

The Triple Burden of Malnutrition: Converging Epidemics of Undernutrition, Micronutrient Deficiencies and Overnutrition

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Abstract: Background: Malnutrition is no longer adequately described as a problem of insufficient food intake. Many countries now face a triple burden comprising undernutrition, micronutrient deficiencies, and overweight, obesity and diet-related noncommunicable diseases. These conditions may coexist within the same country, community, household or individual and arise from shared failures of food, health, education, social-protection and environmental systems. **Objective:** This narrative review examines the magnitude, determinants and health consequences of the triple burden of malnutrition; critically evaluates recent evidence; and identifies policy and research priorities, with particular attention to India. **Key findings:** Global hunger has declined modestly, but approximately 645 million people experienced hunger in 2025, while 2.1 billion faced moderate or severe food insecurity. Around 150 million children younger than five years remain stunted, anaemia among women is worsening, and adult obesity continues to increase. India illustrates this convergence: National Family Health Survey 2019–2021 estimates showed stunting in 35.5%, wasting in 19.3%, and anaemia in 67.1% of children aged 6–59 months, alongside rising overweight and obesity among children and adults. The triple burden is driven not merely by food scarcity, but by poor dietary quality, maternal undernutrition, infection, inadequate care, inequitable food environments, increasing consumption of ultra-processed foods, and declining physical activity. Conventional programmes addressing each form of malnutrition separately may produce fragmented or unintended results. **Conclusion:** Addressing the triple burden requires nutrition-sensitive food systems and “double-duty” actions that reduce undernutrition without accelerating obesity. Priorities include maternal and adolescent nutrition, breastfeeding, diverse complementary feeding, micronutrient interventions, healthy school food environments, fiscal and regulatory measures for unhealthy products, social protection, primary-care integration and stronger nutrition surveillance.

Keywords: Triple burden of malnutrition; undernutrition; micronutrient deficiency; obesity; food systems; India.

INTRODUCTION

Malnutrition encompasses deficiencies, excesses or imbalances in energy and nutrient intake or utilization. Undernutrition includes stunting, wasting and underweight, while micronutrient malnutrition results from inadequate intake, absorption or utilization of vitamins and minerals. At the opposite end of the conventional spectrum, overweight and obesity increase the risk of diabetes, cardiovascular disease, some cancers and other diet-related noncommunicable diseases.[1] These categories are analytically distinct but biologically and socially interconnected.

The phrase “triple burden of malnutrition” generally refers to the coexistence of three broad problems: undernutrition; deficiencies of essential vitamins and minerals, often described as hidden hunger; and

overweight, obesity and associated noncommunicable diseases.[2] The components may occur simultaneously in a population or household. They can also occur in one person—for example, a child who is stunted, anaemic and has excessive adiposity, or an adult with obesity but deficiencies of iron, vitamin B12 or other micronutrients.

This framework extends the better-established concept of the double burden of malnutrition, in which undernutrition coexists with overweight or diet-related disease. It is important, however, not to treat the “triple burden” as a universally standardized epidemiological indicator. Studies differ in whether micronutrient deficiency is represented by anaemia, biochemical deficiency or dietary inadequacy, and whether overnutrition is defined by body mass index, weight-for-height or metabolic risk. Consequently, prevalence estimates depend heavily on the operational definition used.

The global nutrition landscape demonstrates why an integrated framework is needed. The State of Food Security and Nutrition in the World 2026 estimated that 7.8% of the global population—approximately 645 million people—experienced hunger in 2025. Around 2.1 billion people faced moderate or severe food insecurity, and 2.69 billion could not afford a healthy diet. At the same time, approximately 150 million children younger than five years remained stunted, anaemia among women aged 15–49 years was worsening, and adult obesity increased from 12.1% in 2012 to 16.2% in 2024.[3] These trends show that improvements in energy sufficiency do not necessarily translate into nutritionally adequate diets.

Components of the Triple Burden

Persistent undernutrition

Stunting reflects impaired linear growth resulting from cumulative nutritional deprivation, recurrent infection and adverse social conditions, particularly during the period from conception to two years of age. Wasting is characterized by low weight for height and often reflects acute or recent weight loss, although repeated or persistent wasting is common. Underweight combines elements of both chronic and acute undernutrition.

The UNICEF–WHO–World Bank Joint Child Malnutrition Estimates 2025 concluded that global progress remained insufficient to achieve the 2030 targets. Only 28% of countries were on track to halve the number of children affected by stunting, while progress could not be assessed in many countries because of inadequate data.[4] The persistence of undernutrition is concentrated among populations experiencing poverty, conflict, displacement, climatic shocks, poor sanitation, limited health care and low maternal education.

Undernutrition increases susceptibility to infection, delays recovery and contributes to impaired cognitive development, lower educational attainment and reduced adult productivity. Approximately 45% of deaths among children younger than five years are associated with undernutrition, although undernutrition is frequently an underlying vulnerability rather than the immediate recorded cause of death.[1]

Micronutrient deficiencies and hidden hunger

Micronutrient deficiencies may occur even when energy intake is adequate. Iron, vitamin A, iodine, zinc, folate, vitamin B12 and vitamin D deficiencies are of particular public health importance, although their distribution varies by age, sex, diet, geography and disease burden. Anaemia is commonly used as a proxy for iron deficiency, but it is not synonymous with iron deficiency. Infection, inflammation, haemoglobinopathies, malaria, parasitic infestation and deficiencies of folate, vitamin B12 or vitamin A can also contribute.

The widespread use of anaemia as the principal marker of hidden hunger is understandable because haemoglobin can be measured in large surveys. Nevertheless, programmes that assume all anaemia is caused by iron deficiency risk providing an incomplete response. Population assessment should, where feasible, include biomarkers of iron status and inflammation and account for local infectious and genetic causes.

Micronutrient deficiencies impair immunity, cognition, growth, work capacity, pregnancy outcomes and survival. Their apparent invisibility can lead to policy neglect: unlike wasting or obesity, many deficiencies do not produce readily recognizable physical signs until they become severe.

Overweight, obesity and diet-related disease

Overweight and obesity are increasing across low-, middle- and high-income settings. The rise is not confined to affluent urban populations. Rapid increases are increasingly observed in rural areas and lower socioeconomic groups as food systems make energy-dense, nutrient-poor products inexpensive and accessible.[5]

Body mass index remains useful for population surveillance but does not directly measure body fat distribution or metabolic risk. South Asian populations may develop diabetes and cardiometabolic disease at lower body mass index values than some other populations. Reliance on international body mass index thresholds alone may therefore underestimate risk in India.

The drivers of obesity extend beyond individual choice. Food pricing, marketing, product formulation, school food environments, urban design, transport systems, employment patterns, sleep, stress and access to safe physical activity all shape energy intake and expenditure. Policies centred only on nutrition education place excessive responsibility on individuals while leaving obesogenic environments unchanged.

Coexistence Across the Life Course

The three burdens are not independent epidemics. Undernutrition in fetal life or early childhood can alter growth, body composition, appetite regulation and metabolism. When individuals who experienced early nutritional deprivation later encounter energy-dense diets and sedentary environments, their risk of central adiposity, diabetes and cardiovascular disease may increase.[5,6]

A low-birthweight infant may undergo rapid postnatal weight gain without adequate linear growth or lean-tissue development. A stunted child may therefore become an adolescent or adult with short stature and excess adiposity. Meanwhile, a calorie-rich but monotonous diet may provide sufficient or excessive energy while remaining deficient in iron, zinc, folate or other micronutrients.

Intergenerational pathways are equally important. An undernourished or anaemic adolescent girl may enter pregnancy with limited nutrient reserves, increasing the probability of fetal growth restriction and low birth weight. Conversely, maternal obesity and hyperglycaemia can increase the risk of excessive fetal growth and later obesity in the offspring. The same health system may therefore encounter underweight women, women with obesity, and women with both excessive body mass and micronutrient deficiencies.

The household is another site of coexistence. A stunted child may live with an overweight mother because family members have different biological requirements, food allocations and activity patterns. Adults may consume inexpensive refined carbohydrates and fats, while young children receive inadequate complementary feeding. Household-level labels such as “food secure” or “obese household” can therefore conceal important within-family inequalities.

Structural Drivers of the Triple Burden

Food-system transformation

The nutrition transition has altered the availability, affordability and desirability of foods. Traditional diets based on minimally processed grains, pulses, vegetables and locally prepared foods are increasingly supplemented or replaced by refined cereals, packaged snacks, sugar-sweetened beverages, processed meats and ready-to-eat products.

Ultra-processed foods are often convenient, palatable, intensively marketed and relatively inexpensive per unit of energy. They may contain high levels of free sugars, sodium and unhealthy fats while providing limited fibre and micronutrient density. Their expansion does not affect all populations uniformly. Wealthier households may retain access to fruits, vegetables, dairy, nuts and quality protein, while poorer households face a choice between inadequate dietary quantity and inexpensive, energy-dense foods.

The relative price of nutritious foods is central. Indian evidence has shown that vegetables, dairy and animal-source foods can be more difficult for poorer households to obtain than calorie-dense cereals, contributing simultaneously to micronutrient deficiencies and increasing obesity risk.[2] Global estimates similarly indicate that nearly one-third of humanity could not afford a healthy diet in 2025.[3]

Poverty and inequality

Poverty contributes to undernutrition through insufficient food, poor sanitation, inadequate health care and reduced caregiving resources. It also contributes to obesity when cheaper diets are dominated by refined carbohydrates, fats and highly processed products. Income growth alone does not guarantee improved nutrition because food environments, knowledge, gender relations and market incentives influence how additional resources are used.

Social inequalities based on caste, tribe, gender, education, geography and occupation affect exposure to all forms of malnutrition. Rural and tribal populations may have inadequate access to diverse foods and health services, while urban informal settlements combine food insecurity with dense marketing and availability of unhealthy products.

Infection, sanitation and health services

Repeated diarrhoea, respiratory infections, intestinal inflammation and parasitic disease impair nutrient absorption, increase metabolic requirements and reduce appetite. Poor water, sanitation and hygiene conditions therefore perpetuate undernutrition even where food is available.

At the same time, health systems in many low- and middle-income countries remain more prepared to identify severe undernutrition than obesity, unhealthy diets or early metabolic risk. Fragmentation between maternal-child health and noncommunicable disease programmes prevents continuity across the life course.

Climate change, conflict and economic shocks

Climate change affects crop yields, food prices, nutrient composition, infectious-disease patterns and the stability of food supplies. Extreme heat, floods and droughts disproportionately affect small farmers and low-income households. Conflict and displacement interrupt food production, markets, health services and humanitarian assistance.

The Lancet Commission described obesity, undernutrition and climate change as a global syndemic because they interact, share major societal drivers and require coordinated systemic solutions.[7] Agricultural and food policies that promote diversified, sustainable diets may therefore generate benefits for nutrition and planetary health, although transitions must protect livelihoods and local food cultures.

The Indian Context

India exemplifies the triple burden. According to NFHS-5, conducted during 2019–2021, 35.5% of children younger than five years were stunted, 19.3% were wasted and 32.1% were underweight. Among children aged 6–59 months, 67.1% were anaemic.[8] At the same time, 3.4% of children younger than five years were overweight, an increase from 2.1% in NFHS-4.

Among adults aged 15–49 years, 24.0% of women and 22.9% of men were overweight or obese, while 18.7% of women and 16.2% of men had a body mass index below 18.5 kg/m². [8] Thus, adult underweight and excess weight coexist nationally and within states. Anaemia affected 57.0% of women aged 15–49 years, illustrating that a woman may simultaneously have obesity and anaemia.

A recent analysis of NFHS-5 data reported that approximately 34% of Indian children aged 6–59 months were stunted, 4% were overweight and 66% were anaemic. The authors demonstrated marked spatial variation, with stunting and anaemia concentrated particularly in central and eastern regions, while childhood overweight was relatively more common in parts of northern and north-eastern India.[9] These estimates describe simultaneous population-level burdens rather than proving that every affected child had all three conditions.

India has developed a broad policy architecture, including the Integrated Child Development Services, Anaemia Mukh Bharat, PM POSHAN, food fortification programmes, the Public Distribution System and Mission Saksham Anganwadi and POSHAN 2.0. POSHAN 2.0 seeks to integrate supplementary nutrition, maternal nutrition, infant and young-child feeding, management of acute malnutrition, early childhood care and digital monitoring through the Poshan Tracker.[10]

These initiatives provide substantial reach, but implementation quality is uneven. Programme performance is commonly judged by rations distributed, meals served, tablets supplied or beneficiaries registered rather than by dietary diversity, biochemical status or sustained changes in growth. The emphasis on cereal-based calorie provision has historically been stronger than the emphasis on diverse, nutrient-dense diets.

India's response must also avoid creating a sequential policy model in which undernutrition is addressed first and obesity later. Both require action now. Supplementary foods designed to improve energy intake should not be excessively sweetened or energy-dense, and school meals should improve diet quality without normalizing frequent consumption of refined snacks.

Table 1. Components, Drivers, Consequences and Integrated Responses to the Triple Burden of Malnutrition

Component or level	Principal manifestations	Major drivers	Important health consequences	Priority integrated responses
Undernutrition	Stunting, wasting, underweight and low birth weight	Maternal undernutrition, food insecurity, infection, poor complementary	Mortality, impaired immunity, delayed development, lower educational attainment and	Maternal and adolescent nutrition, breastfeeding, diverse complementary

		feeding, inadequate care and sanitation	productivity	feeding, infection control, treatment of wasting and social protection
Micronutrient deficiencies	Iron, vitamin A, iodine, zinc, folate, vitamin B12 and other deficiencies	Monotonous diets, poor absorption, infection, increased requirements and food inequity	Anaemia, impaired cognition and immunity, adverse pregnancy outcomes, visual impairment and reduced work capacity	Dietary diversification, targeted supplementation, context-appropriate fortification, infection control and biomarker-based surveillance
Overweight and obesity	Excess weight, central adiposity and metabolic abnormalities	Ultra-processed foods, sugary drinks, large portions, marketing, sedentary living, stress and inadequate sleep	Diabetes, cardiovascular disease, fatty liver disease, selected cancers and disability	Healthy food environments, fiscal measures, marketing restrictions, front-of-pack labelling, active transport and primary-care prevention
Individual-level coexistence	Stunting with excess adiposity; obesity with anaemia or other deficiencies	Early undernutrition followed by energy-dense diets; poor dietary quality	Combined developmental and metabolic risk	Life-course assessment including growth, diet, micronutrients and metabolic risk
Household-level coexistence	Undernourished child with overweight or anaemic adult	Unequal food allocation, age-specific needs, time constraints and cheap energy-dense foods	Intergenerational transmission and competing care requirements	Household counselling combined with income, food and caregiving support
Food-system level	Coexistence of food insecurity with widespread unhealthy food consumption	High prices of nutritious foods, subsidies favouring staples, aggressive marketing and weak regulation	Population-wide triple burden and widening inequalities	Diversified agriculture, nutritious procurement, reformulation, regulation, social protection and resilient supply chains
Health-system level	Separate programmes for wasting, anaemia, obesity and NCDs	Vertical funding, fragmented indicators and limited workforce capacity	Missed diagnosis, duplication and contradictory advice	Integrated nutrition services across maternal-child health, schools and primary care
Climate and emergency context	Acute wasting, disrupted supplementation and increased reliance on cheap packaged foods	Drought, floods, conflict, displacement and food-price shocks	Rapid deterioration of undernutrition with longer-term obesity and NCD risk	Shock-responsive social protection, resilient local food systems and nutrition-sensitive emergency assistance

Public Health Significance

The triple burden threatens survival, human capital and health-system sustainability. Undernutrition increases childhood mortality and impairs development, micronutrient deficiencies reduce learning and productivity, and obesity drives long-term treatment costs for diabetes, cardiovascular disease and other chronic conditions.

These burdens reinforce inequality. Poor nutrition reduces educational attainment and earning potential, perpetuating poverty across generations. The health system must simultaneously manage severe wasting, anaemia, hypertension, diabetes and obesity—often within the same family.

The triple-burden framework also reveals why programmes based solely on calories or body weight are inadequate. A reduction in underweight may occur without an improvement in height, micronutrient status or dietary quality. Conversely, rising average body mass index may conceal persistent anaemia and childhood stunting. Public health surveillance must therefore measure multiple dimensions.

Recent Advances

The most important recent development is the shift towards “double-duty” or multiple-duty actions. These interventions address one form of malnutrition while reducing the risk of another. Promotion of breastfeeding, for example, supports infant survival and healthy growth and may reduce later obesity risk. Appropriate complementary feeding can prevent growth faltering without relying on products high in sugar or unhealthy fat.

School food policies can combine nutritious meals with restrictions on unhealthy food marketing and access. Maternal nutrition programmes can screen for both low body mass and obesity while managing anaemia and gestational diabetes. Social-protection programmes can support the purchase of diverse foods rather than merely supplying calories.

Digital platforms, geospatial analysis and linked survey data can improve targeting. India’s Poshan Tracker offers opportunities for near-real-time monitoring, but routine measurements require rigorous training, equipment calibration, data-quality audits and safeguards against exclusion caused by identification or connectivity problems.

Recent food-policy approaches include front-of-pack nutrition labelling, taxes on sugar-sweetened beverages, marketing restrictions for children, reformulation targets and healthy public procurement. These measures are potentially powerful because they modify food environments, although industry influence, regulatory delay and weak enforcement frequently limit implementation.

Challenges, Controversies and Limitations

The absence of a standardized definition is a major limitation. Some authors define the triple burden as undernutrition, micronutrient deficiency and overweight; others use stunting, anaemia and overweight as measurable proxies. Prevalence estimates using different definitions should not be directly compared.

Anaemia is particularly problematic. Haemoglobin surveys reveal an important health burden but cannot identify the causal contribution of iron deficiency. Similarly, body mass index does not distinguish fat from lean mass, and child stunting is a population marker of deprivation rather than a diagnosis of a single nutrient deficiency.

Another controversy concerns food fortification. Fortification can be effective and equitable where a widely consumed vehicle, appropriate nutrient and reliable quality-control system exist. It cannot replace dietary diversity and may provide limited benefit when anaemia is driven by infection, inflammation or genetic disorders. Multiple overlapping fortification and supplementation programmes also require monitoring to prevent inappropriate cumulative exposure.

Commercial products promoted as solutions to undernutrition may be nutrient-fortified but high in sugar, sodium or unhealthy fats. Partnerships involving food manufacturers therefore require strong conflict-of-interest safeguards. The aim should be to improve diets, not merely to replace one form of malnutrition with another.

Future Directions

Nutrition surveillance should extend beyond children younger than five years to include school-age children, adolescents, adults and older people. Repeated national surveys should combine anthropometry, dietary assessment, relevant biomarkers and metabolic indicators. Subnational estimates are essential because national averages conceal profound variation.

India should prioritize adolescent girls and women before conception, not only during pregnancy. Preventing early marriage, improving education, reducing anaemia, supporting healthy body composition and strengthening reproductive health can interrupt intergenerational malnutrition.

Food and agricultural policies should increase the availability and affordability of pulses, vegetables, fruits, dairy, eggs, nuts and other locally appropriate nutrient-dense foods. Public procurement for Anganwadi centres and schools can create stable demand for diverse local produce while supporting small farmers.

Primary health care should screen for growth failure, anaemia, unhealthy weight gain, hypertension and diabetes within an integrated life-course framework. Counselling must be supported by affordable food and safe environments for physical activity.

Research priorities include standardized definitions of the triple burden, longitudinal studies of transitions between nutritional states, evaluation of double-duty actions, better measurement of dietary quality and investigation of how climate shocks, ultra-processed foods and commercial determinants alter nutritional inequalities.

CONCLUSION

The triple burden of malnutrition is not simply the simultaneous presence of three unrelated conditions. It reflects a shared failure of food, health, social-protection, education and economic systems to provide equitable access to healthy diets and supportive living conditions.

Global hunger has declined modestly, but undernutrition and micronutrient deficiencies remain widespread while obesity continues to increase. India illustrates this convergence vividly: childhood stunting, wasting and anaemia persist alongside rapidly rising overweight, diabetes and other diet-related diseases.

A fragmented response is no longer defensible. Policies must prevent undernutrition without promoting excessive weight gain, correct micronutrient deficiencies without treating fortification as a substitute for dietary quality, and address obesity without worsening food insecurity or stigmatizing individuals.

The most effective response will combine life-course nutrition services with structural transformation of food environments. Success should be measured not merely by calories distributed, children weighed or supplements issued, but by whether all people can obtain diverse, safe, affordable and sustainable diets that support healthy growth and long-term metabolic health.

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