

Dietary resilience amidst polycrises

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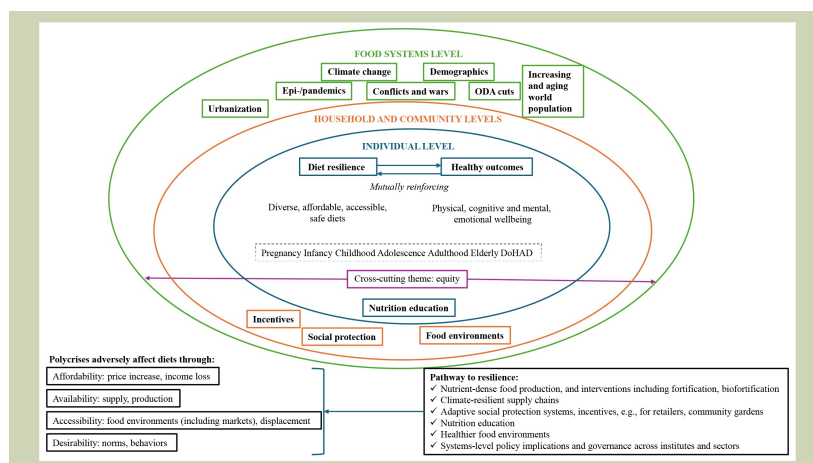
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GRAPHICAL ABSTRACT


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What is a healthy diet and why is it important?

Although the requirements of a healthy diet vary by age, sex, activity levels, and health status, according to the World Health Organization (WHO), a healthy diet is one that is rich in nutrient-dense fruits and vegetables, legumes, nuts, and whole grains and limited in sugar, fats, salt, and red meat^[1].

Despite broad agreement regarding what constitutes a healthy diet, access to such diets remains highly unequal. Almost two-thirds of a billion people globally suffer from hunger, 2.7 billion people cannot afford a healthy diet, and hundreds of millions consume excessive amounts of sugar-, fat-, and salt-laden ultra-processed foods (UPFs)^[2,3], all of which result in approximately one-third to nearly half of the global population suffering from at least one form of malnutrition:

undernutrition, micronutrient deficiencies, overweight, or obesity.

Malnutrition is responsible for the majority of deaths among children and contributes to poor child growth and cognitive development, increased vulnerability to infectious diseases such as malaria, and a growing overall burden of noncommunicable diseases, including diabetes and cardiovascular disease. These consequences constrain economic growth and development by reducing current and future productivity and generating billions of dollars in healthcare expenditures, given that a substantial share of the global burden of disease is diet-related.

Evidence suggests that eliminating malnutrition by making healthy diets accessible, affordable, available, desirable, and widely understood by all, would not only save one in five lives and tackle one of the most consequential and modifiable

determinants of global health, but would also represent one of the highest-return investments in global development^[4]. However, for development gains to be equitable and sustainable, healthy diets must also be resilient.

What is dietary resilience?

Broadly, resilience refers to the capacity of individuals, households, communities and countries, to prevent, resist, adapt, respond to, or recover from shocks and stresses without compromising equitable and sustainable development.

Applied to diets, dietary resilience is the capacity of individuals and the food systems on which they depend to maintain or rapidly restore the conditions needed to consume healthy diets—including their availability, affordability, accessibility, desirability, and the knowledge required to make healthy dietary choices—in the face of shocks and stresses. This capacity is increasingly important in today's volatile world, where multiple and concurrent shocks can disrupt food systems and affect diet quality, with impacts that are unevenly distributed and often exacerbate existing inequities within and/or across countries, communities, households and individuals.

At the individual level, dietary resilience can be defined as the capacity to sustain a healthy diet in the face of shocks, such as income loss or displacement, and stresses, including illness or rising food prices. Healthy diets contribute to resilience by strengthening physical and cognitive capacity and supporting overall wellbeing, enabling individuals to better withstand and recover from shocks and stresses. In turn, greater resilience improves individuals' capacity to maintain healthy diets. The relationship is therefore bidirectional and mutually reinforcing^[5]. Resilience and nutritional vulnerability vary across the life course. Certain populations—including pregnant and lactating people, children, adolescents, and older adults—face heightened nutritional vulnerability and may require targeted support.

Nutritional vulnerability is shaped by physiological, socioeconomic, environmental, and political factors that often compound existing inequities. Dietary resilience is therefore not simply a matter of individual nutrition but fundamentally a food systems challenge that demands coordinated action across multiple levels, from individuals, households and communities

to national and global food systems. While food-system resilience focuses on whether food systems can withstand, adapt to, and recover from shocks and stresses, dietary resilience focuses on whether individuals can maintain or restore healthy diets when those shocks and stresses disrupt food systems.

In this Perspective, we approach dietary resilience from a food systems perspective. Within food systems, diets, nutrition, and health, alongside resilience, represent two strongly interconnected domains, with malnutrition functioning both as an outcome and a determinant of resilience. Reducing malnutrition strengthens physical and cognitive capacity, productivity, and the ability to recover from external shocks, while individuals, households, communities and countries with limited resilience face a greater risk of dietary deterioration and malnutrition.

How do shocks and stresses threaten dietary resilience?

Over the past decade, food systems around the world have been subjected to multiple shocks and stresses, including climate change, a global pandemic, epidemics and zoonotic diseases, conflicts and wars, and reductions in official development assistance (ODA), as well as significant demographic shifts.

Climate change imposes both stresses, such as rising temperatures, and shocks, in the form of extreme weather events such as floods and storms, on food systems. These impacts reduce productivity of all factors of food production (e.g., labor, soil, water, livestock), lower the nutritional quality of foods, disrupt supply chains, and contribute to displacement and migration, thereby undermining the consumption of healthy diets^[6]. Increasing temperatures are also found to heighten the vulnerability of already at-risk populations—particularly young children—to malnutrition^[7].

The COVID-19 pandemic disrupted food supply chains worldwide, particularly for nutrient-dense foods, and contributed to substantial increases in food prices. Combined with income losses—especially among households with individuals employed in informal sectors in low- and middle-income countries (LMICs)—these disruptions reduced consumption of healthy foods while increasing reliance on

staple foods and UPFs. Although many upper-middle- and high-income countries have largely recovered economically, many LMICs remain below pre-pandemic growth trajectories, and malnutrition indicators have similarly failed to recover.

Epidemics such as Ebola and zoonotic diseases including avian influenza continue to threaten food systems. Climate change is expected to increase the frequency and scale of such outbreaks, while reductions in ODA may weaken disease surveillance and response systems, further undermining healthy diet consumption.

The world is currently experiencing the highest number of armed conflicts since World War II, ranging from localized disputes to large-scale wars spanning entire regions. Conflicts and wars adversely affect diets at both local and global levels by displacing populations, disrupting food systems, and undermining agricultural production and trade. Russia's invasion of Ukraine not only disrupted food production in one of the world's most productive agricultural regions, with long-term consequences, but also contributed to rising fertilizer and energy prices through export restrictions. These effects led to substantial increases in global food prices, reducing the consumption of healthy diets for millions of people.

Similarly, recent war in the Middle East and threats to shipping through the Strait of Hormuz, have heightened concerns about potential increases in energy, fertilizer, and food prices, with severe implications for populations already experiencing food insecurity. At a more localized, yet highly devastating scale, wars in Gaza, Sudan, and Yemen have resulted in acute food insecurity, severe undernourishment, and famine-like conditions, while simultaneously damaging food systems in ways that may persist for generations to come.

Historically, ODA has supported maternal and child nutrition and health, and agricultural innovations for food and nutrition security. Recently ODA was reduced abruptly, partly driven by shifting priorities as a result of the aforementioned wars and conflicts. Resulting reductions in lifesaving interventions widely used to treat severe acute malnutrition in humanitarian settings, such as those resulting from the impacts of war and conflict and climate change, not only increased preventable child mortality but also contributed to long-term cognitive and physical impairments among surviving children, many of whom may never fully recover their developmental potential, and are therefore vulnerable to future stresses and shocks^[8].

Funding cuts to food-system research risk reducing future food availability at a time when climate change and resource constraints are already placing growing pressures on food systems.

Finally, demographic shifts are also reshaping food systems and influencing the consumption of healthy diets. Rapid urbanization in many LMICs contributed to rising consumption of increasingly available, affordable, and convenient UPFs. Rising incomes in many middle-income countries—often associated with increasing urbanization—have also increased demand for meat, to unhealthy levels as per the WHO recommendations.

Population aging in nearly every region of the world is creating additional nutritional vulnerabilities. Older adults generally require more nutrient-dense diets, yet they are often unaware of their specific nutritional needs and may face limited physical and financial access to healthy foods. The absence of nutrition education, programs, and policies tailored to older adults is likely to increase their nutritional vulnerability, further diminish their quality of life, and jeopardize their ability to engage in productive and income-generating activities. At the same time, inadequate nutrition among aging populations is likely to contribute to rising healthcare costs associated with age-related diseases and disabilities as the number of older adults continues to grow globally^[9].

In contrast, Africa—the only region still experiencing substantial population growth—faces a youth bulge that is driving demand for healthy diets among pregnant and lactating people, infants and young children, and adolescents. Yet the continent bears the world's highest burden of undernutrition and micronutrient deficiencies, threatening the development and future productivity of its rapidly growing population. Because Africa is disproportionately affected by the impacts of climate change, disease outbreaks, and conflict while accounting for much of future global population growth, investments in resilient, healthy diets on the continent are investments in the future prosperity and stability of humanity as a whole.

Each one of the abovementioned shocks and stresses travel through different pathways within food systems, affecting countries, communities, households and even individuals within a household differently^[10], ultimately converging on the same five conditions for healthy diet consumption: availability, affordability, accessibility, desirability, and knowledge.

Building of dietary resilience requires a portfolio of responses at each level.

How can dietary resilience be strengthened?

To enable equitable and sustainable consumption of healthy diets while strengthening dietary resilience, public and private sectors, civil society, and research and knowledge institutions must work together, at local, national and global levels. Important lessons can be drawn from recent successes and failures across policy, business, technology, and behavioral and cultural change to identify effective and scalable approaches for increasing consumption of healthy diets and strengthening resilience of diets to the aforementioned shocks and stresses to food systems.

First, production and productivity of nutrient-dense foods must increase through investments in future-proof innovations and incentives for scaling key inputs and infrastructure, including climate-resilient seeds, water-efficient irrigation, cold storage, and transportation. Such investments would improve efficiency across supply chains, lowering costs and increasing affordability. Because nutrient-dense foods are often the first items removed from diets when incomes decline or prices rise, improving affordability is essential for strengthening dietary resilience. Improving the nutrient profile of staple foods through approaches such as biofortification can further support dietary resilience.

Second, food processing should increasingly be viewed as an opportunity to improve nutrient-density through fortification and greater availability of wholegrain products rather than as a step to add salt, sugar, and fats. Regulations encouraging reformulation of UPFs, promoting fortified and healthier processed foods, and providing consumers with evidence-based, easy-to-understand nutrition information represent important areas for collaboration between governments, businesses, and research institutions. Such approaches can improve population health while creating opportunities for the private-sector to step up especially if the consumers demand healthy diets.

Third, ensuring that healthy diets are understood and consumed by all—particularly nutritionally vulnerable populations—requires strong public-sector leadership, at local,

national and global levels. At the global level, multilateral organizations such as the FAO, WHO and the CGIAR can support national and local governments' efforts to build dietary resilience by providing technical support and facilitating timely data collection to track progress and identify gaps. At the national level, nutrition education should address dietary needs across the life course, from pregnancy and infancy through older age, while regulations should limit marketing of unhealthy foods to vulnerable populations, particularly children. At national and local levels, access to nutrient-dense foods can be improved by addressing urban food deserts, incentivizing retailers, and promoting home, community, and school gardens in low-resource settings. Targeted and flexible social protection systems are also essential to ensure vulnerable populations can maintain healthy diets during crises. Lessons from social protection responses during COVID-19 can help inform the design of timely and effective responses to future shocks that threaten diet quality, particularly among the most vulnerable populations.

Conclusions

Healthy diets are among the most powerful investments in human development. They improve health, enhance cognitive and physical development and capacity, increase productivity, and strengthen the ability of individuals, households, communities, and countries to withstand and recover from shocks and stresses. However, as recent experiences with climate change, COVID-19, disease outbreaks, conflicts, reductions in ODA, and demographic transitions demonstrate, diets remain highly vulnerable to shocks and stresses occurring within and beyond food systems, highlighting the need for intentional investments in building dietary resilience.

Strengthening dietary resilience requires coordinated action across food, health, social protection, education, research, and environmental systems to ensure that healthy diets remain accessible, affordable, available, desirable, and understood, even during crises. Investments in strengthening the resilience of food systems, as well as nutrition-sensitive policies, innovation, and targeted support for nutritionally vulnerable populations can generate substantial returns not only in improved health outcomes but also in economic growth and social stability.

In an increasingly uncertain world, dietary resilience should be recognized as both a development objective and a strategic

investment. Ensuring that all people can achieve and maintain healthy diets in the face of growing shocks and stresses is

essential not only for ending malnutrition, but also for advancing equitable and sustainable development.

Compliance with ethics guidelines

Destan Aytekin and Ekin Birol declare that they have no conflicts of interest or financial conflicts to disclose. This article does not contain any studies with human or animal subjects performed by any of the authors.

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