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IAP Textbook of Tropical Diseases






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2.1

CHAPTER

Nutritional Considerations for Children in the Tropics

Aaradhana Singh, Piyush Gupta

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INTRODUCTION

The nutritional status of children is a reflection of the developmental status of a country. Nutrition impacts not only the physical but also the mental health of children. Proper nutrition prevents communicable as well as noncommunicable diseases (NCDs). Malnutrition encompasses undernutrition (underweight, stunting, and wasting), overweight/obesity, and micronutrient deficiencies. With a change in lifestyle and easy availability of ultraprocessed food, there is continuous rise in the prevalence of overweight and obesity worldwide leading to a growing risk of NCDs including cardiovascular diseases, diabetes, chronic respiratory diseases, and cancers.

BURDEN OF UNDERNUTRITION AND OVERWEIGHT

Global Burden

As per UNICEF/WHO/World Bank Group Joint Child Malnutrition estimates 2019, 149 million (21.9%) children were stunted, 49 million (7.3 %) were wasted, and 40 million (4.9%) were overweight globally in the under-five age group.[1] Asia and Africa bear the greatest share of malnutrition. In 2018, more than half (55%) of all stunted under-five children lived in Asia and more than one third (39%) lived in Africa. More than two thirds (68%) of all wasted children in the under-five age group lived in Asia and more than one quarter (28%) lived in Africa. Almost half (47%) of all overweight under-five children lived in Asia and one quarter (24%) lived in Africa.[1] **Figures 1 and 2** show the prevalence of stunting and overweight, respectively, in UNICEF regions from 1990 to 2018. **Figure 3** shows the prevalence of wasting in UNICEF regions in 2018. Malnutrition rates continue to remain high. Stunting is declining very slowly while wasting still affects the lives of many young children. Prevalence of overweight/obesity is on the rise.

Burden in South Asia

South Asia has the highest burden of malnourished children. Two out of five stunted children in the world live in South Asia. South Asia is the only region with high wasting prevalence (10–15%). More than half of all wasted children in the world live in South Asia. **Table 1** shows the prevalence of childhood malnutrition in 10 countries of South Asia.[1]

Burden in India

As per the National Family Health Survey (NFHS-4) (2015–16), approximately 38% of under-five children in India were stunted, 21% were wasted, and 36% were underweight.[2] **Figure 4** depicts the trends of nutritional status as found in four NFHS surveys conducted between 1992 and 2016. The Ministry of Health conducted the Comprehensive National Nutrition Survey (CNNS) from 2016 to 2018 to collect data on the nutritional status of Indian children from 0 to 19 years of age. **Table 2** provides the prevalence of malnutrition as per NFHS-4 and CNNSs in India.[2,3] **Figures 5 to 7** show the prevalence of stunting, wasting, and underweight, respectively, in Indian states as per the CNNS.

Stunting prevalence was highest in Bihar, Madhya Pradesh, Rajasthan, and Uttar Pradesh (37–42%) and lowest in Goa and Jammu and Kashmir (16–21%). Madhya Pradesh, West Bengal, Tamil Nadu, and Jharkhand had high prevalence (≥20%) of wasting. The states with the lowest prevalence of under-five wasting were Manipur, Mizoram, and Uttarakhand (6% each). The states with the highest prevalence (≥39%) of underweight were Bihar,

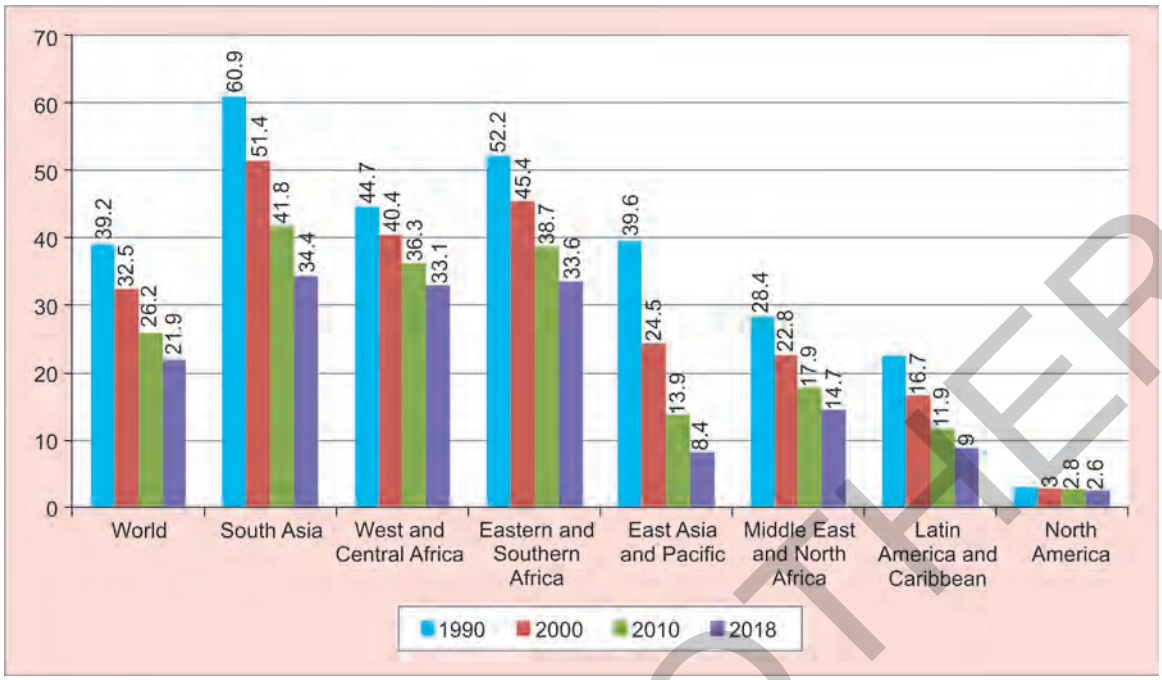

Fig. 1: Prevalence of stunting in under-five children by the UNICEF region, 1990–2019.
Source: Reproduced from UNICEF/WHO/World Bank Joint Malnutrition Estimates, 2018.[1]

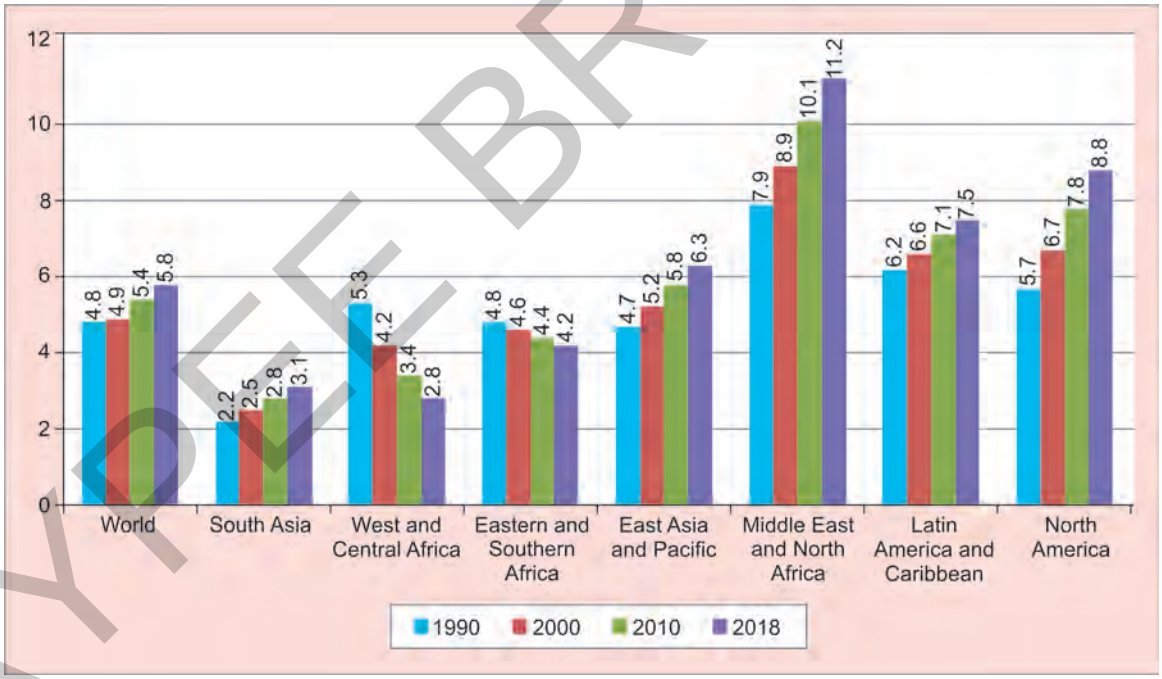

Fig. 2: Prevalence of overweight in under-five children by the UNICEF region from 1990 to 2018.
Source: Reproduced from UNICEF/WHO/World Bank Joint Malnutrition Estimates, 2018.[1]

Chhattisgarh, Madhya Pradesh, and Jharkhand. Mizoram, Sikkim, Manipur, Arunachal Pradesh, and Nagaland had the lowest prevalence (≤16%) of underweight.

The CNNS evaluated the anthropometric status of children as well as adolescents. **Figure 8** shows the prevalence of malnutrition in 0–4-year, 5–9-year, and 10–19-year age groups as per the CNNS.

Among adolescents, the prevalence of overweight and obesity were 5% and 1% respectively. The states with the highest prevalence (>12%) of overweight in adolescents

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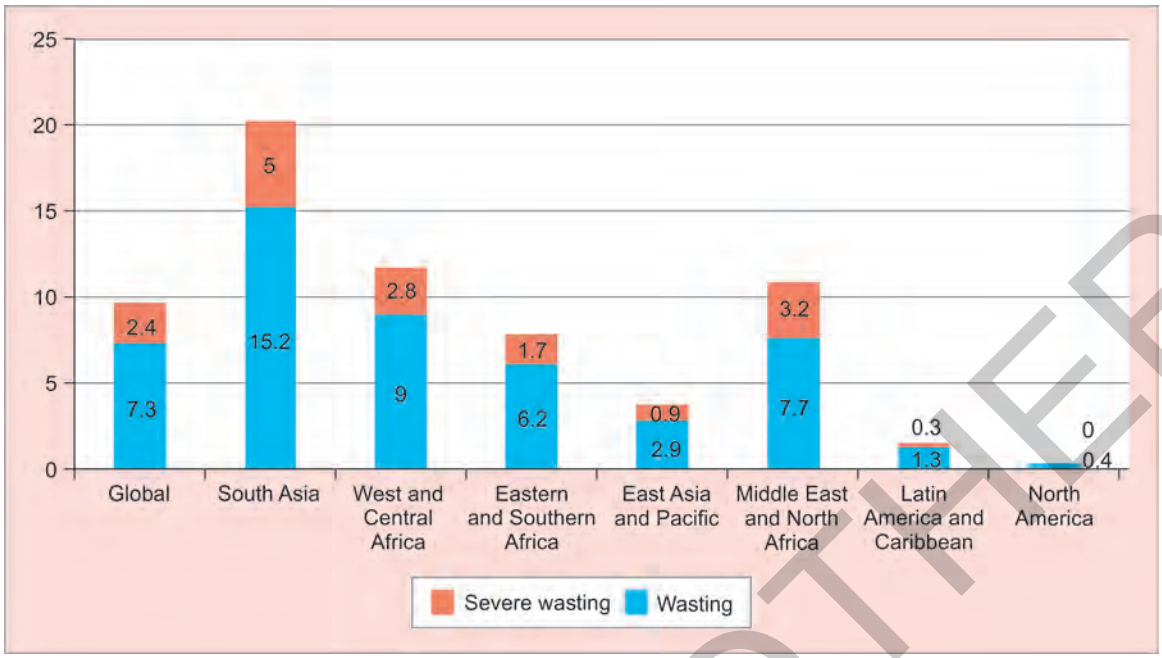

Fig. 3: Prevalence of under-five children with wasting by the UNICEF region, 2018.
Source: Reproduced from UNICEF/WHO/World Bank Joint Malnutrition Estimates, 2018.[1]

Table 1: Prevalence of malnutrition in under-five children in South Asia.

Country	*Survey year*	*Underweight (%)*	*Stunting (%)*	*Wasting (%)*	*Severe wasting (%)*	*Overweight (%)*
Afghanistan	2013	25.0	40.9	9.5	4	5.4
Bangladesh	2014	32.8	36.2	14.4	3.2	1.6
Bhutan	2010	12.7	33.5	5.9	2.0	7.6
China	2013	2.4	8.1	1.9	–	9.1
India	2015–16	36.3	37.9	20.8	7.7	2.4
Maldives	2009	17.7	18.6	10.8	2.7	6.1
Myanmar	2015–16	18.5	29.4	6.6	1.3	1.5
Pakistan	2017–18	23.1	37.6	7.1	2.4	2.5
Sri Lanka	2016	20.5	17.3	15.1	3.0	2.0
Nepal	2014	30.1	37.5	11.3	3.2	2.1

Source: UNICEF/WHO/World Bank joint child malnutrition estimates (country level) 2009-18.[1]

were Delhi, Goa, and Tamil Nadu while the lowest prevalence (< 3%) of overweight was in Bihar, Madhya Pradesh, Uttar Pradesh, Jharkhand, and Rajasthan.[2]

Infant and Young Child Feeding practices: The CNNS 2018 has collected data not only on Infant and Young Child Feeding practices but also on diversity of food consumed by children and adolescents. **Table 3** depicts Infant and Young Child Feeding practices as per the CNNS 2018, NFHS-3, NFHS-4, and UNICEF 2018 (global data). More than 85% of children and adolescents consumed dark green leafy vegetables and pulses or beans at least once per week; one-third consumed eggs, fish, or chicken or meat at least once per week; and 60% consumed milk or curd at least once per week.[2]

MICRONUTRIENT DEFICIENCIES IN INDIA

The prevalence of anemia in the 6–35-month age group was 74%, 79%, and 59% in NFHS-2, NFHS-3, and NFHS-4 surveys, respectively. The CNNS was the largest survey for micronutrient deficiencies. **Table 4** shows the prevalence of anemia, vitamin A deficiency, vitamin D deficiency, vitamin B12 deficiency, and folate deficiency in 0–4-year, 5–9-year, and 10–19-year age groups as per the CNNS.

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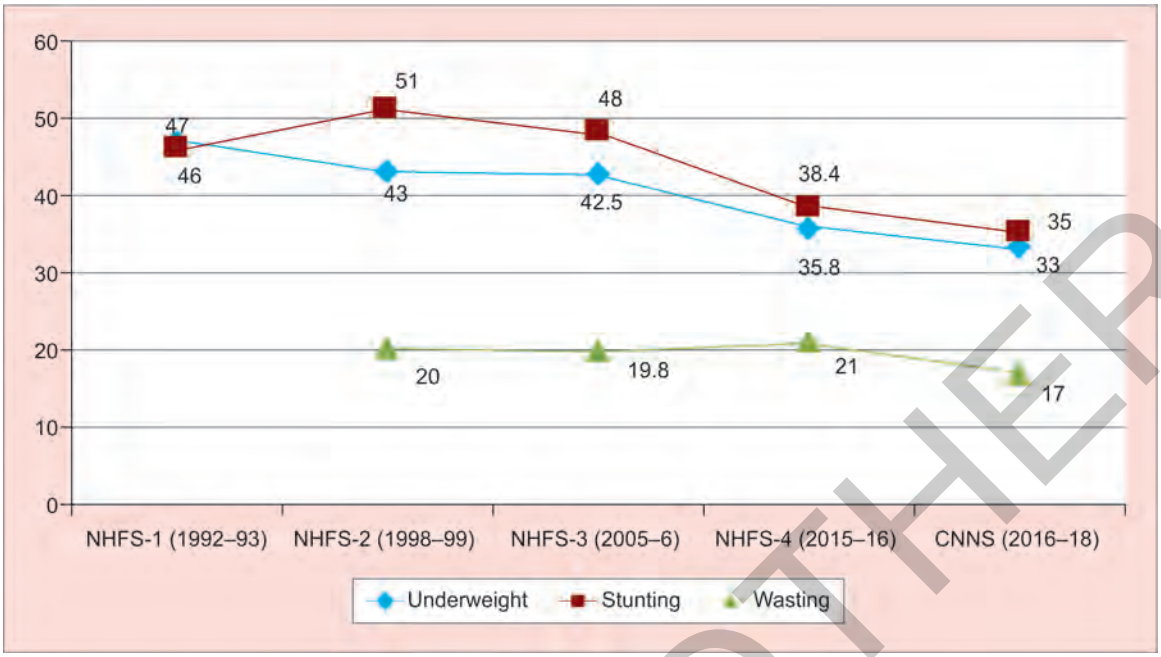

Fig. 4: Trends of malnutrition in under-five children, India.
(CNNS: Comprehensive National Nutrition Survey; NFHS-4: National Family Health Survey-4; UNICEF: United Nations Children's Fund)
Source: NFHS-3 (1998–99), NFHS-4 (2005–06), CNNS (2016–18), UNICEF Global (2018).

Table 2: Prevalence of malnutrition as per NFHS-4 and CNNS in India.

	NFHS-4 survey[3] *(2015–16)**	*CNNS*[2] *(2016–18)**	*UNICEF Global*[1] *(2018)**
Children under 5 years who are stunted (height-for-age)	38.4	35.0	21.9
Children under 5 years who are wasted (weight-for-height	21.0	17.0	7.3
Children under 5 years who are severely wasted (weight-for-height)	7.4	NA	2.4
Children under 5 years who are underweight (weight-for-age)	35.8	33.0	15 (2014)

(CNNS: Comprehensive National Nutrition Survey; NFHS-4: National Family Health Survey-4; UNICEF: United Nations Children's Fund)
*All figures are in percentages.
Source: NFHS-3 (1998–99), NFHS-4 (2005–06), CNNS (2016–18), UNICEF Global (2018).

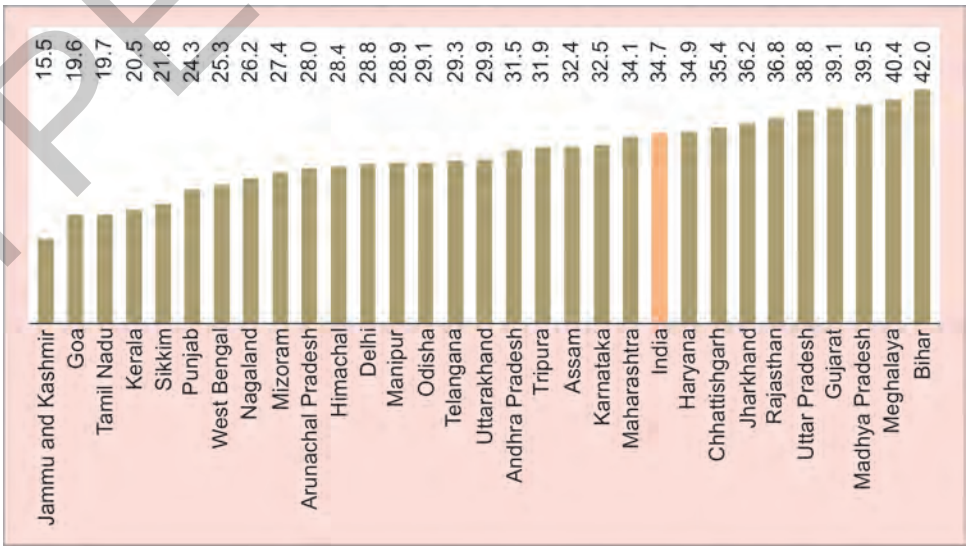

Fig. 5: Prevalence (%) of stunting among children aged 0–4 years by state, India.
Source: Reproduced from Comprehensive National Nutrition Survey, 2016–18.[2]

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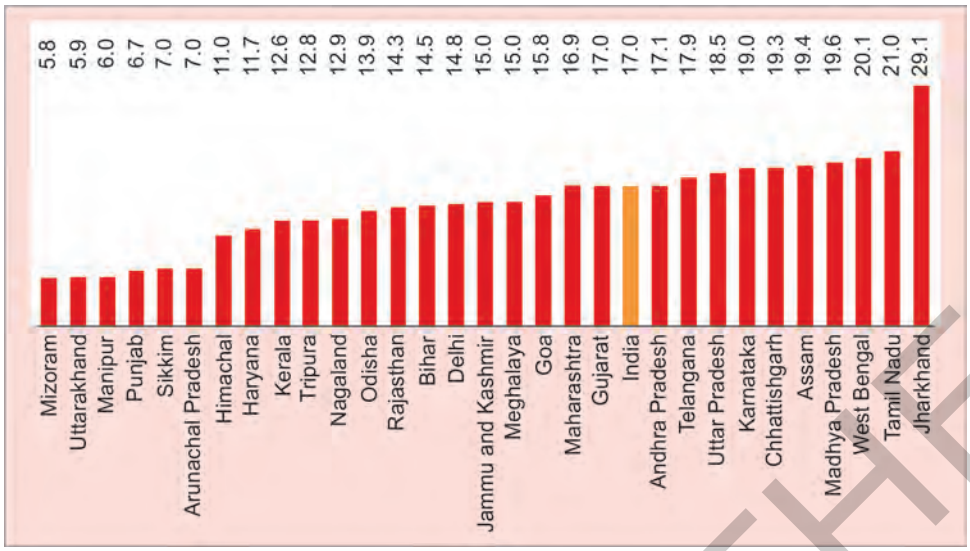

Fig. 6: Prevalence (%) of wasting among children aged 0–4 years by state, India.
Source: Reproduced from Comprehensive National Nutrition Survey, 2016–18.[2]

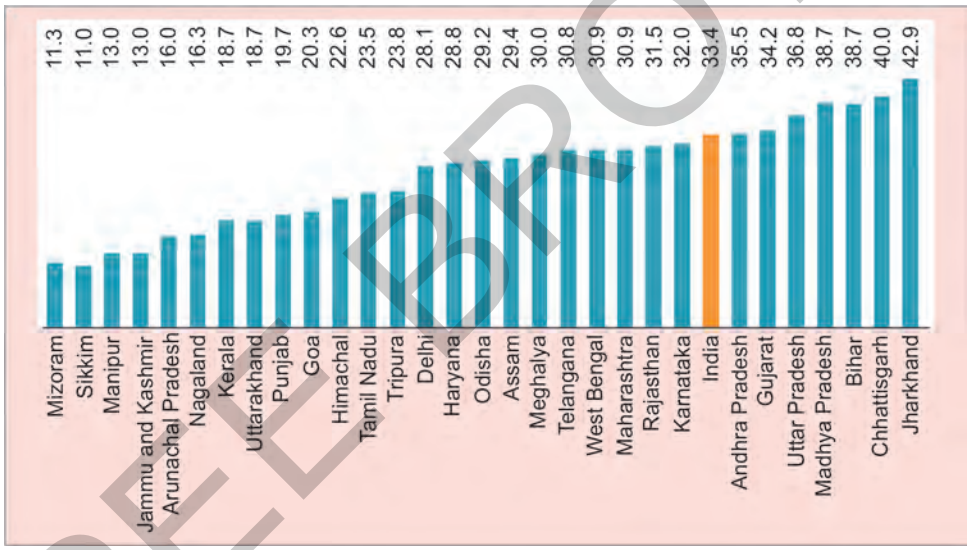

Fig. 7: Prevalence (%) of underweight among children aged 0–4 years by state, India.
Source: Reproduced from Comprehensive National Nutrition Survey, 2016–18.[2]

Nutritional Anemia

Anemia results from deficiency of iron, folate, vitamin B_{12}; malaria; helminthic infestations; genetic hemoglobinopathies such as thalassemia and sickle cell disease; chronic infection and inflammation; and chronic disease conditions such as renal failure.[4] In preschool children, the prevalence of anemia is highest in Madhya Pradesh (54%) and lowest in Nagaland (8%). Among school-age children, Tripura (41%) and Kerala (3%) had the highest and lowest prevalence, respectively. Among adolescents, West Bengal had the highest (46%) while Nagaland (8%) and Kerala had the lowest prevalence.[2]

Iron Deficiency

Iron deficiency is one of the most common nutritional deficiencies worldwide. In the CNNS, low serum ferritin among children and adolescents with normal C-reactive protein levels was considered as a biomarker for iron deficiency. In all three age groups, Punjab had the highest prevalence (67% among preschool children, 51% among school-age children, and 45% among adolescents) and Mizoram had the lowest prevalence of iron deficiency (4% among preschool children, 2% among school-age children, and 9% among adolescents).

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Vitamin A Deficiency

Vitamin A is an essential micronutrient that is particularly important for immune function.

Vitamin A is critical during periods of rapid growth. In the CNNS, Vitamin A deficiency was measured by serum retinol concentration in blood using reversed-phase high-performance liquid chromatography (HPLC). Among preschool children, Goa (2%) had the lowest and Jharkhand (43%) had the highest prevalence. Among school-age children, the prevalence of vitamin A deficiency was lowest in Rajasthan (1%) and West Bengal (4%) and highest in Mizoram (47%) and Jharkhand (42%). Among the adolescents, Rajasthan (2%), Himachal Pradesh (3%), Goa (4%), and Sikkim and West Bengal (5% each) had low prevalence of vitamin A deficiency while the highest prevalence was observed in Jharkhand (30%) and Chhattisgarh (26%).[2]

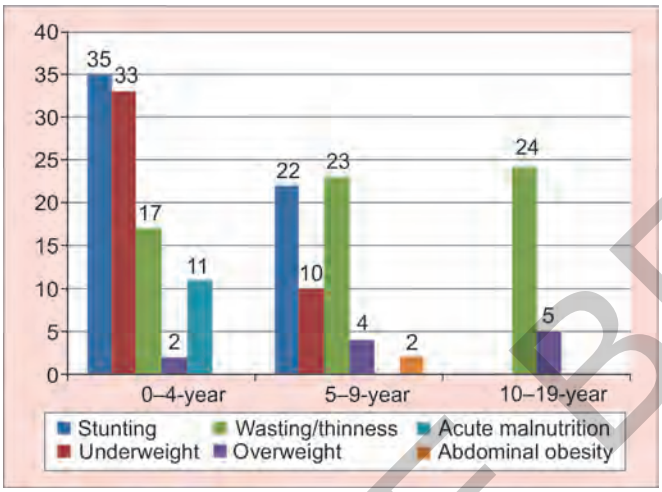

Fig. 8: Prevalence (%) of malnutrition in 0–4-year, 5–9-year, and 10–19-year age groups.
Source: Reproduced from Comprehensive National Nutrition Survey 2016–18.[2]

Vitamin D Deficiency

Vitamin D is essential for bone metabolism and may also play a role in immune system regulation.

The risk of vitamin D deficiency is high where there is low consumption of foods rich in vitamin D and there is inadequate exposure to ultraviolet B (UVB) radiation from sunlight.[5] In the CNNS, the vitamin D status was assessed by measuring serum 25(OH)D concentration with an antibody-competitive immunoassay using direct chemiluminescence (Siemens Centaur). In all three age groups, Punjab had the highest proportions of children and adolescents with vitamin D deficiency, with a 52% prevalence among children aged 1–4 years, 76% among children aged 5–9 years, and 68% among adolescents aged 10–19 years.

Iodine Deficiency

Iodine is an essential nutrient required for the thyroid hormone synthesis. Its deficiency causes hypothyroidism in children. Worldwide, 88% of people consume iodized salt. The CNNS provided national- and state-level estimates of median urinary iodine concentrations (mUICs) among children and adolescents. In all states except Tamil Nadu where mUIC was >300 µg/L, children and adolescents had adequate urinary iodine status.[2]

Zinc Deficiency

Deficiency of zinc causes growth retardation, impaired immune function, hair loss, diarrhea, skin lesion, and delayed sexual maturation. Among children aged 1–4

Table 3: Infant and Young Child Feeding practices in Indian children.

	*NFHS-3 (1998–99)**	*NFHS-4 (2005–06)**	*CNNS (2016–18)**	*UNICEF Global (2018)*
Children breastfed within 1 hour after birth	23.5 (<3 years)	41.6 (<3 years)	56.6 (0–23 months)	44 (<3 years)
Children under age 6 months who are exclusively breastfed	46.4	54.9	58.0	42.0
Children 6–8 months receiving solid/semisolid food and breast milk	42.7	52.6	53.0	69.0
Minimum diet diversity in 6–23 months	NA	NA	21.0	29.0
Minimum meal frequency 6–23 months	NA	NA	42.0	53.0
Minimum acceptable diet	NA	NA	6.0	19.0
Continued breastfeeding aged 12–15 months at 1 year	NA	NA	83.0	65.0

(CNNS: Comprehensive National Nutrition Survey; NFHS-4: National Family Health Survey-4; UNICEF: United Nations Children's Fund)
*All figures are in percentages.
Source: NFHS-3 (1998–99), NFHS-4 (2005–06), CNNS (2016–18), UNICEF Global (2018).

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Table 4: Prevalence of micronutrient deficiencies in children, India 2016–18.

	0–4 years	*5–9 years*	*10–19 years*
Anemia (%) 1–4 yr: Hb < 11.0 g/dL; 5–11 yr: Hb < 11.5 g/dL; 12–14 yr: Hb Girls: <12.0 g/dL, Boys: <13.0 g/dL	41.0	24.0	28.0
Iron deficiency (%) 1–4 yr: S. ferritin < 12 µg/L; ≥5 yr: S. ferritin < 15 µg/L	32.0	17.0	22.0
Vitamin A deficiency (%) 1–9 years: S. retinol concentration < 20 µg/dL 10–19 years S. retinol concentration < 20 µg/dL	18.0	22.0	16.0
Vitamin D deficiency (%) Serum 25(OH)D concentration < 12 ng/mL (30 nmol/L)	14.0	18.0	24.0
Zinc deficiency (%) <10 yr: <65 µg/dL >10 yr: Nonpregnant Females Males Morning fasting <70 µg/dL <74 µg/dL Morning nonfasting <66 µg/dL <70 µg/dL	19.0	17.0	32.0
Vitamin B_{12} deficiency (%) Serum vitamin B_{12} < 203 pg/mL	14.0	17.0	37.0
Folate deficiency (%) Serum erythrocyte folate < 151 ng/mL	23.0	28.0	37.0
Iodine (urinary iodine) status Adequate: >100 to ≤330 µg/L)	Adequate 213	Adequate 175	Adequate 173

(S. ferritin: serum ferritin; S. retinol: serum retinol)
Source: Comprehensive National Nutrition Survey, 2016–18.[2]

years, the highest prevalence was in Himachal Pradesh (41%) and lowest in Nagaland (1%). Among children aged 5–9 years, zinc deficiency ranged from 2% in Nagaland to 38% in Himachal Pradesh and among adolescents from 4% in Nagaland to 55% in Gujarat.[2]

Vitamin B12 and Folate Deficiency

Vitamin B12 and folate are necessary for the formation of healthy red blood cells, for the repair of body cells and tissues, and for the synthesis of DNA. Vitamin B12 is also important for maintaining normal nerve function. It is found primarily in foods of animal origin, and the risks for deficiency are therefore higher where access to these foods is limited.

In the CNNS, vitamin B12 and folate levels were assessed by estimating circulating levels of serum vitamin B12 and erythrocyte folate by a competitive immunoassay using direct chemiluminescence. Gujarat had the highest prevalence of vitamin B12 deficiency at 29% and West Bengal had the lowest prevalence at 2% among children aged 1–4 years. In the 5–9-year age group, prevalence ranged from 0% in Nagaland and 1% in Kerala to 31% in Uttar Pradesh and 32% in Punjab. A prevalence of 2% was reported in Kerala and Nagaland and 48% in Gujarat among adolescents aged 10–19 years.

IMPACT OF MALNUTRITION

Around 45% of deaths among children under 5 years of age are linked to undernutrition.[6] Malnutrition increases susceptibility to infections and delays recovery from illness. Malnourished children have lower intelligence quotient. The degree of cognitive impairment is related to iron deficiency anemia and to the severity of stunting.

As per UNICEF, stunting in early life leads to loss of 0.7 grade in schooling, a delay of 7 months in starting school, and 22–54% reduction in lifetime earning.[7] Malnutrition has a negative impact on the economic growth of a country which is caused by the economic burden of high mortality and morbidity due to malnutrition and by decreasing the productivity of malnutrition-affected individuals. Adults undernourished as children earn 20% less than normally nourished.[8] Asia and Africa lose 80% of GNP (gross national product) every year.[8] An increase of 1 cm in height is associated with an increase of 4% and 6% in wages of men and women, respectively.[8] It is estimated that malnutrition may cost society up to US $3.5 trillion per year and overweight and obesity may cost up to US $500 billion per year. Health consequences of overweight contribute to 120 million of Disability Adjusted Life Years (DALYs) globally.[8]

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DETERMINANTS OF MALNUTRITION

Malnutrition is multifactorial caused not only by unavailability of adequate nutritious food but also by frequent illness and poor access to health services. Knowledge of determinants is essential to tackle this long-standing problem. **Figure 9** depicts the UNICEF conceptual framework of malnutrition.[9] The causes of malnutrition are classified as follows:

- *Immediate causes*: Inadequate dietary intake and diseases are the immediate causes.
- *Underlying causes*: These are household food insecurity (unavailability of food, poor access to food, or poor utilization of a diverse diet), improper feeding practices for children, unhealthy environments of household and surroundings, and poor access to adequate health care.
- *Basic causes*: These include social, economic, and political factors existing in a country which ultimately influence the nutritional status of children, adolescents, and pregnant women. Poverty limits the access of vulnerable populations to essential resources.

Stunting is a consequence of chronic undernutrition during pregnancy and during early childhood while wasting is an acute life-threatening condition resulting from poor feeding and diseases. Emergence of overweight and obesity is because of changing lifestyle resulting in poor physical activity and increased accessibility to processed food. Moreover, the causes of undernutrition and overweight, in many ways, are similar and interlinked. Stunting during early life has been linked to increased risk of overweight and NCDs in later life.

In Africa, Habyarimana et al.[10] found that the age and gender of the child, birth weight, mother's knowledge about nutrition, birth order, recent fever, multiple births, mother's education level, age of mother at child birth, body mass index, anemia prevalence, province, source of drinking water, and wealth quintiles were the key determinants of under-five malnutrition.

STRATEGIES TO COMBAT MALNUTRITION

It is well recognized now that nutrition is a life-long issue. The effect of poor nutrition starts in utero and infancy to persist in adulthood and perpetuates across generations.

Lifecycle Approach of UNICEF

The lifecycle approach of UNICEF highlights the need to target nutrition programs to different stages of life:

- Pregnancy through infancy (*first 1000 days*) is the most critical period of growth and development in a child's life. Inadequate nutrition during this critical period affects

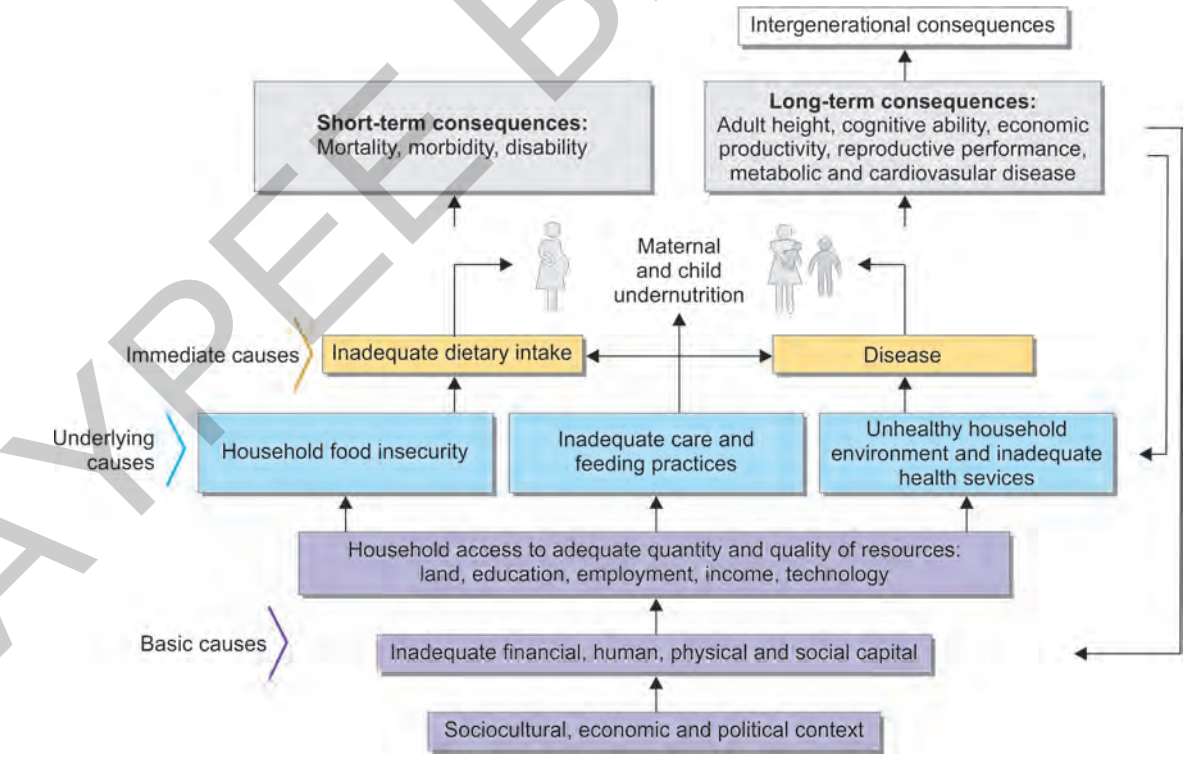

Fig. 9: Conceptual framework of determinants of malnutrition.
Source: Reproduced from United Nations Children's Fund. Strategy for improved nutrition of children and women in developing countries. New York: UNICEF, 1990.

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the growth of child which lasts lifelong. Interventions targeted to this key period by improvement of maternal nutrition, exclusive breastfeeding for the first 6 months of life, and appropriate complementary feeding may reduce malnutrition prevalence.[11]

- Throughout childhood, good nutrition is important for the growth and health of children. Improving WASH (Water Access, Sanitation, and Hygiene) practices, nutritional support, vitamin A supplementation, immunization, and deworming in children are some targeted approaches. UNICEF provides ready-to-use therapeutic food (RUTF) in countries where children are suffering from acute malnutrition.
- From adolescence through pregnancy: Many adolescent girls and women have nutrient deficits. Micronutrient supplementation helps support healthy pregnancy and prevents low birth weight in babies.

Nutrition-Specific versus Nutrition-Sensitive Approaches

Nutrition-specific interventions target the factors which affect nutrition directly. These include promotion of exclusive breastfeeding up to 6 months of age, continued breastfeeding till 2 years of age, and appropriate complementary feed up to 2 years of age; food fortification; micronutrient supplementation; and treatment of severe acute malnutrition. Nutrition-sensitive interventions address the underlying determinants such as agriculture, clean water and sanitation, education, employment, healthcare, and women's empowerment.[12,13]

Global Nutrition Targets for 2025

In 2012 and 2013, the member states of WHO adopted nutrition targets to reduce the burden of malnutrition by 2025.[8]

- *Target 1*: Reduction in the number of children who are stunted by 40%
- *Target 2*: Reduction in anemia in women of reproductive age by 50%
- *Target 3*: Reduction in low birth weight by 3–30%
- *Target 4*: No increase in childhood obesity
- *Target 5*: At least 50% increase the rate of exclusive breastfeeding in the first 6 months
- *Target 6*: Reduce and maintain childhood wasting to less than 5%.

Of the 194 countries analyzed, 38 were found to be on track for overweight, 37 for wasting, 31 for exclusive breast-feeding, and 24 for stunting.[1]

Strategies in India

Poshan Abhiyaan

Poshan Abhiyaan (National Nutrition Mission) is a multiministerial convergence mission launched by Prime Minister Shri Narendra Modi in Rajasthan in March 2018.[14]

Mission Goals

It aims to improve the nutritional status in children (0–6-year age), adolescent girls, pregnant women, and lactating mothers through the life cycle concept. The Mission aims to achieve reduction in stunting from 38.4% (NFHS-4) to 25% by 2022 (*Mission 25 by 2022*). **Table 5** shows the objective and targets of the Mission. The objective of the *Abhiyaan* is to reduce the stunting in the identified districts with the highest burden by improving the quality of nutrition services. *Poshan Abhiyaan* is being implemented in 315 districts in the first year, 235 districts in the second year, and the remaining districts in the third year by the Ministry of Women and Child Development (MWCD).[15]

There are several nutrition programs in India. But there is lack of co-ordination among them. The *Abhiyaan* will monitor, fix targets, supervise, and guide the nutrition-related interventions through a robust convergence mechanism. The Mission will ensure convergence of various ongoing programs:

- Anganwadi Services
- Pradhan Mantri Matru Vandana Yojana
- Scheme for Adolescent Girls of MWCD
- Janani Suraksha Yojana (JSY)
- National Health Mission (NHM) of Ministry of Health and Family Welfare (MoH and FW)

Table 5: Objectives and targets of national nutrition mission.

Sl. No	*Objective*	*Target*
1.	Prevent and reduce Stunting in children (0–6 years)	By 6% @ 2% p.a.
2.	Prevent and reduce undernutrition (underweight prevalence) in children (0–6 years)	By 6% @ 2% p.a.
3.	Reduce the prevalence of anemia among young children (6–59 months)	By 9% @ 3% p.a.
4.	Reduce the prevalence of anemia among women and adolescent girls in the age group of 15–49 years	By 9% @ 3% p.a.
5.	Reduce low birth weight (LBW)	By 6% @ 2% p.a.

Source: Poshan Abhiyaan Guidelines, Ministry of Women and Child Development, Government of India.[14]

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- Swachh Bharat Mission of Ministry of Drinking Water and Sanitation (DW and S)
- Public Distribution System (PDS) of the Ministry of Consumer Affairs, Food and Public Distribution (CAF and PD)
- Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS) of the Ministry of Rural Development (MoRD)
- Drinking Water and Toilets with Ministry of Panchayati Raj and Urban Local Bodies through the Ministry of Urban Development.

Mission Components

- *Information and communication technology enabled real time monitoring (ICT-RTM) system*: ICDS-CAS (Common Application Software) preloaded mobiles will be made available to Anganwadi Workers (AWWs), tablets to lady supervisors, and desktops at block, district, state, and national levels for ICT-RTM monitoring.
- *Training and capacity building*: Incremental Learning Approach (ILA) will be adopted for training of personnel.
- *Community mobilization and Behavior Change Communication (BCC)*: The following activities will be included in this component:
  - *Community-based events*: Each Anganwadi Center (AWC) will organize one community-based traditional event every month to promote maternal and child health, and ₹250/- shall be reimbursed for the same. Information Education and Communication (IEC) to support nutrition behavior change. The IEC strategy aims to create awareness among general public regarding the various nutrition- and health-related government schemes. It guides the citizens on how to access them. The IEC activities mostly will be done through television, radio, print media, and social media.
  - *Jan Andolan*: Through the involvement of Panchayati Raj Institutions and Village Organizations, the Mission will ensure wide public participation by converting the nutrition-related issues into a *Jan Andolan*.
- *Innovations*: Any innovative idea that has the ability to significantly transform or enhance the Mission to achieve any of its stated outcomes may be developed into a pilot project and implemented later on.
- Incentives for AWWs for using the digital tools and for states/UTs based on their performance will be provided.
- *Grievance redressal and citizen engagement*: A Call Centre will be set up to effectively engage with the beneficiaries to provide grievance redressal and to monitor and follow-up on the nutritional indicators so that targeted action may be taken.
- *Nutrition surveillance system, social surveys, and audit monitoring*: Surveys will be conducted based on the data collected from the digitized systems and feedback will be provided for improvement in the programs.

The prevalence of malnutrition may be reduced by a multipronged approach which includes improving maternal nutrition before and during pregnancy and lactation; exclusive breastfeeding up to 6 months of age with continued breastfeeding till 2 years of life; adequate nutrition in early childhood; and access to basic health and WASH services. Many countries are on the right track.

Despite all the efforts done so far, the UNICEF, WHO, and World Bank global and regional child malnutrition estimates reveal that we are still far from a world without malnutrition. The joint estimates, published in March 2019, reveal insufficient progress to reach the World Health Assembly targets set for 2025 and the Sustainable Development Goals set for 2030.[1]

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2.2

CHAPTER

Infant and Young Child Nutrition in Tropics

Satish Tiwari, Rupal Dalal

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INTRODUCTION

In India, out of 1.2 million children aged 0–59 months who die, 58% of those deaths occur during the neonatal period.[1] Infant mortality rate is at present 41 and under-5 mortality rate is 50 per 1,000 live births as per National Family Health Survey (NFHS-4) data. Childhood undernutrition accounts for 45% of under-5 mortality alone and remains a key public health challenge in India. India is striving to reach an under-5 mortality rate of 25 deaths per 1,000 live births by 2030 as part of the Sustainable Development Goals set out by the UN.[2] To achieve good physical and mental development as well as long-term health, optimum nutrition starting in early stages of life is crucial.

INFANT AND YOUNG CHILD FEEDING STATISTICS IN INDIA

In India, breastfeeding is inadequate as only 55% babies are exclusively breastfed for 0–6 months and 41% are able to begin breastfeeding within an hour of birth.[3] For infants born by cesarean section, breastfeeding initiation can be delayed. Out of 92% institutional deliveries, 40% deliveries in Andhra Pradesh and 58% deliveries in Telangana are by cesarean section, but the early initiation of breastfeeding is only 40% and 37% in these respective states as per India's NFHS 2015.[4] According to a new study on the cost of not breastfeeding and an accompanying tool, annually, inadequate breastfeeding results in 100,000 preventable child deaths (mainly due to diarrhea and pneumonia), 34.7 million cases of diarrhea, 2.4 million cases of pneumonia, and 40,382 cases of obesity in India.[5] Only, 14.3% of nonbreastfeeding and 8.7% of breastfeeding children and thus mere 9.6% children aged 6–23 months receive an adequate diet as per NFHS-4 data.

Recommendations of Infant and Young Child Feeding

If every child from 0 month to 23 months was optimally breastfed, then we would have saved over 820,000 children under 5 years of age. Breastfeeding improves cognition, decreases school absence, and is associated with better income in adult life. Overweight and obesity is lower in babies who were breastfed as babies.[6] Optimum maternal, infant, and young child nutrition practices result in improvement in child development and they reduce health costs which results in economic gains for individual families as well as for the country.

World Health Organization (WHO) recommends:[7]

- Initiation of breastfeeding within 1 hour of birth
- First 6 months of exclusive breastfeeding
- Continued breastfeeding up to 2 years or beyond with introduction of nutritionally adequate and safe complementary foods on the completion of 6 months of age.

BREASTFEEDING

Antenatal Preparation

When a pregnant woman receives personal and professional guidance during pregnancy till she is discharged from the hospital postdelivery and beyond, her decision to initiate and maintain breastfeeding improves.[8] Breastfeeding counseling guides mother on proper positioning and latching techniques improving mother's confidence. It also prevents or resolves breastfeeding problems. Breastfeeding support in the community also results in increasing rates of initiation of breastfeeding as well as duration of exclusive breastfeeding.[9] Pregnant women should be informed about the benefits of exclusive

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