients such as vitamins and minerals (micronutrients), fibre and other components to healthy diets that are beneficial for growth, and health and development, guarding against malnutrition. In nutritious foods, the presence of nutrients of public health concern including saturated fats, free sugars, and salt/sodium is minimized, industrially produced trans fats are eliminated, and salt is iodized.

Overweight and obesity
Defined as body weight that is above normal for height as a result of an excessive accumulation of fat. It is usually a manifestation of expending less energy than is consumed. In adults, overweight is defined as a body mass index (BMI) of 25 kg/m^2 or more, and obesity as a BMI of 30 kg/m^2 or more. In children under five years of age, overweight is defined as weight-for-height greater than 2 standard deviations above the WHO Child Growth Standards median, and obesity as weight-for-height greater than 3 standard deviations above the WHO Child Growth Standards median.[67]

Prevalence of undernourishment (PoU)
An estimate of the proportion of the population that lacks enough dietary energy for a healthy, active life. It is FAO's traditional indicator used to monitor hunger at the global and regional level, as well as SDG Indicator 2.1.1.

Resilience
Resilience is the ability of individuals, households, communities, cities, institutions, systems and societies to prevent, resist, absorb, adapt, respond and recover positively, efficiently and effectively when faced with a wide range of risks, while maintaining an acceptable level of functioning and without compromising long-term prospects for sustainable development, peace and security, human rights and well-being for all.[68]

Risk
The probability or likelihood of occurrence of hazardous events or trends multiplied by the impacts if these events or trends occur. Risk to food insecurity is the probability of food insecurity resulting from interactions between a natural or human-induced hazard/shock/stress and vulnerable conditions.

Rural–urban continuum
Represents a different way of examining rural–urban spatial relationships across a continuum, rather than the more conventional rural/urban distinction. The rural–urban continuum views rural and urban areas not as separate spaces, but as two ends of a spectrum of settlements and catchment areas of different sizes and their linkages.

Severe food insecurity
The level of severity of food insecurity at which people have likely run out of food, experienced hunger and, at the most extreme, gone for days without eating, putting their health and well-being at grave risk, based on the Food Insecurity Experience Scale.

Staple foods
Staple foods are those eaten regularly, and in such quantities as to constitute the dominant part of the diet and supply a major proportion of total dietary energy. The main kinds of staple foods are cereals (e.g. rice, maize, wheat, rye, barley, oats, millet, sorghum), roots and tubers (e.g. potatoes, cassava, yams) and legumes (e.g. beans, lentils, soybean).[55]

Structural transformation
The theory of structural transformation describes the transformation of economies, initiated with an increase in agricultural productivity in rural areas leading to an agricultural surplus. The additional income from this surplus then generates demand for other goods and services stimulating the off-farm sectors of the economy. As a result, a gradual shift of jobs from the primary agriculture sector to the secondary and tertiary sectors takes place, typically located in urban areas. This encourages rural-to-urban migration, resulting in an economic transformation from a mainly agrarian to a more diversified national economy, attracting rural people to urban areas.[69]

Stunting
Low height-for-age, reflecting a past episode or episodes of sustained undernutrition. In children under five years of age, stunting is defined as height-for-age less than –2 standard deviations below the WHO Child Growth Standards median.

Undernourishment
Undernourishment is defined as the condition in which an individual's habitual food consumption is insufficient to provide the amount of dietary energy required to maintain a normal, active, healthy life. For the purposes of this report, hunger is defined as being synonymous with chronic undernourishment. The prevalence of undernourishment is used to measure hunger.

Undernutrition
The outcome of poor nutritional intake in terms of quantity and/or quality, and/or poor absorption and/or poor biological use of nutrients consumed as a result of repeated instances of disease. It includes being underweight for one's age, too short for one's age (stunted), dangerously thin for one's height (suffering from wasting) or deficient in vitamins and minerals (suffering from micronutrient deficiency).

Urban and peri-urban agriculture (UPA)
Urban and peri-urban agriculture can be defined as practices that yield foods and other outputs from agricultural production and related processes (transformation, distribution, marketing, recycling, etc.), taking place on land and other spaces within cities and surrounding regions. These involve urban and peri-urban actors, communities, methods, places, policies, institutions, systems, ecologies and economies, largely using and regenerating local resources to meet the changing needs of local populations while serving multiple goals and functions.[70]

Urbanization
Urbanization is a multifaceted social, cultural, economic and physical process that is the result of growing urban populations, the physical expansion of cities (i.e. the reclassification of rural to urban) and migration from rural to urban areas. This process is fickle and context-dependent, driven by intertwined factors including diverse economic developments such as the growth of agriculture, policy choices, natural resource availability and other events such as conflict or environmental degradation.[69]

Vulnerability
Refers to the conditions determined by physical, social, economic and environmental factors or processes that increase the susceptibility of an individual, community, assets or systems to the impacts of hazards.[66] Vulnerability to food insecurity is the range of conditions that increases the susceptibility of a household to the impact on food security in case of a shock or hazard.

Wasting
Low weight-for-height, generally the result of weight loss associated with a recent period of inadequate dietary energy intake and/or disease. In children under five years of age, wasting is defined as weight-for-height less than –2 standard deviations below the WHO Child Growth Standards median.

Weather
Weather describes conditions of the atmosphere over a short period of time (minutes to days), whereas climate is how the atmosphere behaves over relatively longer periods of time (the long-term average of weather over time). The difference between weather and climate is a measure of time (see above definitions for climate, climate change, climate variability and climate extremes).[71] ■

NOTES

CHAPTER 1

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NOTES ON GEOGRAPHIC REGIONS IN STATISTICAL TABLES IN CHAPTER 2 AND ANNEXES 1 AND 2

Countries revise their official statistics regularly for past periods as well as for the latest reporting period. The same holds for statistics presented in this report. Whenever this happens, estimates are revised accordingly. Therefore, users are advised to refer to changes in estimates over time only within the same edition of *The State of Food Security and Nutrition in the World* and refrain from comparing data published in editions for different years.

Geographic regions

This publication follows the composition of geographic regions as presented by the Statistics Division of the United Nations Secretariat primarily for use in its publications and databases (https://unstats.un.org/unsd/methodology/m49). The assignment of countries or areas to specific groupings is for statistical convenience and does not imply any assumption regarding political or other affiliation of countries or territories by the United Nations. Please refer to the list below for the country composition of each region in the tables of Annex 1 and Annex 2, as well as in Tables 1–4 in Section 2.1.

Countries, areas and territories for which there were insufficient or unreliable data for conducting the assessment are not reported and not included in the aggregates. Specifically, with respect to the M49 classification:

- **Northern Africa:** In addition to the countries listed in the table, PoU and food insecurity based on the FIES include an estimate for Western Sahara. Child wasting, stunting and overweight, low birthweight, adult obesity, exclusive breastfeeding and anaemia estimates exclude Western Sahara.
- **Eastern Africa:** This grouping excludes Chagos Archipelago, French Southern and Antarctic Territories, Mayotte and Réunion.
- **Western Africa:** This grouping excludes Saint Helena.
- **Asia and Eastern Asia:** Low birthweight and child wasting aggregates exclude Japan.
- **Caribbean:** This grouping excludes Anguilla, Aruba, Bonaire, Sint Eustatius and Saba, British Virgin Islands, Cayman Islands, Curaçao, Guadeloupe, Martinique, Montserrat, Saint Barthélemy, Saint Martin (French Part), Sint Maarten (Dutch part), and Turks and Caicos Islands. Adult obesity, child wasting, low birthweight and exclusive breastfeeding exclude Puerto Rico and United States Virgin Islands.
- **South America:** This grouping excludes Bouvet Island, Falkland Islands (Malvinas), French Guyana, and South Georgia and the South Sandwich Islands.
- **Australia and New Zealand:** This grouping excludes Christmas Island, Cocos (Keeling) Islands, Heard and McDonald Islands, and Norfolk Island.
- **Melanesia:** Anaemia, child wasting, stunting and overweight, low birthweight and exclusive breastfeeding estimates exclude New Caledonia.
- **Micronesia:** Adult obesity, anaemia, child wasting, low birthweight and exclusive breastfeeding estimates exclude Guam, Northern Mariana Islands and US Minor Outlying Islands. Aggregates for child stunting and overweight exclude only US Minor Outlying Islands.
- **Polynesia:** This grouping excludes Pitcairn Islands, and Wallis and Futuna Islands. Adult obesity, child wasting, low birthweight and exclusive breastfeeding estimates exclude American Samoa, French Polynesia and Tokelau (Associate Member). Aggregates for child stunting and overweight exclude only French Polynesia.
- **Northern America:** This grouping excludes Saint Pierre and Miquelon. Adult obesity, anaemia, low birthweight and exclusive breastfeeding aggregates also exclude Bermuda and Greenland. Aggregates for wasting are based only on data for the United States of America.
- **Northern Europe:** This grouping excludes Åland Islands, Channel Islands, Faroe Islands (Associate Member), Isle of Man, and Svalbard and Jan Mayen Islands.
- **Southern Europe:** This grouping excludes Gibraltar, Holy See and San Marino. However, anaemia, child stunting, overweight and low birthweight estimates include San Marino.
- **Western Europe:** This grouping excludes Liechtenstein and Monaco. However, child stunting, overweight, anaemia and low birthweight estimates include Monaco.

Other groupings

Least developed countries, landlocked developing countries and Small Island Developing States groupings include the countries as presented by the Statistics Division of the United Nations (https://unstats.un.org/unsd/methodology/m49).

Small Island Developing States: Estimates for child stunting, wasting and overweight, adult obesity, exclusive breastfeeding and low birthweight exclude Anguilla, Aruba, Bonaire, Sint Eustatius and Saba, British Virgin Islands, Curaçao, French Polynesia, Montserrat, New Caledonia and Sint Maarten (Dutch part). In addition, estimates for child wasting, adult obesity, exclusive breastfeeding and low birthweight also exclude American Samoa and Puerto Rico.

High-income, upper-middle-income, lower-middle-income and low-income countries include the countries as presented by the World Bank classification for the 2022/23 fiscal year (https://datahelpdesk.worldbank.org/knowledgebase/articles/906519).

Low-income food-deficit countries (2023): Afghanistan, Benin, Burkina Faso, Burundi, Cameroon, Central African Republic, Chad, Comoros, Congo, Democratic People's Republic of Korea, Democratic Republic of the Congo, Eritrea, Ethiopia, Gambia, Guinea, Guinea-Bissau, Haiti, Kenya, Kyrgyzstan, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mozambique, Nepal, Nicaragua, Niger, Rwanda, Sao Tome and Principe, Senegal, Sierra Leone, Somalia, South Sudan, Sudan, Syrian Arab Republic, Tajikistan, Togo, Uganda, United Republic of Tanzania, Uzbekistan, Yemen and Zimbabwe.

Composition of geographic regions

AFRICA

Northern Africa: Algeria, Egypt, Libya, Morocco, Sudan, Tunisia and Western Sahara.

Sub-Saharan Africa

Eastern Africa: Burundi, Comoros, Djibouti, Eritrea, Ethiopia, Kenya, Madagascar, Malawi, Mauritius, Mozambique, Rwanda, Seychelles, Somalia, South Sudan, Uganda, United Republic of Tanzania, Zambia and Zimbabwe.

Middle Africa: Angola, Cameroon, Central African Republic, Chad, Congo, Democratic Republic of the Congo, Equatorial Guinea, Gabon, and Sao Tome and Principe.

Southern Africa: Botswana, Eswatini, Lesotho, Namibia and South Africa.

Western Africa: Benin, Burkina Faso, Cabo Verde, Côte d'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone and Togo.

ASIA

Central Asia: Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan.

Eastern Asia: China, Democratic People's Republic of Korea, Japan, Mongolia and Republic of Korea.

South-eastern Asia: Brunei Darussalam, Cambodia, Indonesia, Lao People's Democratic Republic, Malaysia, Myanmar, Philippines, Singapore, Thailand, Timor-Leste and Viet Nam.

Southern Asia: Afghanistan, Bangladesh, Bhutan, India, Iran (Islamic Republic of), Maldives, Nepal, Pakistan and Sri Lanka.

Western Asia: Armenia, Azerbaijan, Bahrain, Cyprus, Georgia, Iraq, Israel, Jordan, Kuwait, Lebanon, Oman, Palestine, Qatar, Saudi Arabia, Syrian Arab Republic, Türkiye, United Arab Emirates and Yemen.

LATIN AMERICA AND THE CARIBBEAN

Caribbean: Antigua and Barbuda, Bahamas, Barbados, Cuba, Dominica, Dominican Republic, Grenada, Haiti, Jamaica, Puerto Rico, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, and Trinidad and Tobago.

Latin America

Central America: Belize, Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Nicaragua and Panama.

South America: Argentina, Bolivia (Plurinational State of), Brazil, Chile, Colombia, Ecuador, Guyana, Paraguay, Peru, Suriname, Uruguay and Venezuela (Bolivarian Republic of).

OCEANIA

Australia and New Zealand: Australia and New Zealand.

Oceania excluding Australia and New Zealand

Melanesia: Fiji, New Caledonia, Papua New Guinea, Solomon Islands and Vanuatu.

Micronesia: Kiribati, Marshall Islands, Micronesia (Federated States of), Nauru and Palau.

Polynesia: American Samoa, Cook Islands, French Polynesia, Niue, Samoa, Tokelau, Tonga and Tuvalu.

NORTHERN AMERICA AND EUROPE

Northern America: Bermuda, Canada, Greenland and United States of America.

Europe

Eastern Europe: Belarus, Bulgaria, Czechia, Hungary, Poland, Republic of Moldova, Romania, Russian Federation, Slovakia and Ukraine.

Northern Europe: Denmark, Estonia, Finland, Iceland, Ireland, Latvia, Lithuania, Norway, Sweden, and United Kingdom of Great Britain and Northern Ireland.

Southern Europe: Albania, Andorra, Bosnia and Herzegovina, Croatia, Greece, Italy, Malta, Montenegro, North Macedonia, Portugal, Serbia, Slovenia and Spain.

Western Europe: Austria, Belgium, France, Germany, Luxembourg, Netherlands (Kingdom of the) and Switzerland.

THE STATE OF THE WORLD

2023 THE STATE OF FOOD SECURITY AND NUTRITION IN THE WORLD

URBANIZATION, AGRIFOOD SYSTEMS TRANSFORMATION AND HEALTHY DIETS ACROSS THE RURAL–URBAN CONTINUUM

This report provides an update on global progress towards the targets of ending hunger (SDG Target 2.1) and all forms of malnutrition (SDG Target 2.2). It shows that hunger at the global level remained relatively stable between 2021 and 2022, but is still far above pre-COVID-19-pandemic levels and is also rising in many places where people are still struggling to recover income losses in the wake of the pandemic or have been affected by increasing prices of food, agricultural inputs and energy, conflicts and/or extreme climate events. The report also provides updated estimates on the billions of people who are unable to access nutritious, safe and sufficient food all year round. Overall, the report shows that we are far off track to meet all nutrition targets. While progress on important indicators of child nutrition is revealed, rising overweight among children under five years of age in many countries portends growing burdens of non-communicable diseases.

Since its 2017 edition, this report has repeatedly highlighted that the intensification and interaction of conflict, climate extremes and economic slowdowns and downturns, combined with highly unaffordable nutritious foods and growing inequality, are pushing us off track to meet the SDG 2 targets. However, other important megatrends must also be factored into the analysis to fully understand the challenges to and opportunities for meeting the SDG 2 targets. One such megatrend, and the focus of this year's report, is urbanization.

Urbanization is increasing in many countries and this report shows it is changing agrifood systems in ways we can no longer understand using the simple rural–urban divide. The changing pattern of population agglomerations across a rural–urban continuum and its interface as a place of exchange and socioeconomic interactions, is reshaping and being reshaped by agrifood systems, with implications for the availability and affordability of healthy diets, and in turn, for food security and nutrition.
New evidence shows that food purchases in some countries are no longer high only among urban households but also among rural households. Consumption of highly processed foods is also increasing in peri-urban and rural areas of some countries. These changes are affecting people's food security and nutrition in ways that differ depending on where they live across the rural–urban continuum.

This timely and relevant theme is aligned with the United Nations General Assembly-endorsed New Urban Agenda, and the report provides recommendations on the policies, investments and actions needed to address the challenges of agrifood systems transformation under urbanization and to enable opportunities for ensuring access to affordable healthy diets for everyone.

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