

## **Epidemiology of Malnutrition in Low-Income Countries**

**Dr. Satish V. Kakade**, Associate Professor, Department of Community Medicine, Krishna Institute of Medical Sciences, Krishna Vishwa Vidyapeeth, Karad, Maharashtra, India. Email: satishvkakade@yahoo.co.in

**Mahendra Alate** Statistician, Directorate of Research, Krishna Vishwa Vidyapeeth, "Deemed To Be University", Karad, Maharashtra, India. Email: mahendra.alate@gmail.com

**Mr. Dhirajkumar Mane** Statistician, Directorate of Research, Krishna Vishwa Vidyapeeth, "Deemed To Be University", Karad, Maharashtra, India. Email ID: [dhirajmane123@gmail.com](mailto:dhirajmane123@gmail.com)

**Abstract:** Malnutrition remains a widespread issue in many developing nations, affecting 26% of children globally with stunted growth and nearly 7% experiencing severe wasting, contributing to 55% of deaths in children under 58 due to being underweight. Southern Asia and sub-Saharan Africa are particularly affected. Effectively managing severe acute malnutrition (SAM) is challenging in healthcare settings with limited resources, emphasizing the need for more efficient prevention and treatment strategies. The coexistence of undernutrition and overnutrition, known as the double burden of malnutrition (DBM), adds complexity, emphasizing the necessity for context-specific interventions. In low- and middle-income countries (LMICs), the interplay between early undernutrition and later overnutrition amplifies the risk of noncommunicable diseases (NCDs). Rapid weight gain and linear growth in children in LMICs, while beneficial for survival and cognitive development, may also increase the risk of obesity and cardiometabolic diseases in later life, especially after the age of two. Addressing these challenges urgently requires innovative solutions and effective preventive measures.

**Keywords:** Malnutrition, Developing nations, Stunted growth, Severe wasting, Underweight, Child mortality, Noncommunicable diseases (NCDs), Low- and middle-income countries (LMICs), Early undernutrition, Overnutrition, Rapid weight gain, Cardiometabolic diseases

### **I. Introduction**

Malnutrition in low-income countries is a multifaceted challenge deeply rooted in socio-economic disparities and structural deficiencies. The prevalence of malnutrition is often exacerbated by pervasive poverty, limiting access to nutrient-rich foods and leading to a reliance

on inexpensive yet nutritionally inadequate alternatives. Inadequate healthcare infrastructure further compounds the issue, as low-income countries struggle to provide essential maternal and child health services, including nutrition education. Maternal malnutrition during pregnancy and lactation directly impacts child health, and limited access to prenatal and postnatal care contributes to poor nutritional outcomes [1]. Insufficient sanitation and hygiene facilities increase the risk of infectious diseases, while the prevalence of conditions like malaria and parasitic infections further compromises nutritional status. Environmental factors, such as natural disasters and climate change, disrupt food supply chains and exacerbate food insecurity. Additionally, political and social instability, including conflicts and displacement, can disrupt food production and healthcare access, aggravating malnutrition. Addressing this complex issue requires a comprehensive approach that combines short-term interventions with long-term strategies focusing on poverty reduction, healthcare improvement, and sustainable agricultural development. International cooperation, targeted policies, and community-based initiatives are essential components in the collective effort to alleviate malnutrition in low-income countries [2]. The limited agricultural productivity in low-income countries, often characterized by subsistence farming and a lack of diversification, contributes to the monotonous and nutrient-deficient diets of many populations. The cyclical nature of poverty and malnutrition creates a formidable barrier to breaking the cycle of undernutrition, hindering both individual and societal development. The intertwined challenges of inadequate access to clean water, sanitation, and healthcare perpetuate a vicious cycle, where malnutrition and infectious diseases reinforce each other. International initiatives, such as the Sustainable Development Goals (SDGs), emphasize the need to address malnutrition as a crucial component of global development efforts. Nutrition-specific interventions, including supplementation programs and fortification initiatives, aim to directly improve the nutritional status of vulnerable populations. Additionally, investments in healthcare systems, education, and economic development are vital for creating sustainable improvements in living conditions and breaking the intergenerational transmission of malnutrition. Malnutrition persists as a substantial public health challenge, especially in low-income countries, where a myriad of interconnected factors underscores its prevalence. The epidemiology of malnutrition in these regions is a multifaceted inquiry that encompasses various dimensions, spanning from the root causes of malnutrition to its far-reaching consequences, as well as the potential interventions aimed at mitigating its impact. This intricate interplay of

factors underscores the complexity of the issue, requiring a comprehensive understanding to develop effective strategies for prevention and intervention. Malnutrition include the underlying causes that contribute to its persistence. Poverty, a central determinant, restricts access to a diverse and nutritious diet, creating a cycle that hinders socio-economic development. Inadequate healthcare infrastructure and limited access to essential services further compound the problem, exacerbating the vulnerability of populations to malnutrition [3].

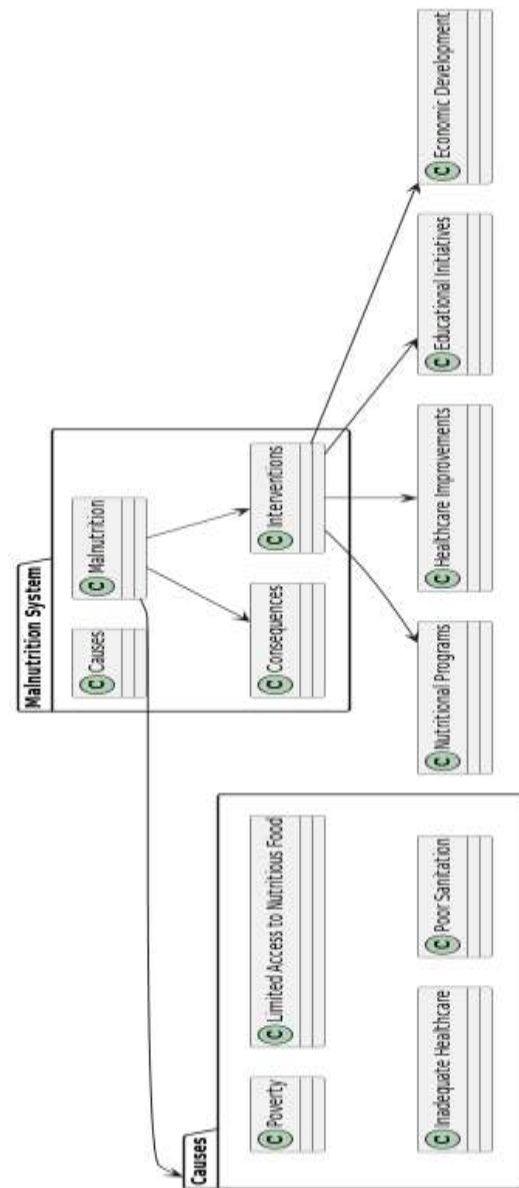


Figure 1. Block Diagram of Malnutrition in Low-Income Countries

Understanding the consequences of malnutrition is equally critical. Beyond the immediate health implications, malnutrition has profound and long-lasting effects on individuals and communities, impacting physical and cognitive development, productivity, and overall well-being. Recognizing the full spectrum of consequences is imperative for crafting holistic interventions that address the multifaceted nature of malnutrition [4]. Importantly, the epidemiology of malnutrition involves exploring potential interventions to break the cycle of its persistence. This includes targeted nutritional programs, healthcare improvements, and educational initiatives. Interventions may range from providing nutrient supplements and fortifying foods to strengthening healthcare systems, enhancing maternal and child health services, and promoting nutrition education. The epidemiology of malnutrition is a comprehensive study of the patterns, causes, and consequences of malnutrition within populations. Malnutrition is a global health concern, but its prevalence is particularly pronounced in low- and middle-income countries. It encompasses various forms, including undernutrition (such as stunting, wasting, and underweight), micronutrient deficiencies, and overnutrition (obesity and diet-related chronic diseases). One key aspect of malnutrition epidemiology involves understanding the social determinants that contribute to its occurrence [5]. Poverty is a significant factor, limiting access to diverse and nutritious foods, adequate healthcare, and sanitation. Inadequate maternal and child health services, coupled with insufficient education on proper nutrition practices, contribute to the perpetuation of malnutrition. Maternal factors play a crucial role in the epidemiology of malnutrition. The nutritional status of mothers during pregnancy and lactation directly influences fetal and child development. Insufficient prenatal and postnatal care, prevalent in many low-income settings, can result in adverse health outcomes for both mothers and their children. Infectious diseases, such as diarrhea, malaria, and other infections, further complicate the picture. Poor sanitation and hygiene practices contribute to the spread of diseases, which, in turn, can lead to malnutrition. Additionally, climate and environmental factors, including natural disasters and climate change, can impact food availability and exacerbate malnutrition. Efforts to address malnutrition epidemiology include nutritional programs, healthcare interventions, and educational initiatives [6]. Nutrition-specific interventions, like vitamin supplementation and food fortification, aim to directly improve nutritional status. Strengthening healthcare systems, promoting exclusive breastfeeding, and enhancing sanitation and hygiene practices are integral components of comprehensive strategies. Global initiatives, such as the Sustainable Development

Goals (SDGs), recognize the importance of addressing malnutrition as part of a broader agenda to improve global health and well-being. Collaboration between governments, non-governmental organizations, and international agencies is essential to implementing effective and sustainable interventions [72].

## **II. Literature Review**

A collection of studies and reviews on malnutrition encompasses various facets of this complex global issue. One investigation focused on the impact of WHO guidelines in managing severe malnutrition in South African hospitals, delving into case fatality rates and operational factors to illuminate challenges and effectiveness. Another study delved into the intricate relationship between maternal and child undernutrition and overweight in low- and middle-income countries [8], providing insights into the dual burden of nutritional challenges. A review on the prevention of childhood malnutrition explored the enormity of the challenge, presenting a spectrum of strategies and critically examining diverse approaches. Addressing the intersection of malnutrition and HIV, a study highlighted the challenges in managing severely malnourished, HIV-infected children in high-prevalence areas, emphasizing the necessity of integrated approaches [9]. Additionally, a review scrutinized methods to detect severely malnourished children in communities for admission into therapeutic care programs. Focusing on the neglected aspect of enteropathies in the developing world, another paper underscored their effects on global health, emphasizing the crucial link between malnutrition and gastrointestinal health. WHO guidelines provided evidence-based recommendations for managing severe acute malnutrition in infants and children, catering to healthcare professionals as a critical resource [10]. The Scaling Up Nutrition initiative outlined goals and strategies, emphasizing the importance of multi-stakeholder collaboration for sustainable improvements. Furthermore, a joint report offered estimates, levels, and trends in child malnutrition, serving as a valuable resource for policymakers and researchers engaged in child health and nutrition. Each contribution to this literature serves as a building block in the collective effort to understand, prevent, and address malnutrition's multifaceted challenges on a global scale [11]. The phenomenon known as the double burden of malnutrition (DBM), or occasionally referred to as "malnutrition in all its forms," denotes the simultaneous existence of undernutrition, encompassing deficiencies in macronutrients and micronutrients, and overnutrition within the

same population across their life course [12]. Undernutrition arises from insufficient nutrient intake, poor absorption, and/or inadequate biological utilization of nutrients. Conversely, overnutrition results from excessive or imbalanced nutrient consumption, leading to impaired bodily functions as well as conditions such as overweight and obesity. Notably, in many regions, undernutrition and overnutrition coexist within the same country, community, or even household. An intricate interplay is observed between early undernutrition, occurring in mothers before and during pregnancy and in early childhood, and later overnutrition, intensifying the risk of noncommunicable diseases (NCDs). The prevalence of NCDs is rapidly escalating in low- and middle-income countries (LMICs) [13]. Undernutrition during pregnancy, influencing fetal growth, and in the initial two years of life significantly determines the risk of both stunted linear growth and subsequent obesity and NCDs in adulthood [14]. Rapid weight gain and linear growth in children in LMICs are correlated with enhanced survival and improved cognitive development but may also pose an elevated risk of obesity and cardiometabolic diseases in later life, especially with rapid weight gain after the age of two [15]. Malnutrition is a pervasive global issue affecting one-third of the global population and all countries. Approximately 1 billion people continue to face undernourishment, lacking sufficient calorie, protein, and micronutrient intake [16], while around 2 billion people grapple with overweight issues. Almost half of all countries confront multiple burdens of malnutrition, including poor child growth, micronutrient deficiencies, and adult overweight. The anticipated cost of treating NCDs, primarily nutrition-related ones, is projected to reach US\$ 30 trillion globally over the next two decades [17]. Among the top 20 determinants of global deaths, 14 are associated with diet and nutrition. Obesity currently holds the third-highest global social burden (US\$ 2.0 trillion, or 2.8% of global GDP), trailing closely behind tobacco and armed violence, war, and civil disorder [18].

Author & Year	Area	Methodology	Key Findings	Challenges	Pros	Cons	Application
Ashworth et al. (2004)	Severe Malnutrition Management in	Investigation	WHO guidelines impact, case fatality rates,	Implementation challenges, effectiveness	Insights into challenges and effectiveness	Limited scope, operational complexity	Healthcare, policy planning

	South African Hospitals		operational factors	ess assessment	ess	es	
Black et al. (2013)	Maternal and Child Nutrition in Low- and Middle- Income Countries	Comprehensive Study	Complex relationship analysis	Data collection, cross-cultural variations	In-depth understanding of dual nutritional burden	Limited generalizability	Public health, policy development
Duggan (2014)	Prevention of Childhood Malnutrition	Review	Variety of prevention strategies	Implementation scalability	Diverse prevention strategies	Potential resource constraints	Pediatric healthcare, community programs
Heikens et al. (2008)	Case Management of Severely Malnourished, HIV-Infected Children	Case Study	Challenges in integrated management	HIV and malnutrition dual treatment	Insight into integrated approach needs	Resource-intensive, coordination hurdles	Pediatric HIV care, program integration
Myatt et al. (2006)	Review of Methods	Review	Community-based detection	Resource-intensive, community	Identification of practical	Limited generalizability,	Community healthcare



	to Detect Severely Malnourished Children in the Community		methods	y acceptance	detection methods	potential biases	re, therapeutic care programs
Prendergast and Kelly (2012)	Enteropathies in the Developing World	Review	Effects on global health	Limited data availability	Highlighting the link between malnutrition and gastrointestinal health	Data gaps, awareness challenges	Public health, global health initiatives
WHO Guidelines (2013)	Management of Severe Acute Malnutrition	Guideline Development	Evidence-based management recommendations	Implementation challenges	Standardized management guidelines	Resource-intensive, potential adaptability issues	Healthcare protocols, professional guidelines
Scaling Up Nutrition (2014)	Scaling Up Nutrition Initiative	Program Description	Goals and strategies of the initiative	Coordination among stakeholders	Emphasis on collaborative efforts	Potential for divergent goals, resource disparities	Public-private partnerships, global health



							initiatives
UNICEF-WHO-The World Bank (2014)	Joint Report on Child Malnutrition Estimates	Data Analysis	Estimates, levels, and trends in child malnutrition	Data accuracy, regional variations	Comprehensive overview for policymakers	Potential data inaccuracies	Policy planning, global health initiatives

**Table 1. Summarizes the Review of Literature of Various Authors**

**III. key Components of Malnutrition**

Malnutrition. Low-income countries often face challenges in providing accessible and quality healthcare services, particularly in the realms of maternal and child health. Limited access to healthcare exacerbates the vulnerability of populations, especially women and children, to malnutrition-related health issues. Poor sanitation and hygiene practices also play a significant role in the persistence of malnutrition. Inadequate access to clean water and proper sanitation facilities increases the risk of infectious diseases, contributing to malnutrition, particularly in children. These health challenges further compound the nutritional deficiencies prevalent in low-income settings.

**A. Prevalence and Types of Malnutrition:**

- **Undernutrition:** This includes stunting (chronic malnutrition), wasting (acute malnutrition), and underweight. Stunting is an indicator of long-term nutritional inadequacy, while wasting reflects acute nutritional deficiency.
- **Micronutrient Deficiencies:** Inadequate intake of essential vitamins and minerals, such as vitamin A, iron, and zinc, contributes to malnutrition.

**B. Determinants of Malnutrition:**

- **Poverty:** Limited financial resources often restrict access to diverse and nutritious foods.
- **Food Insecurity:** Inconsistent access to sufficient, safe, and nutritious food contributes to malnutrition.

- Limited Healthcare Access: Lack of access to healthcare services, including maternal and child health services, can exacerbate malnutrition.
- Poor Sanitation and Hygiene: Inadequate sanitation facilities increase the risk of infections and contribute to malnutrition.
- Educational Status: Low educational attainment, especially among women, can affect knowledge about nutrition and childcare practices.

**C. Maternal and Child Health:**

- Maternal Nutrition: The nutritional status of mothers during pregnancy and lactation directly impacts the health of the child.
- Exclusive Breastfeeding: Timely initiation and exclusive breastfeeding contribute to optimal infant nutrition and reduce the risk of malnutrition.

**D. Infectious Diseases:**

- Diarrheal Diseases: Waterborne diseases and poor sanitation contribute to diarrheal illnesses, leading to malnutrition.
- Malaria and Other Infections: Parasitic infections and diseases like malaria can affect nutritional status.

**E. Climate and Environmental Factors:**

- Drought and Famine: Environmental factors such as drought and famine can lead to food shortages and exacerbate malnutrition.
- Natural Disasters: Events like floods or earthquakes can disrupt food supply chains, exacerbating malnutrition.

**F. Interventions:**

- Nutritional Programs: Implementing nutrition-specific interventions, such as supplementation and fortification programs.
- Healthcare Access: Strengthening healthcare systems to provide essential maternal and child health services.
- Agricultural and Economic Development: Improving agricultural practices and promoting economic development can enhance food security.

**G. Global Initiatives:**

- Sustainable Development Goals (SDGs): Targeting SDG 2, which aims to end hunger, achieve food security, and improve nutrition by 2030.

- International Aid and Cooperation: Collaborative efforts involving governments, NGOs, and international organizations to address malnutrition.

#### **IV. Factors Prevalence of Malnutrition**

Malnutrition in low-income countries stands as a pervasive and intricate challenge, bearing profound consequences for both public health and socio-economic development. The prevalence of malnutrition in these regions is shaped by a convergence of multiple factors, creating a complex web of challenges that significantly impact the well-being of populations. Economic constraints play a pivotal role in exacerbating malnutrition. The scarcity of financial resources within low-income households often restricts access to a varied and nutrient-rich diet, forcing individuals and families to rely on more affordable yet often less nutritious food options. This economic limitation perpetuates a cycle of food insecurity and malnutrition, hindering the potential for socio-economic advancement. Inadequacies in healthcare infrastructure further contribute to the high prevalence of

##### **A. Limited Access to Nutrient-Rich Foods**

**Poverty:** Low-income households often struggle to afford a diverse and nutritious diet, leading to a reliance on inexpensive, calorie-dense, but nutrient-poor foods.

**Food Insecurity:** Inconsistent access to an adequate and balanced diet contributes to chronic malnutrition (stunting) and acute malnutrition (wasting).

##### **B. Inadequate Healthcare Infrastructure**

- **Limited Access to Healthcare:** Low-income countries may face challenges in providing accessible and quality healthcare services, including maternal and child health services critical for preventing malnutrition.
- **Lack of Nutrition Education:** Limited awareness and understanding of proper nutrition practices contribute to inadequate dietary choices.

##### **C. Maternal and Child Health Factors**

- **Maternal Malnutrition:** The nutritional status of mothers during pregnancy and lactation directly influences the health and development of the child.
- **Lack of Prenatal and Postnatal Care:** Inadequate healthcare during the prenatal and postnatal periods can result in poor maternal and child nutritional outcomes.

**D. Sanitation and Hygiene**

- **Poor Sanitation:** Lack of access to clean water and proper sanitation facilities increases the risk of diarrheal diseases and other infections, contributing to malnutrition.
- **Hygiene Practices:** Inadequate hygiene practices further exacerbate the spread of diseases that affect nutritional status.

**E. Infectious Disease**

- **Malaria and Other Infections:** Diseases such as malaria, HIV/AIDS, and tuberculosis can weaken the immune system and lead to malnutrition, especially in vulnerable populations.
- **Parasitic Infections:** Soil-transmitted helminths and other parasitic infections are prevalent in some low-income countries, affecting nutrient absorption.

**F. Climate and Environmental Factors**

- **Natural Disasters:** Low-income countries are often more vulnerable to natural disasters, disrupting food supply chains and exacerbating food insecurity.
- **Climate Change:** Changing weather patterns, extreme events, and environmental degradation can impact agricultural productivity and food availability.

**G. Limited Agricultural Productivity**

- **Subsistence Agriculture:** Reliance on subsistence farming, characterized by low agricultural productivity and limited access to modern farming techniques, contributes to food insecurity.
- **Lack of Diversification:** Limited crop diversity can result in a monotonous diet, lacking essential nutrients.

**H. Political and Social Instability**

- **Conflict and Instability:** Political instability, armed conflicts, and displacement can disrupt food production, distribution, and access to healthcare, aggravating malnutrition.

**V. Conclusion**

In conclusion, the multifaceted challenges of malnutrition, encompassing both undernutrition and overnutrition, underscore the urgent need for comprehensive and context-specific interventions.

The prevalence of malnutrition, particularly in developing nations, demands swift and efficient strategies to address its devastating impact on the health and well-being of children. The sobering statistics from 2012, revealing high percentages of stunted growth, severe wasting, and underweight children, emphasize the severity of the issue on a global scale, with Southern Asia and sub-Saharan Africa being significantly affected. The management of severe acute malnutrition (SAM) poses a considerable challenge, particularly in healthcare settings with limited resources. This underscores the necessity for innovative and practical solutions to effectively prevent and treat malnutrition comprehensively. The concept of the double burden of malnutrition (DBM) further complicates the scenario, emphasizing the coexistence of inadequate nutrient intake and excessive or imbalanced nutrient consumption within the same population. This complexity necessitates nuanced and tailored interventions that consider regional and household-specific factors. In low- and middle-income countries (LMICs), the interplay between early undernutrition and later overnutrition intensifies the risk of noncommunicable diseases (NCDs). While rapid weight gain and linear growth in children in LMICs are associated with improved survival and cognitive development, there is a potential trade-off, as these factors may increase the risk of obesity and cardiometabolic diseases in later life, particularly after the age of two.

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