CHAPTER 2.

The double burden of malnutrition in low- and middle-income countries

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The double burden of malnutrition (DBM) (sometimes referred to as "malnutrition in all its forms") is the coexistence of undernutrition (including macronutrient and micronutrient deficiencies) and overnutrition in the same population across the life-course [1]. Undernutrition is the result of insufficient intake, poor absorption, and/or poor biological use of the nutrients. Overnutrition is the result of excess or imbalanced nutrient intakes, which can result in impaired body functions as well as overweight and/or obesity. In most regions, undernutrition and overnutrition coexist in the same country, in the same community, or even in the same household.

There is a complex interplay between early undernutrition (in mothers before and during pregnancy, and in early childhood) and later overnutrition that exacerbates the risk of noncommunicable diseases (NCDs), the prevalence of which is rising rapidly in low- and middle-income countries (LMICs) [2, 3]. Undernutrition during pregnancy, which affects fetal growth, and during the first 2 years of life is a major determinant of the risk of both stunting of linear growth and subsequent obesity and NCDs in adulthood [4]. Fast weight gain and linear growth in children in LMICs are associated with better survival and improved cognitive development but might be associated with an increased risk of obesity and cardiometabolic diseases in later life, particularly for rapid weight gain after age 2 years [5].

Malnutrition affects all countries and one third of people worldwide. Almost 1 billion people continue to be undernourished, with an insufficient intake of calories, protein, and micronutrients [6], and currently about 2 billion people are overweight. Nearly half of all countries face multiple serious burdens of malnutrition, such as poor child growth, micronutrient deficiency, and adult overweight. The cost of treating NCDs, of which nutrition-related NCDs are the major share, is likely to be US$ 30 trillion globally over the next 20 years [7]. Of the top 20 determinants of global deaths, 14 are related to diet and nutrition. Obesity now has the third highest global social burden (US$ 2.0 trillion, or 2.8% of global gross domestic product [GDP]), only marginally less than those of tobacco and armed violence, war, and civil disorder [8].

This chapter summarizes the evidence on the DBM in LMICs in various geographical areas of the world.

Global situation and trends in the DBM

Globally, the prevalence of stunting and wasting (see Box 2.1) in preschool children in LMICs has declined during the past two to three decades, whereas rates of overweight/obesity have been rising at a faster rate than the declines in the rates of stunting and wasting [9–11]. Stevens et al. [10], using nationally representative data for 141 developing countries for the period 1985–2011 from the World Health Organization (WHO) and other sources, showed that in 2011, the average prevalence of moderate and severe stunting (height-for-age < −2 standard deviations from the median) was 29.9%. The number of children with moderate and severe stunting was highest in South Asia, followed by sub-Saharan Africa and South-East Asia, and much lower in Latin America, the Middle East, and North Africa. The differences in the prevalence of stunting among preschool children in LMICs were greater between income groups than between urban and rural areas of residence [4].

Box 2.1. Cut-off points used to classify underweight, wasting, and stunting

Underweight. Moderate and severe: weight-for-age < −2 standard deviations (SD) from the median weight-for-age of the reference population. Severe: weight-for-age < −3 SD from the median weight-for-age of the reference population.

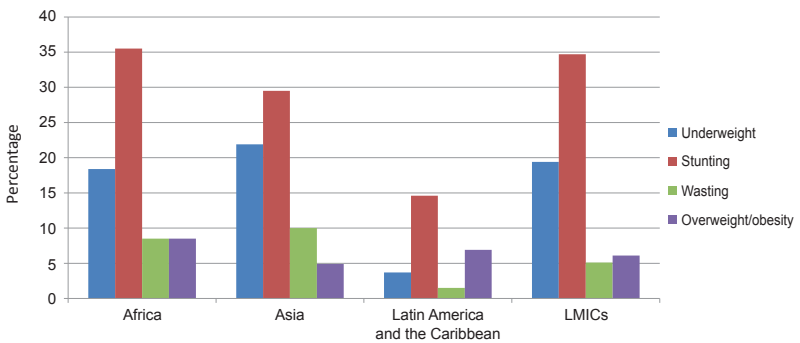
Wasting. Moderate and severe: weight-for-height < −2 SD from the median weight-for-height of the reference population.

Stunting. Moderate and severe: height-for-age < −2 SD from the median height-for-age of the reference population.

The prevalence of obesity varies widely across regions. It is highest in Latin America and the Caribbean, the Middle East, and Oceania. Globally, the prevalence of obesity in preschool children was 6.7%. The average prevalence was 8.5% in Africa (17% in North Africa, but < 6.4–8.7% in other parts of this region) and 6.9% in Latin America. The lowest prevalence (4.9%) was in Asia. However, because of its larger population, Asia is estimated to have the highest number of overweight/obese children [9, 11] (see Fig. 2.1 and Box 2.2).

The causes of obesity have been grouped into four broad cross-cutting themes: the biological/health environment, the economic/food environment, the physical/built environment, and the sociocultural environment. In LMICs, overweight and obesity in adults were recognized much earlier than in children. Between 1980 and 2008, global (including LMICs and high-income countries [HICs]) mean increases in body mass index (BMI) were 0.4 kg/m^2 per decade in men and 0.5 kg/m^2 per decade in women [12]. In men, increases in BMI were observed in almost all regions, but in women the largest increase in BMI was in Oceania and the smallest was in central/eastern Europe and central Asia. Globally, the prevalence of obesity (BMI ≥ 30 kg/m^2) in 2008 was 9.8% in men and 13.8% in women. Overweight accounted for about 37% of the global burden of disease in 2013 [11]. Between 1990 and 2010, the annual increase in the prevalence

Fig. 2.1. Prevalence of underweight, stunting, wasting, and overweight/obesity in children younger than 5 years, by region (LMICs, low- and middle-income countries). Data for underweight, stunting, and wasting from Table 3 in Black et al. (2013) [4]; data for overweight/obesity (weight-for-height > +2 standard deviations from the median) from Table 4 in de Onis et al. (2010) [9].



Box 2.2. The double burden of malnutrition in low- and middle-income countries

Stunting of young children, which reflects both maternal and child undernutrition, affects about one quarter of the world's children. Overweight and obesity affect about one third of adults and about 10% of children worldwide. Whereas the rates of stunting and wasting have declined over the past two decades, the rates of obesity have risen, with the most rapid rates of increase in Latin America and the Caribbean, the Middle East, and Oceania. High rates of stunting persist in many parts of the world, particularly South Asia, where disparities between income groups are greater than those between urban and rural areas of residence.

of overweight (BMI ≥ 25 and < 30 kg/m^2) in women aged 19–49 years in LMICs was highest (0.9% per year) in the Middle East and North Africa, where the prevalence of overweight was 70.6% in 2010, and lowest (0.3% per year) in Latin America and the Caribbean, where the prevalence was 56.7% in 2010 [13]. In contrast, underweight (BMI < 18.5 kg/m^2) still predominated in South Asia, with a prevalence of 30.2%, compared with a prevalence of 16.8% for overweight. In East Asia and the Pacific and in sub-Saharan Africa, the prevalence of overweight (26.5% and 22.2%, respectively) in 2010 was greater than that of underweight (7.9% and 12.1%, respectively). Finally, substantial increases in the prevalence of overweight or obesity were also observed in children and adolescents in developing countries (where the prevalence in 2013 was 12.9% for boys and 13.4% for girls) as well as in developed countries (where the prevalence in 2013 was 23.8% for boys and 22.6% for girls) [11].

Much more limited data are available on the prevalence of overweight and obesity in pregnant and lactating women; most of the nationally representative surveys do not include these vulnerable groups. Overweight/obesity in women of reproductive age before pregnancy was shown to pose potential health risks during pregnancy (gestational diabetes, hypertensive disorders) and, alone or together with high gestational weight gain, resulted in poor birth outcomes (e.g. large for gestational age) [14, 15]. The prevalence and impacts of the DBM before and during pregnancy and the interaction between undernutrition and overnutrition at these critical times have not been thoroughly explored, although a few hospital-based studies have been reported. Poor maternal nutrition has also been linked to poor birth outcomes and an increased risk of NCDs among the offspring in later life. Maternal and child undernutrition in the aggregate has been estimated to be a cause of 3.1 million child deaths annually, or 45% of all child deaths in 2011 [4].

Common micronutrient deficiencies in women and children that are of public health importance in LMICs (and persist in sectors of HICs) include deficiencies of vitamin A, iron, iodine, and recently, also folate, zinc, and vitamin D; many of these deficiencies coexist in the same individuals, suggesting that poor-quality diets, poor sanitation, and inadequate health care are major contributory factors [16, 17]. Anaemia (presumably due to iron deficiency, with a prevalence of 37–46% in women and children) and iodine deficiency disorders separately affect about 2 billion people in both developed and developing countries, and vitamin A deficiency (with a prevalence of 10–12%) is still common in developing countries [18]. Muthayya et al. [19] defined a "hidden hunger index" by combining the national prevalence of and the disability-adjusted life years (DALYs) attributable to stunting, iron-deficiency anaemia, vitamin A deficiency, and iodine deficiency in school-aged children to map the global spread of hidden hunger. Hot spots were found in most countries in sub-Saharan Africa (where the prevalence was highest) and South Asia. Moreover, recent evidence has shown that deficiencies of iron and iodine also exist in overweight and obese women. Metabolic disturbances related to overweight/obesity, in addition to poor diets, have been postulated to affect micronutrient (iron and iodine) metabolism in women and children [20].

Drivers of the DBM

Wherever people live – whether they are rural smallholders, urban poor, or urban better-off – they all use food systems to procure the food they eat. The majority of the global hungry live in rural areas and are smallholder farmers who produce most of the food they eat. Improving nutrition for this sector requires an understanding of the factors that currently constrain their access to sufficient healthy, nutritious food. Increasingly, these rural smallholders are purchasing unhealthy, cheap processed foods. With economic development, there is a shift away from diets based largely on minimally processed staple foods to diets high in meat, vegetable oils, and processed foods [21–23] (see Box 2.3). This unhealthy transition has been accompanied by large numbers of people consuming excess calories, thereby contributing to overweight and obesity in more than 2 billion people in 2013 [11], while micronutrient deficiencies persist because the nutrient quality of these foods is poor.

Three important changes have taken place in the industrialized food system that increasingly dominates: (i) the opening of domestic markets to international food trade and foreign direct investment; (ii) the subsequent increased entry of transnational food companies and their global market, and (iii) global food advertising [24–26]. These changes have made energy-dense,

Box 2.3. Changing food patterns in low- and middle-income countries

Food patterns are changing dramatically in LMICs, away from diets based on minimally processed staple foods to diets that are higher in meats, oils, and ultra-processed foods and beverages high in fat, salt, and added sugar. These changing patterns are driving excess calorie intake and are linked to obesity and NCDs; at the same time, these low-quality diets are not meeting micronutrient needs, and thus these patterns are driving the DBM.

nutrient-poor foods relatively more readily available, affordable, and acceptable than nutritious foods [27]. Ultra-processed foods are now the major sources of sugar, salt, and fats in most diets around the world. Total consumption of processed foods is now positively associated with excess energy intake and obesity, and with rising rates of diabetes and NCDs.

Drivers of increased consumption of ultra-processed foods – particularly in Asia, where the change is most dramatic and is closely linked to rising rates of obesity – include rising household incomes, rapid urbanization, and increasing female economic participation, which may be driving the demand for convenience foods. This demand for ultra-processed foods and beverages is also being driven by national and transnational food companies using aggressive, unregulated marketing of processed foods and beverages. To date, in most LMICs, the marketing of foods and non-alcoholic beverages is unregulated; where regulations are in place, they tend to be voluntary codes and are poorly monitored and enforced. WHO guidance on best practice for such marketing [28] is rarely followed.

In addition, there has been a rapid expansion of supermarkets and fast-food companies. For example, the number of international food franchises in the Asia-Pacific region expanded from 1458 in 1991 to 6775 in 2001 [29]. People in countries with industrial and mixed food systems consume on average 80–90 kg per person per year of energy-dense, ultra-processed foods, with added salt, refined sugars, and low amounts of essential micronutrients. People in countries with emerging and rural food systems consume on average 20–30 kg of ultra-processed foods per person per year. Nonetheless, consumption of packaged food is growing fastest in transitioning, emerging, and rural food systems [30].

Although consumption of processed foods and soft drinks is highest in HICs, growth rates are mostly declining or stagnating in HICs, whereas they are rising rapidly in LMICs. Between 1996 and 2002, sales of processed (packaged) foods grew by 28% in LMICs, compared with only 2.5% in HICs. In Viet Nam, consumption of ultra-processed food increased 3.6-fold, from 10.7 kg per capita in 1999 to 38.7 kg per capita in 2013. Volumes of consumption of soft drinks (sodas, sugar-sweetened beverages) have been increasing in almost all countries. Thailand, Indonesia, and the Philippines have consumption patterns comparable to those of HICs. In Viet Nam, retail sales of frozen processed food, cheese, and chocolate confectionery grew by 24%, 15%, and 13%, respectively, in 2013, and consumption of sugar-sweetened beverages rose by about one third from 2010 to 2014, to 836 million litres.

For many LMICs, government policy does not address the drivers of the DBM. Most governments continue to have polarized policies that focus efforts separately on undernutrition and overnutrition in different target populations. They also tend to focus on individual behaviour change or specific interventions, such as fortification and supplementation, although with an increasing emphasis on reformulation of less healthy foods. Little consideration has been given to the impact of fiscal and regulatory policies on the marketing of unhealthy foods and beverages, particularly to children, or to the impact of agricultural policies on the quality of the diet.

The DBM and NCDs

Despite the abundance of knowledge about the substantial burden of cancer that is attributable to obesity, there is a significant research gap between LMICs and HICs. Most available research has focused on Caucasians in HICs, where the combinations of risk factors and exposures may differ from those in LMICs. The acquisition by people in LMICs of diet and lifestyle habits typical of industrialized countries, particularly among the poorest people, has produced changing patterns of diseases.

In East Asia and the Pacific, the DALYs lost due to high BMI increased by 198% between 1990 and 2010, nearly 2.5 times the global average [31]. Overweight and obesity are key underlying risk factors for the growing burden of NCDs, particularly diabetes, heart disease, and certain cancers. NCDs are already the leading cause of death in 12 Pacific Island countries; importantly, at least one quarter of the deaths from NCDs in Tonga, Samoa, and Vanuatu are premature [32].

Currently, the most frequently diagnosed cancers in LMICs are tumours of the lung, female breast, stomach, liver, colorectum, cervix, and oesophagus [33]. The increase in the burden of NCDs may be explained partly by demographic changes; however, changes in lifestyle factors and globalization related to diet (increased consumption of highly processed foods, red meat, and sugar-sweetened beverages) and increases in sedentary behaviour are also increasingly being recognized as major contributors to the increase in the burden of NCDs, including cancer [34]. Interactions between undernutrition and the immune response remain unresolved and are now further complicated by the rising impact of obesity. A major challenge is to capture life-course exposure and identify windows of susceptibility. The growth patterns of infants and children can be altered by early exposure to poor diet, increased consumption of sugar-sweetened beverages, dietary contaminants (e.g. mycotoxins), physical

inactivity, tobacco smoke, and other environmental exposures, including those from the way foods are produced, and these factors may result in altered metabolism, obesity, and a high risk of chronic diseases in adulthood [14].

Discussion

The rapidly changing dietary patterns unfolding in LMICs provide an important window of opportunity to study the impact of these changes on health outcomes. In particular, research conducted in these dynamic environments can help fill the gaps in our knowledge as to which of these factors can explain the increases in the risk of NCDs, including cancer, observed across different populations. Strengthening the evidence base will support the development of more effective policies and programmes to prevent and ameliorate the growing burden of NCDs in LMICs.

Adopting a food systems approach to the DBM provides the opportunity to explore how a coherent approach to the way food is grown, processed, and sold can address both the quality and the quantity of the food supply. Thus, a coherent approach that focuses on food systems and food security can ensure that those who are currently not getting enough of the right food can improve the quality of their diet, without healthy foods being displaced by the cheap, unhealthy, ultra-processed foods high in fat, salt, and sugar that are driving the rise in rates of obesity and diet-related NCDs. There is the potential for a win–win solution, with all forms of malnutrition being reduced.

Food consumption and dietary choices are culturally structured from birth. In some cultures food is seen merely as a source of energy for the body, whereas in other cultures food is considered to be part of social bonding and an essential feature of cultural or religious experiences. The available global nutrition data are often limited to weight and height, with poor or limited data available on dietary patterns or more detailed aspects of nutritional status, such as body composition or biochemical/metabolic status. There is often not even agreement about how best to measure nutritional status in infants and children and what cut-offs to use for adults from different regions of the world. Limited data are available on the impact of poor nutrition at different stages of the life-course on subsequent longer-term health. The wider socioecological determinants of change in nutrition-related behaviours need to be assessed. Understanding how local, national, and international food systems shape consumption is important to help guide local policy responses. To influence positive change and to protect desirable culinary traditions, it is vital that the link between culture and nutritional choice be acknowledged, understood, and addressed for each specific context.

To date, most of the evidence that supports global nutrition policy comes from HICs, with limited data from surveillance surveys and cross-sectional studies available from LMICs. The lack of data from LMICs is a function of limited support for infrastructure and human capacity to undertake and lead the research and data collection from within countries. Without consideration of how to build and support this capacity, the opportunities that arise to learn from the rapid dietary changes that are occurring will be lost. It will also be difficult to provide reliable surveillance data for key indicators to assess progress on global targets for both NCDs and infant and young child nutrition. Global funders need to consider how to support this capacity within LMICs.

Key points

- Half of all stunted and overweight children in the world live in LMICs, where rates of obesity are rising, particularly in Asia.
- Micronutrient deficiencies persist.
- There are more premature deaths from NCDs in LMICs than in HICs.
- Early undernutrition and later overnutrition exacerbate the risk of NCDs.
- Changing food patterns and food systems are driving the rising rates of overweight, while not addressing micronutrient deficiencies.
- The policy response is polarized and is not addressing the DBM in a coherent way; the drivers of the food systems need to be addressed.
- The capacity and evidence base in LMICs are limited, which is weakening the policy commitment to action.

Research needs

- Study the impact of the nutrition transition on health outcomes in LMICs, to strengthen the evidence base to support the development of more effective policies and programmes to prevent and ameliorate the growing burden of NCDs in LMICs.
- Adopt a food systems approach to the DBM, to explore how a coherent approach to the way food is grown, processed, and sold can address both the quality and the quantity of the food supply (a win–win approach to reduce all forms of malnutrition).
- Assess the wider socioecological determinants of change in nutrition-related behaviours.
- Understand how local, national, and international food systems shape consumption, to help guide local policy responses.
- Assess the link between culture and nutritional choice for each specific context, to influence positive change and to protect desirable culinary traditions.
- Identify and validate key indicators for reliable surveillance to assess progress on global targets for both NCDs and infant and young child nutrition.
- Build and support infrastructure and human capacity to undertake and lead the research and data collection from within LMICs.

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