

# Hunger and malnutrition in the 21st century

Despite record food output globally, hunger is still with us. **Patrick Webb and colleagues** argue that key policy actions are urgently needed to tackle this scourge and must focus on improving diet quality for all

**T**oday's world is characterised by the coexistence of agricultural bounty and widespread hunger and malnutrition.<sup>1</sup> Recent years have seen a reversal of a decades old trend of falling hunger, alongside the re-emergence of famine.<sup>1</sup> National and global evidence shows that ensuring an adequate food supply is still an important contribution to eradicating hunger. However, generating more food in the form of staple grains or tubers is not enough. Good nutrition and an end to hunger both require everyone to have an appropriate diet. How can that be achieved?

## Characterising the problem

A recent report for the World Committee on Food Security argued that “malnutrition in all its forms—not only hunger, but also micronutrient deficiencies, as well

as overweight and obesity—is ... a critical challenge not only in the developing but also in the developed countries. Resolving malnutrition requires a better understanding of the determinants and processes that influence diets.”<sup>1</sup> Malnutrition ranges from extreme hunger and undernutrition to obesity (box 1).<sup>2,3</sup> Furthermore, malnutrition is found in all countries, irrespective of their economic development, where people lack high quality diets.<sup>4-6</sup> Thus, solutions to hunger and to all forms of malnutrition need to focus on ensuring an adequate supply of food, but equally, on the quality of diets.

Today, risk factors for ill health associated with poor quality diets are the main causes of the global burden of disease.<sup>5,6</sup> Low quality diets lack key vitamins, minerals (micronutrients), and fibre or contain too many calories, saturated fats, salt, and sugar.<sup>7</sup> In 2010, dietary risk factors combined with physical inactivity accounted for 10% of the global burden of disease (measured as

disability adjusted life years, which reflect the number of years lost due to ill health, disability, or early death).<sup>8</sup> By 2015, six of the top 11 global risk factors were related to diet, including undernutrition, high body mass index (BMI), and high cholesterol.<sup>9,10</sup> Where governments have invested the economic gains derived from rising productivity in safety nets and services accessible to the poor, this has resulted in national growth.<sup>11-13</sup> However, where poverty persists, including in rich nations, hunger also persists.

## Several faces of hunger

Hunger is a broad unscientific term that relates to nutrition and health outcomes in various ways. The proportion of people defined as hungry over the long term (usually termed “chronically undernourished”) fell from 18.6% globally in 1990-2002 to under 11% in 2014-16 (table 1). That was a decline of 211 million people while the

## KEY MESSAGES

- Despite record levels of food production globally, hunger and many forms of malnutrition still affect billions of people
- While traditionally associated with a lack of food, hunger, and malnutrition (which includes overweight and obesity as well as undernutrition) are associated with low quality diets
- Poor diet quality is a problem in every country—high and low income alike. A high quality diet meets most key nutrient needs, mainly through nutrient rich foods
- Securing high quality diets for all, comprising sufficiency, diversity, balance, and safety, is necessary to resolve hunger and malnutrition in all its forms
- Policy makers must urgently implement evidence based, cost effective actions that have a triple purpose: eradicate hunger, resolve all forms of undernutrition, and tackle obesity
- Governments must consider how policies across multiple sectors influence the functioning of food systems from farm to fork. They must identify changes that will help all consumers to have healthy diets
- The challenge is huge, but the urgency has never been so great

## Box 1: Terms and definitions<sup>1-3</sup>

- **Hunger**—is characterised in many ways. It encompasses individual sensations and household behavioural responses, food scarcity (actual or feared) and national food balance sheets that focus on supply of energy (kilocalories) in any country in relation to a minimum threshold of need. The food balance sheet approach is the only standard of measurement used globally. It is based on data collated by the Food and Agriculture Organization of the United Nations. This organisation has replaced its previous use of the word “hunger” in describing this metric with the phrase “chronic undernourishment”. This today is defined as “a person's inability to acquire enough food to meet daily minimum dietary energy requirements during 1 year”<sup>1</sup>
- **Malnutrition**—An all inclusive term that represents all manifestations of poor nutrition. It can mean any or all forms of undernutrition, overweight, and obesity
- **Undernutrition**—Refers to any form of nutritional deficiency, particularly those manifest in maternal underweight, child stunting, child wasting, or micronutrient deficiencies. It does not include reference to overweight and obesity
- **Maternal underweight**—A body mass index (BMI) of <18.5 among women of reproductive age. This typically reflects chronic energy deficiency coupled with a lack of other key macronutrients or micronutrients, ill health, or energy expenditure higher than consumption. A prevalence >20% indicates a serious public health problem
- **Child stunting**—Height for age  $\leq -2$  standard deviations of the median for children aged 6-59 months, according to World Health Organization child growth standards
- **Child wasting**—Weight for height  $\leq -2$  standard deviations of the median for children aged 6-59 months, according to WHO child growth standards
- **Micronutrient deficiencies**—A lack of various key vitamins and minerals leads to a range of symptoms that are of global concern. These include anaemia due to iron deficiency and risk of child mortality associated with clinical vitamin A deficiency. Such deficiencies are measured in several ways, including biomarkers (assessed using blood, serum, urine, etc), clinical manifestations, or proxy measures of diet quality
- **Overweight and obesity**—For non-pregnant adults, a BMI  $\geq 25$  represents being overweight. The threshold for obesity is a BMI  $\geq 30$ . Child obesity is of increasing concern and was included in the latest global nutrition goals for 2030 (“no increase in childhood obesity”)<sup>4</sup>

**Table 1 | Numbers (millions) and prevalence (%) of people with chronic undernourishment, stunting, and wasting\* by year and geographical region<sup>2,14</sup>**

Region	Undernourished		Stunted (6-59 million)		Wasted† (6-59 million)	
	1990-2002	2014-16	1990-2002	2014-16	1990-95	2014-16
World	1010 (19)	795 (11)	254 (40)	155 (24)	50 <sup>†</sup> (9)	52 (7)
Sub-Saharan Africa	176 (33)	220 (19)	38 (42)	59 (32)	8 (7)	14 (7)
Asia	742 (24)	512 (12)	190 (48)	88 (25)	40 (11)	36 (10)
Latin America and Caribbean	66 (15)	34 (6)	14 (26)	6 (12)	2 (3)	1 (1)
Oceania	1 (16)	1 (14)	<1 (36)	<1 (38)	<1 (6)	<1 (9)

\* These are the three main metrics relating to hunger that can be reported globally, comparably and over time. Other measures (relating to food security, obesity, and micronutrient deficiencies) are not standardised in this way. This suggests an urgent need for the development of global data systems.

† No global dataset is available for wasting estimates covering the early 1990s. The data presented here for 1990-95 were calculated by de Onis et al 1993<sup>15</sup> and by de Onis and Blössner 2000<sup>16</sup> for developing countries only.

world's population increased by 2 billion.<sup>2</sup> Big gains were made in large countries like China and in Brazil, Ethiopia, and Bangladesh (box 2). South America was particularly successful, reducing undernourishment by over 50% in 25 years.<sup>1</sup> Such gains were made possible largely by rapid reduction of poverty, rising levels of literacy, and health improvements that reduced preventable child mortality.<sup>17</sup>

However, despite such progress the world still has unacceptably high numbers of undernourished people. Of the roughly 800 million undernourished, 780 million are in low income countries, especially in sub-Saharan Africa and South Asia.<sup>1</sup> The continents of Africa and Asia have the greatest number of people living in extreme poverty, and it is here that extreme hunger and poverty together present the greatest risk of famine.

Famine is the most acute face of hunger. Over 70 million people died in famines during the 20th century.<sup>22-24</sup> Most deaths occurred in human induced crises, in which political mismanagement, armed conflict, and discrimination of marginalised political or ethnic groups compounded the effects of environmental shocks, such as droughts or locust invasions.<sup>25</sup> Deaths from famine fell from the mid-1980s onwards. However, as of 2017 four countries were again struggling to cope: Somalia, Yemen, South Sudan, and Nigeria.<sup>26</sup> In each case, instability induced by conflict, terrorism, drought and decades of failed governance have left over 20 million people facing famine, including 1.4 million children "at imminent risk of death."<sup>27</sup>

A major cause of mortality in famines is children becoming severely wasted. Around 52 million children were wasted in 2016, of whom around 70% (36 million) resided in Asia (table 1).<sup>14</sup> Roughly 12.6% of deaths among children under 5 are attributed to wasting worldwide.<sup>28</sup> Although wasting has declined, progress has been slow and some countries have seen a rise, including Pakistan and India.<sup>29</sup> Many of the drivers of wasting are often the same as for stunting—namely, low birth weight, lack of exclusive breast feeding, poor hygiene and sanitation, and infectious disease.<sup>30</sup> While wasting is one sign of acute hunger, stunting (being too short for one's age) represents chronic distress. Around 151 million preschool children were stunted in 2017, down from 200 million at the turn of the 20th century.<sup>14</sup> Improvements were made in east Asia, including China (today reporting a prevalence of only 6% compared with the global mean of 23%) and Bangladesh as well as in Latin America (table 1).<sup>31</sup> Nevertheless, South Asia and East and Central Africa all still had rates over 32% in 2017.

**Coexisting forms of malnutrition related to diet**  
The coexistence of multiple forms of malnutrition is a global phenomenon. That is, wasting often coexists with stunting in the same geographical areas, and can be found simultaneously in children.<sup>32</sup> For example,

#### Box 2: Successful resolution of undernutrition: Brazil, Ethiopia, and Bangladesh

Hunger (chronic undernourishment) has remained static at around 800 million people for several decades. This is largely because of rising populations in fragile states and the escalation of armed conflict in numerous parts of the world.<sup>12</sup> Nevertheless, child undernutrition has been falling. In 2000, roughly 200 million children under 5 years of age were stunted, but this has fallen to less than 151 million today. Rapid improvements in nutrition have been concentrated in several large nations, which have shown the way with policy success stories

- *Brazil* saw its prevalence of child stunting decline from 37% in 1974–1975 to 7% in 2006–7.<sup>17</sup> It achieved these gains through a sustained commitment to expand access to maternal and child health services (reaching into previously underserved geographical regions). This was coupled with large scale investment in social reform and safety net programmes that supported a narrowing of the income gap (through equitable poverty reduction), rising numbers of girls in school, declining fertility, and greater stability in income flows and food consumption among the poor. Stable food consumption was achieved through food supplementation targeted at mothers and children, and with cash transfers targeted at the poorest groups. All of this was helped by improved stability of governance. Few of these actions focused explicitly on nutrition, but many were driven by a policy agenda called "zero hunger." Even with recent economic challenges and changes of government, the gains made over past decades persist
- *Ethiopia* has faced famines many times between the 1980s and the early 2000s. It has also reduced child stunting from 58% in 2000 to <40% by 2014.<sup>18</sup> Although this figure is still unacceptably high, it represents a fall of about 1.2% a year.<sup>19</sup> Ethiopia also increased enrolment and retention of girls in schools during this period, increased agricultural productivity, and implemented a huge employment based safety net (one of the largest social protection programmes in Africa). However, two other important drivers improved nutrition in this period. Firstly, a move by government to treat nutrition as a multisector challenge (met by numerous line ministry responsibilities) and, secondly, improved sanitation, focused on eradicating open defecation, which was a major impediment to health and the retention of nutrients in the diet.<sup>18,19</sup>
- *Bangladesh* is a modern nutrition superstar. It emerged from famine in the 1970s. Successive governments have worked alongside an unusually vibrant non-governmental sector to deal with underlying problems and visible symptoms of malnutrition. While service delivery remains generally weak, widespread targeted interventions were combined with a variety of nutritional measures that deal with underlying problems.<sup>20</sup> Such actions included economic growth policies aimed at the poor, girls' education, improved sanitation, and a significant turnaround in the agricultural sector, which moved Bangladesh from being a net importer of food to a significant exporter.<sup>18,21</sup> As a result, child stunting fell from almost 57% in 1997 to around 36% in 2014.<sup>18,19</sup>

around 9% of children in India exhibit both conditions, while the rate in parts of Ghana is reported to be >3%.<sup>32-33</sup> Many countries with a high prevalence of stunting have made limited progress in achieving annual average rates of reduction required to meet global targets. For example, Timor Leste needs an annual reduction of around 5% to reduce stunting by 40% by 2030, but its current reduction rate is barely above zero.<sup>9</sup> Ethiopia also needs an annual average rate of reduction of 5%, but continues to remain at 3%.

Part of the reason for slow progress lies in overlapping micronutrient deficiencies. Inadequate supply of energy and protein both impair a child's growth, but micronutrient deficiencies also have a role. It has been estimated that roughly 2 billion people, or about 29% of the world's population, faced micronutrient deficiencies in 2010.<sup>34-37</sup> Micronutrient deficiencies are also widely present in high income countries. For example, childhood anaemia in 2010 was 26% in the Russian Federation and in Georgia, and 16%, on average, across the European Union.<sup>38</sup>

Obesity is conventionally associated with food excess, but it is also associated with micronutrient deficiencies and even with daily hunger, as shown for Malaysia,<sup>39</sup> Canada,<sup>40</sup> and Iran.<sup>41</sup> Indeed, people with obesity can be prone to deficiencies of micronutrients, such as zinc, iron, and vitamins A, C, D, and E.<sup>42-46</sup> Between 1990 and 2010, the prevalence of adults with a high BMI in sub-Saharan Africa tripled. At the same time, hypertension increased by 60%, and the prevalence of high blood glucose rose nearly 30%.<sup>47</sup> The prevalence of overweight and obesity among South Asian women is almost the same today as the prevalence of underweight.<sup>6</sup> Pacific

and Caribbean islands and countries in the Middle East and Central America have reached extremely high rates of adult overweight and obesity. Some have a prevalence as high as 80% (eg, Tonga, 84% for men, 88% for women).<sup>48</sup>

Many countries today face the dual burden of rising rates of female obesity with continuing high rates of maternal underweight. The latter matters because of ill effects on the mother and on the unborn child. Roughly 30% of stunting by a child's 3rd birthday can be attributed to being born small for gestational age, which is linked to nutrition before birth and health problems of the mother.<sup>28</sup> Not only is maternal underweight still more prevalent than overweight in rural parts of South Asia and sub-Saharan Africa but adult female underweight rose recently in Senegal, Madagascar, and Mali, mainly in urban settings.<sup>49</sup>

Thus, actions are needed in all countries around the world to deal with undernutrition, micronutrient deficiencies, and overweight and obesity simultaneously. No country is exempt. "Triple duty" investments are needed everywhere because wealth and food sufficiency will not in themselves resolve the problems of low quality of diets.

#### Effective actions to tackle hunger and malnutrition

In 2016, the world hit a new record by producing over 2.5 billion metric tons of cereal grains—up from 1.8 billion tons 20 years earlier.<sup>50</sup> But hunger persists because an increased supply of food alone is neither the solution to hunger nor an answer to malnutrition. Countries that have made recent progress in reducing hunger and improving nutrition have a core set of

common characteristics. Firstly, they tend to be politically stable countries that have pursued relatively equitable growth policies (not only increasing wealth for some but reducing poverty overall). Secondly, they employ targeted safety nets for the poor and invest in accessible services (education, clean water, healthcare). Thirdly, they assume responsibility for responding to shocks (economic, environmental, or due to conflict) in timely ways that mitigate human suffering.

Successful actions typically include a mix of targeted so called nutrition specific programming (aimed at preventing or resolving defined nutrition and health problems in individuals) and nutrition sensitive interventions for the whole population that deal with the underlying causes.<sup>9 32 35</sup> Table 2 provides details of evidence based policies and programmes in a variety of sectors, which are known to reduce hunger and deal with malnutrition.<sup>32</sup> In food and agriculture, these may include national price support interventions that increase the supply and accessibility of nutrient rich foods (often perishables, like dairy, fruits and fresh meats), coupled with technical and financial support for women farmers to produce nutrient rich vegetables in their gardens. In health, national policies to support accessible high quality services are critical to ensuring antenatal and postnatal care, particularly combined with targeted nutrition, exclusive breast feeding, and infant feeding messaging. Measures directed at underweight mothers are important for good birth outcomes, as well as varied forms of micronutrient supplementation.<sup>1</sup> In other words, the quality of services, scale of coverage, and the singling out of nutritionally vulnerable

Table 2 | Examples of actions to tackle hunger and malnutrition across sectors<sup>3 20 47 51</sup>

Sectors of intervention	Sensitive to nutrition (dealing with underlying causes)	Specific for nutrition (dealing with specific symptoms)
Agriculture	Promotion and support of smallholder horticulture production; investments in research and extension supporting productivity gains in foods rich in nutrients; promoting food market development to increase smallholder farmer incomes and price accessibility to diets rich in nutrients	Enhanced agriculture extension with messaging on optimal diet choices; facilitating access to rural finances for farmers, food processors and traders (particularly focusing on women's involvement); interventions supporting optimal levels of consumption of foods rich in nutrients (eg, poultry promotion/vaccination, egg marketing, fruit/vegetable cold chain marketing)
Health	Establishment of high quality, high coverage health services, including nutrition counselling and reproductive health; effective reduction of the burden of infectious diseases; promotion of evidence based dietary guidelines to the population	Promotion and facilitation of exclusive breast feeding and early child development, targeted food supplementation of underweight mothers; cash transfers for populations at risk; micronutrient supplementation; management of diseases (access to impregnated bed nets, reduction of household air pollution through improved stoves and fuel); maternal deworming (which may improve anaemia)
Education	Universal enrolment and retention of girls in schools; use of schools to provide instruction on nutrition and health; promotion of awareness of a healthy diet through school gardening; enhanced curricular initiatives on diet, and physical activity	Healthy meals/snacks provided in schools (and other institutions), using locally procured foods, as appropriate; deworming and vaccination at school; after-school outreach education programmes for adolescent girls, focusing on antenatal nutrition and health
Water and sanitation	National and local programmes that eliminate open defecation; universal provision of clean water; promotion of good sanitation and hygiene practices	Promotion of hygiene and sanitation best practices in households; use of improved water sources; facilitating access to improved toilets
Market development	Micronutrient fortification of widely accessible foods, including salt iodisation; quality and food safety regulation	Development of rural feeder roads and other infrastructure (facilitating sale of produce and access to a diversity of fresh produce at markets)
Resilience building	Implementing effective social safety nets that smooth income flows and food consumption among vulnerable groups	Preparedness for rapid establishment of targeted management/treatment of acute malnutrition; targeted use of specialised nutritious food products to individuals at risk in emergencies

demographic groups are all keys to success.<sup>20 47</sup>

Good nutrition and eradication of hunger comes at a price, but pays for itself in the longer term. Donor funding for nutrition sensitive programmes rose between 2003 and 2015, from 11.8% to 19.4%, reaching around \$19bn (£14bn, €16bn) in 2015.<sup>48</sup> Such assistance is deemed to be effective, in that a 10% increase in overall nutrition sensitive aid delivers an estimated 1.1% “decrease in hunger” (measured as chronic undernourishment).<sup>48</sup> The World Bank has argued that a “priority package” of evidence based nutritional interventions that could be readily scaled up would require roughly \$23bn over a decade, or \$5 per child.<sup>51 52</sup> The World Bank emphasises that while international donor agencies should increase spending to achieve global nutrition goals, national governments and citizens themselves need to increase spending and act appropriately. The role of individuals and families comes largely in the form of preferences and constraints.<sup>52</sup> People make choices that shape dietary patterns and physical activity but also the uptake of healthcare services, spending on smoking and hygiene, as well as investments in schooling for their children and agricultural productivity (if farmers).

The value of such large investments to future human and economic development has long been understood in high income countries, such as Europe and the United States. European countries deploy a wide range of policies to combat residual hunger. These include promoting more diverse local food production and diversified diets, the latter “encouraged through nutrition education targeting school children and mothers of young children.”<sup>38</sup> The United States also supports large state food provisioning through nutrition programmes aimed at women and children. For example, spending on the federal food stamp programme in 2017 reached \$68bn (\$126 per person).<sup>53</sup> Similarly, spending on the Women Infants and Children programme, which targets low income families nutritionally at risk with food supplements, nutrition education, and health system referrals, reached \$6.5bn in 2017.<sup>54</sup>

## Conclusions

The sustainable development goals require all countries and their citizens to act together to end hunger and all forms of malnutrition by 2030.<sup>13</sup> Setting targets is a good first step, but actions need to follow quickly. Urgent attention to achieve such goals is seriously overdue. Policy action must be designed to reduce malnutrition

in all its forms, and be adequately funded. Measures must be evidence based, implemented at scale, and include both broad based and targeted actions aimed at the most nutritionally vulnerable people. The evidence to support such actions is growing, but it is already plentiful and compelling; there is no need for delay. The rapidly escalating threats posed by malnutrition represent a planetary challenge on a par with poverty and climate change. An appropriate response at the required scale is top priority for decision makers globally. It cannot wait.

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## 1 High Level Panel of Experts: Food Security and Nutrition

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