# Protein-Energy Malnutrition in Children: A Comprehensive Review of Current Concepts and Homoeopathic Perspectives

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*Abstract*—**Protein-Energy Malnutrition (PEM) remains one of the most important causes of childhood morbidity, impaired growth, developmental delay, and mortality worldwide, particularly in low- and middle-income countries. The understanding of PEM has evolved from a simple deficiency disorder to a complex multifactorial condition influenced by inadequate dietary intake, recurrent infections, poor socioeconomic conditions, maternal factors, environmental adversities, and limited access to healthcare services. This review aims to provide a comprehensive overview of the historical evolution, epidemiology, determinants, pathophysiology, clinical manifestations, consequences, assessment, prevention, management, and homoeopathic perspectives of PEM in children. A narrative review methodology was employed through an extensive appraisal of standard paediatric textbooks, nutrition references, reports from international organizations, and published scientific literature relevant to childhood undernutrition and homoeopathic concepts. The review discusses the transition from classical classifications of PEM to the contemporary concept of Severe Acute Malnutrition (SAM), emphasizing modern anthropometric assessment and evidence-based therapeutic approaches. The homoeopathic perspective is explored through constitutional assessment, miasmatic interpretation, and therapeutically indicated remedies traditionally recommended for children presenting with features suggestive of defective assimilation, growth retardation, and recurrent illnesses. While nutritional rehabilitation, infection control, micronutrient supplementation, and public health interventions remain the cornerstone of management, individualized homoeopathic treatment may serve as a supportive adjunct in selected cases. Further clinical research is warranted to establish the potential contribution of homoeopathic interventions in improving health outcomes among children recovering from Protein-Energy Malnutrition.**

*Index Terms*—**Protein-Energy Malnutrition; Childhood Undernutrition; Severe Acute Malnutrition; Marasmus; Kwashiorkor; Nutritional Assessment; Child Health; Homoeopathy; Constitutional Treatment; Miasmatic Approach.**

## I. OBJECTIVES

General Objective

To provide an updated and integrated understanding of Protein-Energy Malnutrition and its relevance to contemporary paediatric and homoeopathic practice.

Specific Objectives

1. To describe the historical evolution and changing concepts of Protein-Energy Malnutrition.
2. To review the global and Indian epidemiology of childhood undernutrition.
3. To identify the major determinants and risk factors associated with PEM.
4. To discuss the pathophysiological mechanisms and clinical manifestations of marasmus, kwashiorkor, and marasmic-kwashiorkor.
5. To summarize contemporary methods of nutritional assessment and classification.
6. To evaluate current strategies for prevention, control, and management of PEM.
7. To explore homoeopathic concepts, miasmatic interpretations, and commonly indicated remedies

in children with manifestations suggestive of Protein-Energy Malnutrition.
8. To identify gaps in knowledge and emphasize the need for future clinical research.

## II. MATERIALS AND METHODS

### Study Design
Narrative Review Article.

### Data Sources
The review was prepared through an extensive literature search and critical appraisal of information obtained from:
- Standard paediatric textbooks;
- Nutritional assessment references;
- Homoeopathic classical literature;
- Reports published by international organizations including WHO and UNICEF;
- National reports such as NFHS-5;
- Peer-reviewed journal articles indexed in biomedical databases.

### Search Strategy
Relevant literature was identified using keywords such as:
- Protein-Energy Malnutrition
- Childhood Undernutrition
- Severe Acute Malnutrition
- Marasmus
- Kwashiorkor
- Nutritional Assessment
- Child Growth
- Homoeopathy
- Constitutional Treatment
- Miasmatic Approach

### Inclusion Criteria
- English-language publications;
- Textbooks and guidelines related to paediatric nutrition;
- WHO and UNICEF publications;
- Articles discussing epidemiology, pathophysiology, assessment, prevention, and management of PEM;
- Classical and contemporary homoeopathic literature relevant to nutritional disorders.

### Exclusion Criteria
- Studies unrelated to childhood undernutrition;
- Non-English publications;
- Articles lacking scientific relevance or adequate methodological information.

### Data Extraction and Synthesis
Relevant information was extracted, categorized, and synthesized under thematic headings including historical evolution, epidemiology, determinants, pathophysiology, clinical manifestations, consequences, nutritional assessment, prevention, management, and homoeopathic perspectives to provide a comprehensive overview of current concepts in Protein-Energy Malnutrition.

## III. REVIEW OF LITEATURE

### Introduction
Malnutrition remains one of the most important public health challenges worldwide and continues to affect millions of children, particularly in low- and middle-income countries. The term malnutrition encompasses a broad spectrum of nutritional disorders arising from deficiencies, excesses, or imbalances in the intake, absorption, or utilization of nutrients. It includes both undernutrition and overnutrition. Undernutrition comprises conditions such as wasting, stunting, underweight, and micronutrient deficiencies, whereas overnutrition includes overweight, obesity, and diet-related non-communicable diseases. Although malnutrition technically refers to both ends of the nutritional spectrum, the terms malnutrition, undernutrition, and protein-energy malnutrition (PEM) have frequently been used interchangeably in paediatric literature because undernutrition remains the predominant nutritional problem affecting children in developing nations.
Protein-Energy Malnutrition (PEM) represents one of the most important manifestations of undernutrition and encompasses a group of pathological conditions arising from deficiencies of dietary energy and protein. The World Health Organization defines malnutrition as “the cellular imbalance between the supply of nutrients and energy and the body's demand for them to ensure growth, maintenance, and specific functions.” Historically, PEM was viewed primarily as a deficiency disorder resulting from inadequate intake

of protein and calories and was largely described in terms of its classical clinical syndromes, namely marasmus, kwashiorkor, and marasmic-kwashiorkor [1,2].

The concept of PEM has, however, undergone considerable evolution over time. Subsequent research demonstrated that the pathogenesis and clinical manifestations of PEM cannot be explained solely by deficiencies of protein and energy. Instead, nutritional status is shaped by complex interactions among dietary inadequacy, recurrent infections, host responses, environmental influences, and socioeconomic conditions. This broader understanding shifted the focus of PEM from a purely deficiency-based disorder to a multifactorial condition and has substantially influenced contemporary approaches to its classification, assessment, and management [2, 3].

Consequently, while marasmus, kwashiorkor, and marasmic-kwashiorkor continue to represent the classical and most recognizable manifestations of PEM, contemporary nutritional research recognizes these syndromes within a wider continuum of childhood undernutrition, extending from subclinical nutritional deprivation and growth faltering to overt clinical disease. This evolving perspective has provided the foundation for modern systems of nutritional assessment and classification, which seek to identify nutritional compromise long before the development of advanced clinical manifestations.

This review aims to provide a comprehensive overview of Protein-Energy Malnutrition, including its historical evolution, epidemiology, determinants, pathophysiology, clinical manifestations, assessment, prevention, management, and homoeopathic perspectives, with emphasis on contemporary concepts relevant to child health.

Historical Evolution of Childhood Undernutrition: From Protein-Energy Malnutrition to Severe Acute Malnutrition

The concept of Protein-Energy Malnutrition evolved considerably during the twentieth century. In the early 1930s, Cicely Williams introduced the term kwashiorkor to describe a severe nutritional disorder observed among African children who had been displaced from breastfeeding and subsequently fed predominantly starchy diets. Following investigations conducted by the World Health Organization (WHO) and the Food and Agriculture Organization (FAO) in the post-Second World War period (late 1940s and 1950s), kwashiorkor came to be widely regarded as a consequence of dietary protein deficiency, leading to the widespread use of the term protein malnutrition. However, during the 1960s and 1970s, dietary surveys and clinical observations increasingly challenged the adequacy of a purely protein-deficiency explanation and highlighted the contributory role of energy deficiency. This shift in understanding culminated in the adoption of the broader term Protein-Energy Malnutrition (PEM), which encompassed the spectrum of childhood undernutrition, including marasmus, kwashiorkor, and intermediate forms. Nevertheless, the term kwashiorkor has been retained in clinical practice because of its distinctive clinical features, particularly oedema and related manifestations [4].

The Gómez classification represented one of the earliest attempts to standardize the assessment of childhood undernutrition through anthropometric measurements. It utilized weight-for-age as the principal criterion and classified malnutrition according to the percentage of expected weight for age, categorizing children into first-, second-, and third-degree malnutrition based on increasing severity of weight deficit. The system provided a simple and practical method for grading nutritional status and was widely adopted in both clinical and public health settings. However, because it relied solely on body weight in relation to age, it could not differentiate children who were acutely wasted from those who were chronically growth-retarded, thereby limiting its biological and prognostic interpretation.

To overcome these limitations, the Wellcome classification incorporated both weight-for-age and the presence or absence of oedema, recognizing the clinical importance of oedematous malnutrition. This approach enabled classification into underweight, kwashiorkor, marasmus, and marasmic-kwashiorkor, thereby linking anthropometric deficits with distinct clinical syndromes. The Wellcome system represented an important advance because it acknowledged that children with similar weight deficits could exhibit markedly different clinical manifestations and prognoses. Nevertheless, it continued to rely primarily on weight-for-age and therefore remained unable to distinguish acute undernutrition from long-standing growth failure.

A major conceptual shift occurred with the introduction of the Water low classification, which employed height-for-age and weight-for-height measurements rather than weight-for-age alone. This system recognized that deficits in body size may reflect different biological processes and durations of nutritional deprivation. Children with low height-for-age were classified as stunted, indicating chronic or long-term undernutrition, whereas those with low weight-for-height were considered wasted, reflecting acute or recent nutritional insult. By separating chronic growth retardation from acute tissue wasting, the Water low classification provided a more physiologically meaningful framework for understanding childhood undernutrition and significantly influenced subsequent nutritional assessment systems.

In India, these concepts were adapted through the Indian Academy of Paediatrics (IAP) classification, which retained weight-for-age as the principal parameter because of its simplicity and applicability in community-based programmes. Children were categorized into Grade I, Grade II, Grade III, and Grade IV malnutrition according to progressively decreasing percentages of expected weight for age. The classification gained widespread acceptance in paediatric practice and national nutrition programmes because it was easy to apply under field conditions. However, similar to Gómez classification, it could not distinguish wasting from stunting and was gradually supplemented by approaches based on internationally standardized growth references.

The subsequent evolution of nutritional assessment reflected a broader conceptual transition from grading nutritional deficiency to identifying children at greatest risk of adverse outcomes. This culminated in the WHO/UNICEF framework for Severe Acute Malnutrition (SAM), which employs weight-for-height below −3 standard deviations of WHO growth standards, mid-upper arm circumference (MUAC) below 115 mm, or bilateral pitting oedema as diagnostic criteria. Unlike earlier classifications that primarily described nutritional status, the WHO approach was designed to identify children at immediate risk of morbidity and mortality and to facilitate timely therapeutic intervention. Consequently, contemporary management strategies increasingly focus on SAM as a distinct clinical and public health entity within the broader spectrum of childhood undernutrition [5].

The historical evolution of Protein-Energy Malnutrition mirrors advances in the understanding of childhood undernutrition, progressing from a deficiency-based concept to a multifactorial framework. Simultaneously, classification systems evolved from clinical descriptions to standardized anthropometric and risk-based approaches, forming the basis of contemporary nutritional assessment and management.

## IV. EPIDEMIOLOGY AND BURDEN OF PROTEIN–ENERGY MALNUTRITION

### Global Burden

Protein–Energy Malnutrition (PEM) remains a major public health challenge worldwide despite substantial improvements in nutrition and healthcare over recent decades. According to estimates from the Global Burden of Disease (GBD) 2019 study, approximately 14.8 million individuals were affected by PEM globally. Although age-standardized mortality and disability-adjusted life year (DALY) rates attributable to PEM have declined since 1990, the disease continues to impose a considerable burden on global health.

The distribution of PEM is highly uneven, with the greatest burden concentrated in low- and middle-income countries, particularly in South Asia, Southeast Asia, and Sub-Saharan Africa. The burden is closely associated with poverty, food insecurity, recurrent infections, inadequate sanitation, and limited access to healthcare services. Children under five years of age remain the most vulnerable group, as nutritional deprivation during this critical period adversely affects growth, immune function, neurodevelopment, and survival. In addition, PEM contributes substantially to DALYs worldwide, reflecting both premature mortality and the long-term consequences of impaired growth and development [6].

### Burden in India

India continues to bear a substantial burden of childhood undernutrition. According to the National Family Health Survey-5 (NFHS-5, 2019–21), 35.5% of children under five years are stunted, 19.3% are wasted, and 32.1% are underweight, indicating the persistence of both chronic and acute forms of undernutrition despite ongoing nutritional and public health interventions. Childhood undernutrition remains a major contributor to morbidity, impaired growth, cognitive deficits, and mortality among Indian children [7].

An important epidemiological observation is that nearly 80% of malnourished children belong to the mild and moderate categories. Although these children often lack the overt clinical manifestations seen in severe malnutrition, their large numbers contribute substantially to the overall burden of disease. Undernutrition is also a major underlying factor in childhood mortality. It has been estimated to contribute to 60.7% of deaths associated with diarrheal diseases, 52.3% of pneumonia-related deaths, 44.8% of measles deaths, and 57.3% of malaria-related deaths among children. Furthermore, more than half of all childhood deaths have been attributed to undernutrition, with the risk of mortality increasing progressively with the severity of malnutrition [2].

Beyond its immediate effects on morbidity and mortality, PEM has profound long-term consequences on physical growth, cognitive development, educational attainment, economic productivity, and human capital formation. The persistence of childhood undernutrition therefore remains a major obstacle to both public health advancement and socioeconomic development in India [2,3].

## V. DEFINITION AND SPECTRUM

According to WHO Growth Standards, undernutrition is classified into three subgroups:

1. Underweight

Underweight refers to low weight-for-age. A child is considered underweight when the weight-for-age is less than −2 standard deviations (SD) from the WHO Growth Standard for age.

Classification:

Moderate underweight: Weight-for-age below −2 SD and up to −3 SD

Severe underweight: Weight-for-age below −3 SD

2. Stunting

Stunting refers to low height-for-age (or length-for-age). A stunted child has a height-for-age below −2 SD on the WHO Growth Standard. Stunting indicates chronic undernutrition.

Classification:

Moderate stunting: Height-for-age below −2 SD and up to −3 SD

Severe stunting: Height-for-age below −3 SD

3. Wasting

Wasting refers to low weight-for-height. A child whose weight-for-height is below −2 SD on the WHO Growth Standard is considered wasted. Wasting indicates acute undernutrition resulting from recent food deficit or acute illness.

Classification:

Moderate wasting: Weight-for-height below −2 SD and up to −3 SD

Severe wasting: Weight-for-height below −3 SD

## VI. CLASSIFICATION OF PROTEIN ENERGY MALNUTRITION (PEM)

Protein Energy Malnutrition (PEM) is a major form of undernutrition in children and is associated with deficiency of both energy and protein. Moderate and severe malnutrition are associated with one of the classical clinical syndromes, namely marasmus, kwashiorkor, or manifestations of both. In addition, the World Health Organization (WHO) recommends the classification of Severe Acute Malnutrition (SAM) for identifying children at high risk.

1. Marasmus

Marasmus is characterized by a severe form of wasting resulting from marked depletion of body fat and muscle stores, which are utilized to provide energy during prolonged nutritional deficiency. It is a typical manifestation of severe acute malnutrition.

2. Kwashiorkor

Kwashiorkor usually affects children between 1 and 4 years of age. The hallmark feature is pitting edema, which commonly begins in the feet and legs and may later involve the hands and face. Due to edema, affected children may appear deceptively well nourished.

3. MarasmicKwashiorkor

Marasmickwashiorkor is a mixed form of undernutrition characterized by edema occurring in a child who also exhibits manifestations of marasmus. Features of both marasmus and kwashiorkor may be present simultaneously.

4. Severe Acute Malnutrition (SAM)
Severe Acute Malnutrition (SAM) is a special WHO classification used for identifying and managing children with life-threatening undernutrition. Children with SAM often exhibit features of marasmus, kwashiorkor, or both and are at a high risk of mortality.

WHO Criteria for SAM (Children 6–59 Months)
A child is classified as having SAM if any one of the following is present: Weight-for-height below −3 standard deviations (−3 SD) of the WHO Growth Standards. Presence of bilateral pitting edema. Mid-upper arm circumference (MUAC) less than 11.5 cm.
Children with SAM frequently suffer from serious infections such as diarrhoea, pneumonia, sepsis, malaria and skin infections, and therefore require urgent medical attention [1].

Determinants of Protein–Energy Malnutrition
Protein–Energy Malnutrition (PEM) is a multifactorial disorder resulting from the complex interaction of dietary, biological, socioeconomic, environmental, and health-care-related factors. Rather than arising solely from inadequate food intake, PEM reflects the combined influence of nutritional deprivation, recurrent infections, poverty, inappropriate feeding practices, and limited access to health services. These determinants often interact synergistically, creating a cycle of undernutrition that is particularly difficult to break.

Inadequate Dietary Intake and Feeding Practices
Insufficient intake of dietary energy and protein remains the immediate cause of PEM. Inadequate consumption of calorie-rich and protein-rich foods, poor dietary diversity, reliance on monotonous staple-based diets, and reduced appetite contribute directly to nutritional deficits. Feeding-related factors such as early cessation of breastfeeding, delayed initiation of complementary feeding, inadequate quantity or quality of complementary foods, and inappropriate weaning practices further increase the risk of undernutrition. Lack of caregiver awareness regarding age-appropriate feeding practices also contributes substantially to the development of PEM.

Infection and the Malnutrition Cycle
Infections and malnutrition share a bidirectional relationship. Undernutrition impairs immune function, increasing susceptibility to infections, while infections reduce appetite, impair nutrient absorption, increase metabolic demands, and promote nutrient losses. Diarrheal diseases, respiratory infections, measles, gastroenteritis, and helminthic infestations are particularly important contributors to nutritional deterioration. Recurrent infections hinder catch-up growth and perpetuate the cycle of malnutrition.

Socioeconomic Determinants
Poverty is one of the most important underlying determinants of PEM, influencing food availability, dietary quality, sanitation, education, and access to health care. Low household income, food insecurity, poor food production and distribution systems, and socioeconomic deprivation limit the ability of families to provide adequate nutrition. Although poverty remains strongly associated with undernutrition, evidence suggests that economic factors alone do not fully explain the persistence of PEM, indicating the contribution of several interacting determinants.

Maternal Factors and Parental Education
Maternal nutritional status has a profound influence on child nutrition. Undernourished mothers are more likely to deliver low-birth-weight infants who are vulnerable to growth faltering and recurrent infections. Maternal literacy and education consistently emerge as protective factors, improving awareness regarding nutrition, hygiene, health-care utilization, and child-rearing practices. Paternal education and parental occupation also influence nutritional outcomes through their effects on household resources and caregiving practices.

Family Structure and Demographic Factors
Several family-related factors influence the occurrence of PEM. Large family size, higher birth order, and multiple dependents may reduce the availability of food and caregiver attention for individual children. Short birth intervals can contribute to undernutrition by limiting maternal recovery between pregnancies and reducing the duration of breastfeeding and maternal care available to older siblings. Children between six and twenty-four months of age constitute the most vulnerable group because of rapid growth requirements and increased exposure to environmental pathogens during the complementary feeding period.

Environmental and Living Conditions

Poor environmental sanitation, inadequate housing, overcrowding, unsafe water supplies, and poor hygiene practices increase exposure to infectious diseases that contribute to malnutrition. Environmental adversities such as droughts, floods, and other natural disasters may further compromise food availability and household food security, increasing the risk of PEM. Rural populations often experience a higher burden of undernutrition because of inadequate infrastructure and limited access to essential services, although undernutrition among urban poor populations also remains a significant concern.

Sociocultural and Gender-Related Factors

Cultural beliefs and traditional feeding practices can significantly influence nutritional status. Practices such as prelacteal feeding, delayed initiation of breastfeeding, withholding colostrum, and inappropriate complementary feeding may adversely affect child nutrition. Gender disparities in caregiving and feeding practices have also been associated with differences in nutritional status, with some populations demonstrating a higher prevalence of undernutrition among female children [2,8,9,10].

Health-Care Service Factors

Access to quality health-care services plays an important role in the prevention and management of PEM. Limited availability of preventive and curative services, inadequate nutrition education, poor growth monitoring, and delayed treatment of childhood illnesses contribute to the persistence of undernutrition. Programmes such as the Integrated Child Development Services (ICDS) have been developed to address these issues through supplementary nutrition, health checkups, growth monitoring, and nutrition education; however, challenges related to implementation and service utilization continue to affect their effectiveness.

Intergenerational Cycle of Malnutrition

Undernutrition often perpetuates itself across generations. Maternal undernutrition increases the likelihood of low-birth-weight infants, who are subsequently at greater risk of growth failure, recurrent infections, and undernutrition during childhood. These children may become undernourished adolescents and adults, thereby continuing the cycle into future generations [3].

## VII. PATHOPHYSIOLOGY AND CLINICAL MANIFESTATIONS OF PROTEIN–ENERGY MALNUTRITION

Protein–Energy Malnutrition (PEM) develops when dietary intake fails to meet the body's requirements for energy and protein over a prolonged period. In response to nutritional deprivation, the body initiates a series of adaptive metabolic and physiological mechanisms aimed at preserving the function of vital organs. These adaptations involve alterations in protein, carbohydrate, lipid, hormonal, and electrolyte metabolism. The severity and duration of these changes determine the clinical manifestations of PEM, which may present as marasmus, kwashiorkor, or marasmic-kwashiorkor.

Protein Metabolism

One of the earliest metabolic responses to PEM is the development of a negative nitrogen balance. When dietary protein intake becomes inadequate, the body increasingly utilizes endogenous protein stores, particularly skeletal muscle, to meet metabolic demands. Progressive protein catabolism leads to loss of lean body mass, growth retardation, and muscle wasting. Hepatic synthesis of visceral proteins such as albumin, transferrin, and retinol-binding protein may also decline, particularly in kwashiorkor. Severe hypoalbuminemia contributes to the development of edema, one of the hallmark features of kwashiorkor.

Carbohydrate Metabolism

Carbohydrate stores are rapidly depleted during prolonged nutritional deficiency. Glycogen reserves become exhausted, forcing the body to rely on gluconeogenesis and alternative energy sources. Basal metabolic rate decreases as an adaptive mechanism to conserve energy. Children with severe PEM are therefore particularly susceptible to hypoglycaemia, especially during periods of fasting or intercurrent illness. Reduced physical activity, lethargy, and decreased growth are common consequences of impaired energy availability.

### Lipid Metabolism

As carbohydrate stores become depleted, adipose tissue serves as an important source of energy through lipolysis. In marasmus, extensive mobilization of fat stores results in marked loss of subcutaneous fat and severe emaciation. In contrast, children with kwashiorkor frequently develop fatty infiltration of the liver due to impaired synthesis and transport of lipoproteins. These metabolic alterations contribute to hepatomegaly and abdominal distension commonly observed in kwashiorkor.

### Hormonal and Electrolyte Changes

PEM is associated with significant endocrine and electrolyte disturbances. Adaptive hormonal responses favour catabolism and energy conservation, while growth-promoting mechanisms are suppressed. Potassium and magnesium depletion are common despite normal or elevated serum sodium levels. Alterations in fluid and electrolyte balance contribute to edema, muscle weakness, impaired cardiac function, and increased susceptibility to complications. These disturbances become more pronounced in severe forms of malnutrition.

## VIII. CLINICAL SYNDROMES OF PROTEIN–ENERGY MALNUTRITION

### Marasmus

Marasmus represents an adaptive response to prolonged deficiency of both energy and protein. The body progressively utilizes adipose tissue and skeletal muscle to maintain essential metabolic functions, resulting in severe wasting. Although profound weight loss occurs, edema is typically absent because serum albumin levels are relatively preserved compared with kwashiorkor.

### Clinical Features of Marasmus

- Severe wasting with marked loss of subcutaneous fat and muscle mass
- Emaciated appearance with prominent ribs and bony prominences
- Thin, wrinkled, loose skin giving an “old man” appearance
- Growth retardation and failure to thrive
- Alert but irritable behaviour
- Absence of edema

### Kwashiorkor

Kwashiorkor is characterized by severe protein deficiency associated with complex metabolic disturbances. Impaired hepatic protein synthesis, hypoalbuminemia, oxidative stress, and abnormalities of fat metabolism contribute to the characteristic manifestations of the disease. The presence of edema often masks the degree of underlying wasting.

### Clinical Features of Kwashiorkor

- Bilateral pitting edema, initially involving the lower limbs
- Moon face and generalized puffiness
- Fatty liver with hepatomegaly
- Hair changes including discoloration and the “flag sign”
- Dermatosis producing a characteristic “flaky paint” appearance
- Apathy, lethargy, and reduced appetite
- Growth failure

### Marasmic-Kwashiorkor

Marasmic-kwashiorkor represents a mixed form of severe malnutrition in which profound wasting coexists with nutritional edema. Children exhibit clinical features of both marasmus and kwashiorkor and are at particularly high risk of morbidity and mortality.

### Clinical Features of Marasmic-Kwashiorkor

- Severe muscle wasting and marked loss of subcutaneous fat
- Bilateral pitting edema
- Distended abdomen and hepatomegaly
- Hair and skin changes characteristic of kwashiorkor
- Growth failure and developmental delay
- Frequent infections due to impaired immune function [1,11,12,13,14]

Table 1: Comparison of Marasmus and Kwashiorkor

| Feature | Marasmus | Kwashiorkor |
|---|---|---|
| Primary deficiency | Energy deficiency | Predominantly protein deficiency |
| Edema | Absent | Present |
| Appearance | Severely emaciated | Puffy due to edema |
| Appetite | Usually preserved | Often poor |

| | | |
|---|---|---|
| Subcutaneous fat | Markedly depleted | Relatively preserved |
| Liver | Usually, normal | Fatty liver common |
| Mental state | Alert and irritable | Apathetic and lethargic |
| Mortality risk | High | High |

## IX. CONSEQUENCES OF PROTEIN-ENERGY MALNUTRITION

### Growth Failure
Protein-energy malnutrition leads to impaired physical growth, resulting in underweight, wasting, and stunting. Children affected by chronic malnutrition often remain shorter and have reduced physical capacity in adulthood.

### Impaired Cognitive Development
PEM adversely affects brain growth and development, particularly during early childhood. Malnourished children may experience delayed mental development, poor concentration, learning difficulties, and reduced academic performance.

### Increased Susceptibility to Infections
Malnutrition weakens the immune system and reduces the body's ability to fight infections. As a result, affected children are more prone to recurrent infections such as diarrhoea, pneumonia, measles, and other communicable diseases.

### Increased Morbidity and Mortality
PEM is a major contributor to childhood illness and death, especially in developing countries. Severe malnutrition significantly increases the risk of mortality from common childhood infections.

### Reduced Work Capacity and Productivity
Children who suffer from PEM often develop reduced muscle mass and physical strength. In adulthood, this may lead to decreased work capacity, lower productivity, and reduced earning potential.

### Adverse Reproductive Outcomes
Undernourished girls are more likely to become undernourished mothers and give birth to low-birth-weight infants. This perpetuates the cycle of malnutrition across generations.

### Increased Risk of Chronic Diseases
Evidence suggests that undernutrition during foetal life and early childhood may increase the risk of developing obesity, type 2 diabetes, hypertension, and cardiovascular diseases later in life, particularly when followed by rapid weight gain.

### Impaired Bone and Muscle Development
PEM can negatively affect skeletal growth and muscle development, leading to reduced bone mass, poor muscle strength, and an increased risk of fractures in later life.

### Mental and Behavioural Effects
Early nutritional deprivation may be associated with behavioural problems, poor social development, depression, and other mental health disorders later in life.

### Socioeconomic Consequences
The combined effects of poor health, reduced educational achievement, and lower productivity contribute to poverty and hinder social and economic development at both individual and community levels [15].

### Nutritional status assessment
Assessment of protein-energy malnutrition (PEM) is essential for identifying affected individuals, determining the severity of malnutrition, and guiding appropriate nutritional interventions. Since PEM primarily affects growth, body composition, and functional health, its evaluation requires a comprehensive assessment of nutritional status. The assessment of PEM is commonly carried out using the ABCD approach, which includes the following methods

- Anthropometric
- Biochemical
- Clinical
- Dietary

### Anthropometric Assessment
Anthropometric assessment is the cornerstone of PEM evaluation and provides an objective measure of growth and nutritional status. It is simple, non-invasive, inexpensive, and widely used in both clinical and community settings. The assessment is based on comparison of a child's measurements with the WHO Child Growth Standards.

Weight-for-Age (WFA):
Weight-for-age is used to identify underweight children and reflects both acute and chronic undernutrition. A value below −2 SD indicates underweight, while below −3 SD indicates severe underweight.

Height-for-Age (HFA):
Height-for-age assesses linear growth and is used to identify stunting, a marker of chronic malnutrition. Children with HFA below −2 SD are classified as stunted, and those below −3 SD as severely stunted.

Weight-for-Height (WFH):
Weight-for-height is an indicator of wasting and reflects acute malnutrition. A WFH Z-score below −2 SD indicates wasting, while a value below −3 SD indicates severe wasting.

Body Mass Index-for-Age (BMI-for-Age):
BMI-for-age is increasingly used to evaluate thinness and overall nutritional status in children and adolescents and is interpreted using age- and sex-specific WHO reference standards.

Mid-Upper Arm Circumference (MUAC):
MUAC is a simple and rapid screening tool for acute malnutrition, particularly in field settings. A MUAC <125 mm indicates acute malnutrition, while a MUAC <115 mm is diagnostic of severe acute malnutrition in children aged 6–59 months.

WHO Criteria for Severe Acute Malnutrition (SAM):
According to WHO and UNICEF, severe acute malnutrition is diagnosed when any one of the following is present:

- Weight-for-height Z-score < −3 SD
- MUAC <115 mm
- Bilateral pitting edema

Biochemical Assessment
Biochemical assessment evaluates nutritional status through the analysis of blood, urine, and other biological samples. It helps detect nutrient deficiencies before clinical signs become apparent and provides objective evidence of nutritional alterations. In protein-energy malnutrition, commonly assessed parameters include haemoglobin, serum albumin, prealbumin, transferrin, total protein, and micronutrient levels. Biochemical measurements are useful for identifying subclinical deficiencies, monitoring disease progression, and assessing response to nutritional interventions.

Clinical Assessment
Clinical assessment involves a detailed medical history and physical examination to identify signs and symptoms associated with malnutrition. It focuses on detecting changes in the skin, hair, eyes, lips, oral cavity, muscles, and subcutaneous tissues that may indicate nutritional deficiencies. Clinical assessment is simple and inexpensive; however, many signs are nonspecific and usually appear during advanced stages of deficiency. Therefore, it is most effective when used alongside anthropometric and biochemical methods.

Dietary Assessment
Dietary assessment evaluates the quantity and quality of food consumed by an individual or population. It helps identify inadequate intake of energy, protein, and other nutrients that may contribute to malnutrition. Common methods include the 24-hour dietary recall, food frequency questionnaire, food record, and dietary history. Dietary assessment provides valuable information regarding eating patterns, food habits, and nutrient intake, and is useful for identifying individuals or groups at risk of nutritional deficiency [16,17].

## X. PREVENTION AND CONTROL OF PROTEIN-ENERGY MALNUTRITION

Nutritional Interventions

- Promotion of exclusive breastfeeding during the first six months of life.
- Timely introduction of appropriate complementary feeding after six months while continuing breastfeeding up to two years or beyond.
- Provision of adequate energy- and protein-rich diets appropriate for age and nutritional requirements.
- Improvement of maternal nutrition during pregnancy and lactation to reduce the risk of low birth weight and childhood malnutrition.
- Nutrition education for parents and caregivers regarding infant feeding practices, food preparation, dietary diversity, and feeding during illness.

Infection Prevention and Child Health Measures

- Complete immunization according to national schedules.
- Early diagnosis and treatment of common childhood illnesses such as diarrhoea, respiratory infections, and parasitic infestations.
- Periodic vitamin A supplementation and iron-folic acid administration to prevent micronutrient deficiencies.
- Promotion of safe water, sanitation, and hygiene practices to reduce infection-related malnutrition.

Community and Public Health Measures

- Strengthening of nutrition surveillance and growth monitoring for early identification of children at risk.
- Community-based nutrition education and counselling programmes.
- Improvement of food security and socioeconomic conditions through multisectoral interventions.
- Early referral of severely malnourished children for specialized care.

## XI. NATIONAL NUTRITION PROGRAMMES

Integrated Child Development Services (ICDS)

- Supplementary nutrition for children, pregnant women, and lactating mothers.
- Growth monitoring and early detection of malnutrition.
- Nutrition and health education for caregivers.
- Referral of severe cases to higher healthcare facilities and Nutrition Rehabilitation Centres.
- Distribution of micronutrient supplements and health services through Anganwadi Centres.

Mid-Day Meal Programme

- Improves daily calorie and protein intake among school-going children.
- Reduces classroom hunger and nutritional deficiencies.
- Supports physical growth, cognitive development, and school attendance.
- Vitamin A Supplementation Programme
- Improves immune function and resistance to infections.
- Reduces morbidity and mortality associated with vitamin A deficiency.
- Supports normal growth and development.

Management of Protein-Energy Malnutrition

Management depends on the severity of malnutrition and the presence of complications. The objectives are to correct life-threatening conditions, restore nutritional status, treat associated infections, promote catch-up growth, and prevent relapse. Management is carried out in three phases: stabilization, transition, and rehabilitation.

Stabilization Phase

The initial phase focuses on correction of acute complications and metabolic abnormalities.

- Treat or prevent hypoglycaemia through immediate feeding and administration of F-75 therapeutic diet.
- Prevent and manage hypothermia by maintaining warmth and ensuring frequent feeding.
- Correct dehydration using appropriate oral rehydration solutions such as ReSoMal; intravenous fluids are reserved for shock.
- Correct electrolyte imbalances, particularly potassium and magnesium deficiencies, while avoiding excess sodium.
- Treat infections with broad-spectrum antibiotics, as infections may be present without obvious clinical signs.
- Correct micronutrient deficiencies through supplementation of vitamin A, folic acid, zinc, and other essential micronutrients; iron supplementation is delayed until recovery begins.

Transition Phase

- Initiated once appetite improves and acute complications are controlled.
- Gradual transition from F-75 to F-100 therapeutic milk or Ready-to-Use Therapeutic Food (RUTF).
- Close monitoring for feeding tolerance and clinical stability.

Rehabilitation Phase

The objective of this phase is rapid catch-up growth and nutritional recovery.

- Provide high-energy and high-protein diets supplying approximately 150–220 kcal/kg/day and 4–6 g protein/kg/day.
- Continue feeding with F-100 or RUTF until adequate weight gain is achieved.

- Continue breastfeeding and gradually introduce age-appropriate family foods rich in energy and protein.
- Provide sensory stimulation, emotional support, and structured play activities to promote cognitive and psychosocial development.
- Regularly monitor weight gain, nutritional status, and clinical progress.

Follow-up and Long-Term Care
- Continued growth monitoring and nutritional assessment.
- Nutrition counselling for caregivers.
- Completion of immunization schedules.
- Treatment of underlying illnesses and prevention of recurrence through appropriate feeding practices and community support [12,13,18].

Homoeopathic Perspective in the Management of Protein-Energy Malnutrition
The successful management of Protein-Energy Malnutrition (PEM) requires not only nutritional rehabilitation and correction of medical complications but also sustained measures to promote growth, improve general health, and prevent recurrence. While dietary support, infection control, micronutrient supplementation, and public health interventions remain the cornerstone of treatment, individualized care is essential because the clinical manifestations, constitutional characteristics, susceptibility to recurrent illnesses, and response to nutritional stress vary considerably among affected children. Within this holistic framework, homoeopathic management may be employed as an adjunct to conventional care, with remedy selection based on the totality of symptoms and the individual characteristics of the patient.

Hahnemannian Concept of Nutrition and Health
Although Dr. Samuel Hahnemann did not use the modern term "malnutrition," his writings in the Organon of Medicine reflect a clear understanding of the influence of diet and lifestyle on health, particularly in chronic diseases. Hahnemann emphasized that a simple and nourishing diet is essential for maintaining health and facilitating the action of homoeopathic remedies. In Aphorism 261, he stated that a simple but nourishing diet is most suitable to preserve health and enable the remedy to act effectively.
In Aphorism 5, Hahnemann advised physicians to consider the patient's constitution, hereditary tendencies, physical build, and general health status while selecting a remedy. Nutritional status, body habitus, and developmental characteristics therefore become important considerations in the holistic assessment of patients with PEM [19].

Kent's Constitutional and Miasmatic Perspective
Dr. James Tyler Kent regarded disease as a disturbance of the vital force that precedes structural or pathological changes. According to Kent, the underlying constitutional state and inherited predispositions play a fundamental role in the development of chronic disease. He emphasized that tissue changes represent only the later manifestations of a deeper disorder, stating that "the real sickness is prior to the tissue changes; the man is sick before the microscope can reveal it. From this perspective, malnutrition is not viewed solely as a consequence of inadequate nutrient intake but also as an expression of constitutional weakness and miasmatic influence. The undernourished or stunted child is assessed through the totality of symptoms, including appetite, digestion, growth pattern, recurrent infections, mental characteristics, and general vitality. Kent further suggested that chronic nutritional disorders may reflect the influence of underlying miasms, particularly Psora, Sycosis, and Syphilis [20].

Miasmatic Analysis of Protein-Energy Malnutrition [19,21]

Table 2: Miasmatic analysis of PEM

| Miasm | Miasmatic Characteristics | Clinical Features in PEM |
|---|---|---|
| Psora | Deficiency, lack, functional weakness, poor assimilation, hypersensitivity. Early PEM cases commonly belong to the psoric miasm. | • Failure to gain weight • Thin child • Weak digestion • Dry skin • Irritability • Restlessness • Functional anaemia • Recurrent minor infections |
| Sycosis | Overgrowth, retention, glandular enlargement. Most cases of kwashiorkor belong | • Edema • Puffy face • Distended abdomen • Enlarged liver • Enlarged glands • Flabby muscles |

| | | |
|---|---|---|
| | to the sycotic miasm. | |
| Syphilis | Destruction and degeneration. Advanced marasmus and severe chronic PEM commonly belong to the syphilitic miasm. | • Severe wasting • Extreme emaciation • Bone deformities • Developmental delay • Mental retardation • Failure to thrive • Severe recurrent infections • Severe restlessness |
| Tubercular Miasm | Psora + Syphilis. Characterized by rapid wasting, recurrent infections, and glandular weakness. | • Marked emaciation • Enlarged glands • Failure to thrive • Rapid exhaustion • Recurrent lung infections |

Homoeopathic Therapeutics [22,23,24]

Abrotanum
- Useful in marasmus, particularly affecting the lower extremities despite a good appetite.
- Appetite remains good but emaciation progressively increases.
- Enormous appetite with constant desire for food.
- Pain in the stomach and abdomen.
- Food passes undigested.
- Gnawing hunger with whining disposition.
- Indigestion with vomiting of large quantities of offensive fluid.
- Distended abdomen.
- Alternate diarrhoea and constipation.
- Skin is flabby and hangs loosely.

Acetic Acidum
- Suitable for pale, lean individuals with lax and flabby muscles.
- Marked wasting and debility.
- Irritability.
- Pale, waxy, emaciated appearance.
- Sunken eyes with dark rings.
- Ascites.
- Emaciated extremities with edema of feet and legs.

Calcarea Carbonica
- Valuable remedy in marasmus associated with defective nutrition and acidity.
- Sour stools and vomiting of milk.
- Profuse perspiration on scalp, head, and face.
- Cold and damp feet.
- Enlarged glands with voracious appetite.
- Body wastes while abdomen remains prominent.
- Craving for indigestible substances.
- Engorged mesenteric glands.
- Useful in children with scrofulous tendencies.

Calcarea Phosphorica
- Suited to emaciated children predisposed to glandular and osseous disorders.
- Large head with defective bony development.
- Open fontanelles and delayed dentition.
- Weak spine unable to support the body.
- Thin neck and poorly developed physique.
- Persistent vomiting.
- Green, slimy, undigested stools with offensive flatus.
- Flabby and sunken abdomen.

Hepar Sulphur
- Lies between Sulphur and Calcarea Carbonica in its action.
- Weak digestion.
- Greenish, slimy, sour, undigested stools.
- Sour body odour.
- Child appears plump but muscles are flabby and wasted.
- Tendency to unhealthy skin and suppurative conditions.
- Susceptibility to catarrhal complaints from exposure to cold air.

Iodine
- Important remedy in marasmus with extreme hunger and progressive emaciation.
- Suitable in acute cases with febrile manifestations.
- Sluggish glandular function.
- Yellow and shrunken face.
- Enlarged mesenteric glands.
- Rapid metabolism with marked debility.
- Extremely thin, dark-complexioned individuals with enlarged lymphatic glands and voracious appetite.

Natrum Muriaticum
- Useful in marasmus resulting from defective nourishment.
- Thin neck with ravenous appetite despite progressive emaciation.

- Marked thirst and craving for water.
- Dry mouth and throat.
- Constipation.
- Emaciation disproportionate to fever or diarrhoea.
- Dry, scurfy skin with tendency to eruptions.
- Craving for salt.
- Great weakness and weariness.

Sulphur

- Suited to old-looking children with heat of the head and cold feet.
- Hard and distended abdomen.
- Dirty, sallow, shrivelled skin hanging in folds.
- Marked emaciation of fingers.
- Acrid stools causing soreness around the anus.
- Offensive faecal odour.
- Excessive hunger around 11 a.m.
- Enlarged cervical, axillary, and inguinal glands.
- Delayed dentition and poor muscular development.

Repertorial Rubrics Related to Protein-Energy Malnutrition [25,26]

- MIND – Irritability
- MIND – Apathy
- FACE – Old-looking expression
- STOMACH – Appetite wanting
- ABDOMEN – Distension
- EXTREMITIES – Weakness of lower limbs
- EXTREMITIES – Thin, emaciated limbs
- SLEEP – Drowsiness
- SLEEP – Lethargy
- SKIN – Dry
- SKIN – Shrivelled/Wrinkled
- SKIN – Flabbiness
- GENERALITIES – Starvation
- GENERALITIES – Emaciation
- GENERALITIES – Emaciation in children
- GENERALITIES – Weakness in children
- GENERALITIES – Anaemia
- GENERALITIES – Dropsy, general
- GENERALITIES – Lack of assimilation of food

## XII. DISCUSSION

Protein-Energy Malnutrition (PEM) continues to be one of the most significant causes of morbidity and mortality among children, particularly in low- and middle-income countries. Despite considerable advances in nutrition science, public health interventions, and socioeconomic development, childhood undernutrition remains highly prevalent, especially in South Asia and Sub-Saharan Africa. The findings discussed in this review highlight that PEM is no longer viewed merely as a consequence of inadequate protein intake but rather as a complex multifactorial disorder resulting from the interplay of dietary insufficiency, recurrent infections, poverty, poor sanitation, inappropriate feeding practices, maternal undernutrition, limited access to healthcare, and adverse environmental conditions.

The evolution of nutritional assessment from traditional classifications such as Gómez, Wellcome, and Waterlow to the current WHO criteria for Severe Acute Malnutrition (SAM) reflects an improved understanding of the biological processes underlying childhood undernutrition. Contemporary anthropometric indicators, particularly weight-for-height Z-scores, Mid-Upper Arm Circumference (MUAC), and the identification of nutritional edema, have significantly enhanced the early detection of children at high risk of mortality and facilitated prompt therapeutic interventions.

The pathophysiological mechanisms of PEM demonstrate extensive metabolic adaptation involving protein catabolism, depletion of glycogen and adipose tissue stores, endocrine disturbances, impaired immunity, and electrolyte imbalances. The distinct clinical syndromes of marasmus and kwashiorkor illustrate varying adaptive responses to nutritional deprivation, while marasmic-kwashiorkor represents a particularly severe form associated with high morbidity and mortality. In addition to immediate consequences, undernutrition exerts long-lasting effects on cognitive development, educational attainment, physical capacity, reproductive health, and future economic productivity, thereby contributing substantially to the intergenerational cycle of poverty and malnutrition.

Although substantial progress has been achieved through programmes such as Integrated Child Development Services (ICDS), the Mid-Day Meal Programme, immunization initiatives, micronutrient supplementation, and community-based nutritional rehabilitation, the persistence of high rates of wasting, stunting, and underweight among Indian children indicates the need for strengthened implementation strategies and multisectoral approaches. Effective prevention and management require coordinated efforts involving healthcare providers, policymakers, nutritionists, educators, and communities to address both immediate and underlying determinants of malnutrition.

From a homoeopathic standpoint, nutritional disorders are considered within a broader constitutional and individualistic framework. The homoeopathic approach emphasizes assessment of the child's constitution, susceptibility to recurrent infections, growth pattern, mental and emotional characteristics, and miasmatic background. Remedies such as Abrotanum, Calcarea carbonica, Calcarea phosphorica, Natrum muriaticum, and Sulphur have traditionally been recommended in children exhibiting features suggestive of defective assimilation, delayed growth, recurrent illnesses, and constitutional weakness. However, it is important to emphasize that homoeopathic treatment should be considered only as an adjunctive and supportive measure and cannot replace evidence-based nutritional rehabilitation, therapeutic feeding, management of complications, and established public health interventions. Further well-designed clinical studies are required to evaluate the potential role of homoeopathic interventions in improving nutritional recovery, reducing susceptibility to infections, and enhancing overall wellbeing among children recovering from PEM.

## XIII. CONCLUSION

Protein-Energy Malnutrition remains a major global health challenge and continues to impose a substantial burden on child survival, growth, neurodevelopment, and socioeconomic progress. Contemporary understanding recognizes PEM as a multifactorial disorder influenced by nutritional, infectious, environmental, socioeconomic, and maternal determinants rather than a simple deficiency of dietary protein and energy. Early identification through standardized anthropometric assessment, timely nutritional rehabilitation, effective infection control, and sustained public health measures are essential to reducing morbidity and mortality associated with childhood undernutrition.

Comprehensive strategies focusing on maternal health, optimal infant and young child feeding practices, food security, sanitation, health education, and strengthened nutrition programmes are critical for breaking the intergenerational cycle of malnutrition. Within an integrative healthcare framework, homoeopathy may offer individualized constitutional support aimed at improving general health and resilience in selected children; however, nutritional rehabilitation and evidence-based medical management remain the cornerstone of treatment. Continued research, policy commitment, and community participation are indispensable to achieving sustainable reductions in childhood malnutrition and ensuring optimal growth and developmental outcomes for future generations.

## ACKNOWLEDGEMENT

The authors would like to express sincere gratitude to Director Dr. Umesh Akkaladevi. Prof. Dr. Srinivas Babu Kathi Principal. Hamsa Homeopathy Medical College, Hospital & Research Centre, for their valuable support and encouragement.

## CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this article.

## REFERENCES

[1] Paul VK, and Bagga A, editors. Ghai Essential Pediatrics. 9th ed. New Delhi: CBS Publishers & Distributors Pvt Ltd; 2019.

[2] Grover Z, and Ee LC. “Protein energy malnutrition.” Pediatric Clinics of North America. 2009;56(5):1055–1068.

[3] Bhutia DT. “Protein energy malnutrition in India: The plight of our under five children.” Journal of Family Medicine and Primary Care. 2014;3(1):63–67. doi:10.4103/2249-4863.130279.

[4] Semba RD. “The rise and fall of protein malnutrition in global health.” Annals of Nutrition and Metabolism. 2016;69(2):79–88.

[5] Picot J, Hartwell D, Harris P, Mendes D, Clegg AJ, and Takeda A. “The effectiveness of interventions to treat severe acute malnutrition in young children: A systematic review.” Health Technology Assessment. 2012;16(19):1–316.

[6] Zhang X, Zhang L, Pu Y, Sun M, Zhao Y, Zhang D, Wang X, Li Y, Guo D, and He S. “Global,

Regional, and National Burden of Protein-Energy Malnutrition: A Systematic Analysis for the Global Burden of Disease Study." Nutrients. 2022;14(13):2592. doi:10.3390/nu14132592.

[7] International Institute for Population Sciences (IIPS), and ICF. National Family Health Survey (NFHS-5), 2019–21: India. Mumbai: IIPS; 2021.

[8] Latham MC. "Protein-energy malnutrition—its epidemiology and control." Journal of Environmental Pathology, Toxicology and Oncology. 1990;10(4–5):168–180.

[9] Rabeneck S. The Determinants of Protein-Energy Malnutrition Among Preschool Children in Kenya with Respect to Cash Cropping and Self-Sufficiency in Staple Food Production. Cornell University; 1982.

[10] Bhatti ZI, Nawaz K, and Ali M. "Prevalence and determinants of protein energy malnutrition among children under five years of age in rural communities of Lahore, Pakistan." The Professional Medical Journal. 2021;28(1).

[11] Park K. Park's Textbook of Preventive and Social Medicine. 26th ed. Jabalpur: Banarsidas Bhanot Publishers; 2021.

[12] World Health Organization. Pocket Book of Hospital Care for Children: Guidelines for the Management of Common Childhood Illnesses. 2nd ed. Geneva: WHO; 2013.

[13] Kliegman RM, St. Geme JW III, Blum NJ, Shah SS, Tasker RC, Wilson KM, editors. Nelson Textbook of Pediatrics. 22nd ed. Philadelphia: Elsevier; 2024.

[14] Vasudevan DM, Sreekumari S, and Vaidyanathan K. Textbook of Biochemistry for Medical Students. 10th ed. New Delhi: Jaypee Brothers Medical Publishers; 2023.

[15] Victora CG, Adair L, Fall C, Hallal PC, Martorell R, Richter L, et al. "Maternal and child undernutrition: Consequences for adult health and human capital." The Lancet. 2008;371(9609):340–357.

[16] Gibson RS. Principles of Nutritional Assessment. 2nd ed. New York: Oxford University Press; 2005.

[17] World Health Organization, and UNICEF. WHO Child Growth Standards and the Identification of Severe Acute Malnutrition in Infants and Children. Geneva: WHO; 2009.

[18] World Health Organization. Management of Severe Malnutrition: A Manual for Physicians and Other Senior Health Workers. Geneva: World Health Organization; 1999.

[19] Hahnemann S. Organon of Medicine. 6th ed. New Delhi: B Jain Publishers Pvt Ltd; 2005.

[20] Kent JT. Lectures on Homoeopathic Philosophy. New Delhi: B Jain Publishers Pvt Ltd; 2014.

[21] Roberts HA. The Principles and Art of Cure by Homoeopathy. New Delhi: B Jain Publishers Pvt Ltd; 2005.

[22] Allen HC. Keynotes and Characteristics with Leading Remedies of the Materia Medica and Bowel Nosodes Including Repertorial Index. New Delhi: B Jain Publishers Pvt Ltd; 2002.

[23] Dewey WA. Practical Homoeopathic Therapeutics. New Delhi: B Jain Publishers Pvt Ltd; 2007.

[24] Boericke W. Boericke's New Manual of Homoeopathic Materia Medica with Repertory. 3rd rev. ed. New Delhi: B Jain Publishers Pvt Ltd; 2010.

[25] Kent JT. Repertory of the Homoeopathic Materia Medica. New Delhi: B Jain Publishers Pvt Ltd; 2007.

[26] Boger CM. The Principles and Practicality of Boenninghausen's Therapeutic Pocket Book for Homoeopathic Physicians to Use at the Bedside and in the Study of the Materia Medica. New Delhi: B Jain Publishers Pvt Ltd; 2002.