

1. Details of Module and its structure

Module Detail	
Subject Name	Food, Nutrition for Healthy Living
Course Name	Food, Nutrition for Healthy Living
Module Name/Title	Malnutrition
Module Id	FNHL_101016
Pre-requisites	General knowledge about Malnutrition
Objectives	After going through this lesson, the learners will be able to understand the following : <ol style="list-style-type: none">1. Types of Malnutrition2. Protein Energy Malnutrition3. Impact of Undernutrition4. Strategies to Combat Undernutrition5. Iodine Deficiency Disorders
Keywords	Concept, Under nutrition, Over nutrition, Micro nutrient, Deficiencies of public health significance (prevalence and preventive measures of: Anaemia, PEM, Vitamin A deficiency and Iodine deficiency)

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“End hunger, achieves food security and improved nutrition, and promotes sustainable agriculture”.

Sustainable Development Goal 2

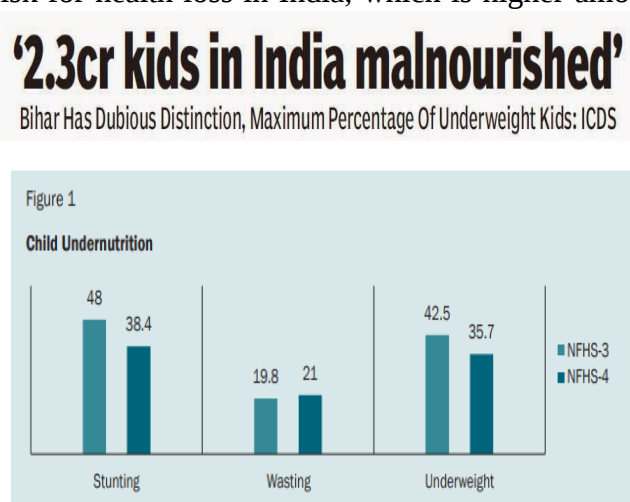
1. Introduction

Malnutrition is now not a strange phenomena around the globe because it is eroding the potential of the person to remain healthy, happy and productive. It increases the risk of many preventable disorders, diseases and death.

Malnutrition continues to be the single largest risk for health loss in India, which is higher among females and still severe in several states in India. (ICMR, PHFI, 2017). The news paper data speaks another stark reality (Nov 15th 2017 TOI).

In spite of declining data from National Family Health Survey (NFHS IV, 2016) report shown in picture, child undernutrition remains high and challenging in different states which call for focused interventions in those areas

for optimal results. In this lesson we are trying to project the causes, consequences as well as some



strategies to combat malnutrition. Though there is sharp decline in stunting but stunted growth is of high concern because it limits the brain development during childhood and pose threat to academic and professional performance later in life. Let us understand what the malnutrition is:

Malnutrition refers to the deficient, excess or imbalanced intake of energy and /or nutrients. It is an undesirable state of health in which normal functioning in the body is impaired reflecting through various clinical symptoms in the body. It is largely due to inadequate intake of food or nutrients in relation to nutritional requirements of the body. Earlier malnutrition was perceived through undernutrition and overnutrition.

Now triple burden of malnutrition (undernutrition, Micronutrient Deficiency Disorders, and overnutrition) is being observed in different section of the societies in all geographical areas. **Malnutrition** violets the “fundamental right of the child to food, health and life with dignity as per “the Nutrition Security Acts, 2013”. Different types of malnutrition is shown in figure

2. Different types of Malnutrition

Millions of newborns, young and old children, adolescents, adults, pregnant and lactating women and senior citizens, even sick and hospitalized patients are victims of malnutrition in terms of underweight, stunting, wasting. Different categories of people suffer from various micronutrient deficiencies such as vitamin A deficiency disorder, iron deficiency anemia, iodine deficiency disorder, and vitamin D deficiency. Under the influence of undernutrition and micronutrient deficiencies, several children die of diarrhea, become blind and live with poor growth and mental retardation. Overweight and obesity are now emerging health problems and linked with many degenerative diseases.

Under nutrition

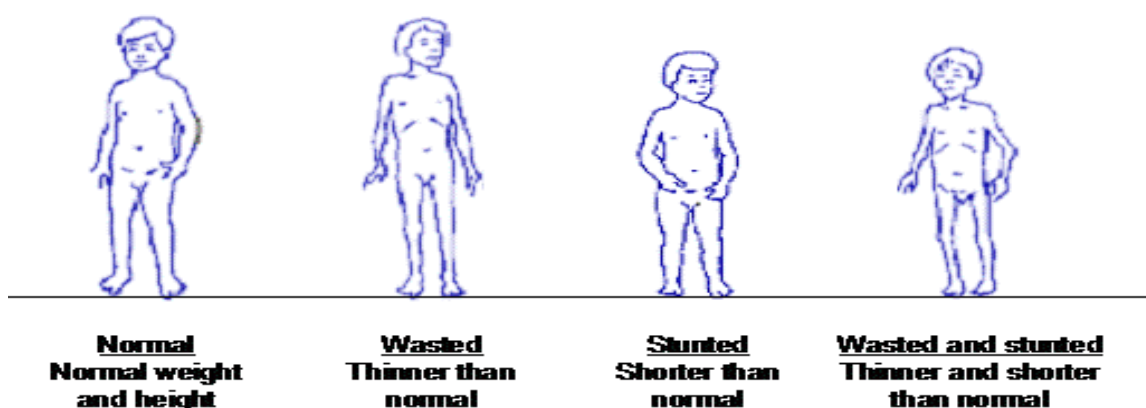
Undernutrition is inadequate food intake for long duration resulting in low body weight, stunted stature, growth retardation, poor absorption of nutrients, poor immunity and frequent episodes of infection and poor physical and academic performance. There are following three indicators for undernutrition or malnutrition which are also considered in national vital indicators.

Underweight (current malnutrition): Underweight means low body weight for the given age as compared to reference standards (WHO Child Growth Standards (2006). It reflects the body size

and easily influenced by current food intake or illness. It reduces the immunity and brings the child in vicious cycle of malnutrition and sickness (mainly infectious diseases like diarrhoea).

Stunting (chronic malnutrition): Stunting means low height (length in babies) for the given age when compared to reference standards. It is not affected by immediate intake of food or illness. It is a result of low food or nutrient intake for long time. It is also an indicator of household food insecurity and chronic energy deficiency. Chronic malnutrition early in life (1000 days) prevents the child to fully grow in body and brain. This type of malnutrition is irreversible and limits the learning and chances for good earnings in future.

Wasting(acute malnutrition): Wasting means low body weight for the given height compared to reference standards. Low weight and low height indicates growth faltering or failure to thrive. Acute malnutrition is a threat for survival.



3. Protein Energy Malnutrition (PEM)

Protein Energy Malnutrition (PEM) is a syndrome and synonymous with undernutrition. PEM commonly occurs in infants and young children as a result of deficiency of energy and protein and other nutrients. Mainly it is discussed in terms of kwashiorkor and marasmus that is shown in the table below:

Kwashiorkor	Marasmus
Kwashiorkor is predominately the deficiency of protein in children who continue to eat starchy diet.	Marasmus is predominately the deficiency of energy, protein and other nutrients.
Edema on face (moon face) and feet	No edema but marked reduction in weight
Water accumulation in abdomen (pot belly)	Marked weakness, dehydration
Thin legs and arms	Severe stunting

Pigmentation of skin and hair	Dry, wrinkled and loose skin
Loss of body weight and muscle tone	No muscles and no fat in the body
Pale dull look	Bony structure and pigeon chest
Irritable and cry easily	Do not respond easily
Signs of vitamin A deficiency and anemia often accompany PEM patients	Frequent episodes of gastroenteritis, respiratory infection, eyes and skin lesions

Moderate Acute Malnutrition (MAM) is moderate level of malnutrition indicated by low weight for age appropriate height. Edema is missing and growth and development of the child is impaired. If measured at mid arm circumference (left hand) it will be less than less than 12.5 cm.

Severe Acute Malnutrition (SAM):

Severe Acute Malnutrition (SAM) extreme level of malnutrition, indicated by severe wasting, edema, poor muscle mass and frequent diarrhoea or respiratory infection or fever. It can be fatal, if not treated in time. . If measured at mid arm circumference (left hand) it will be less than less than 11.5 cm.

Nutrition Rehabilitation Centers (NRC) along with hospitals and other health centres manage MAM and SAM cases in several places of India.

Chronic Energy Deficiency: Chronic Energy Deficiency implies the insufficient intake of energy foods for several months and years. BMI below 16.0 is Chronic Energy Deficiency (CED). It is common in people affected by poor social, economical and environmental circumstances. There is gradual or sharp decline in body weight, body fat and physical working capacity. Supplementation with foods rich in energy, protein, vitamins and minerals improves CED condition.

4. Factors influencing Undernutrition

There are myriad reasons for malnutrition/undernutrition and all are interdependent. Heredity, age, gender, infections, inadequate infant feeding practices, inadequate diet, stress, lack of exercise and sleep, smoking, alcohol consumption, poverty and climate change all contributes to undernutrition. Undernutrition directly or indirectly influenced by following factors:

Table: Factors affecting undernutrition

Major factors

Food accessibility

Influencing features

- Insufficient amount of food available at home

Environmental factors	<ul style="list-style-type: none"> • Delayed feeding of complementary foods • Food shops are far away from home • Lack of nutritious foods in outside home • Poor food distribution in spite of various provisions from government and NGOs • Many mouths to feed- large size family • Lack of cooking skill • Poor housing- highly populated, dark and damp living conditions • Poor sanitation- lack of waste disposal facilities and toilets • Inadequate facilities for water, electricity, roads, markets, transport and modes of communication • Climate change in many geographical regions • Pollution in air, water and soil
Socio-economic and cultural factors	<ul style="list-style-type: none"> • Indiscriminate use of plastics, pesticides, adulteration • Food habits governed by cultural taboos and religion (such as prolonged fasting) • Poor eating behaviour- missing meals • Low purchasing power- poverty • Shifting expenditure from nutritious food to luxury items
Pathological factors	Infectious diseases

Undernutrition is also common in first 1000 days of life (from conception to 24 months of age), adolescence, pregnancy and disease conditions because nutritional demands are critically high and often are not met. Loss of nutrients during menstruation or infections or accidents and processing and storage of foods are other risks of undernutrition.

5. Impact of Undernutrition

Undernutrition may begin with the fetal stage (during pregnancy) and leads to low birth weight, intrauterine growth retardation. Fetal undernutrition may manifest diseases like obesity, diabetes, heart diseases later in adulthood. Undernutrition in first 1000 days of life seriously impairs normal growth and development of the body particularly of the brain resulting in poor school achievement, school dropout and risk of neuro-motor problems (lack of coordination of hands and body with mind). Severe malnutrition can be life threatening.

It adversely affects the appetite, growth and development, learning ability, social adjustment, work efficiency and performance. It decreases the immunity and increases the episodes of diarrhea and respiratory infection. Infectious disease reduces the food intake causing undernutrition. It becomes a vicious cycle. Moderate and severe lack of nutrients aggravates the problem of undernutrition to the extent of hospitalization and death.

Undernourished children when grow into adults lose better opportunities in terms of productivity, career and income. It is a threat to economy and overall development of the nation.

6. Strategies to Combat Undernutrition

Food production seems to be enough to feed everyone but data on malnutrition is dismal. Let's use what further can be done to improve the condition or combat undernutrition at different levels-

- ✓ Dietary diversification from farm to plate stages
- ✓ Exclusive breast feeding from 0-6 months of age
- ✓ Adequate and timely complementary feeding from 6-24 months
- ✓ Adequate hygiene practices at every stage of food handling and eating
- ✓ Extra care and support for infants, adolescents girls and pregnant and lactating women and elders with regard to food choice
- ✓ Regular Deworming
- ✓ Nutrition and Health education at health centres, schools, media and public places
- ✓ Better sanitation facilities
- ✓ Access to safe drinking water and nourishing food
- ✓ Improvement in food access and household food security through public distribution
- ✓ system, fair price shops and other places
- ✓ Food fortification- it does not require change in food pattern hence better compliance
- ✓ Participation of many national nutrition programmes and other programmes organized by UNICEF, WFP and NGOs.
- ✓ Growth monitoring of children
- ✓ Ensuring better hygienic condition and sanitation in homes and surroundings
- ✓ Creating home environment feasible in term of behaviour and relationship for normal growth and development
- ✓ Health and nutrition education on nutritious diet, deworming, immunization,
- ✓ Improving the access to primary health care services, ICDS, NRCs and hospitals

Approach to tackle undernutrition can be top down such as from central government to the grass root level and bottom up approach from grass root to top level. For example ICDS is a top down approach. There is an interesting example of bottom up approach developed in a village of Jharkhand i.e. “Tiranga Bhojan”

<https://yourstory.com/2016/02/tiranga-bhojan-jharkhand/>

7. Micronutrient Deficiencies (MDD)

Micronutrient Deficiencies Disorders (MDD) is a phenomenon in which a person may be deficient in one or more vitamins and minerals at the same time. Micronutrient deficiencies are leading many adverse health consequences including communicable and non-communicable diseases. It also risks the safety, security and survival of the human beings. Largely, deficiency of iron, folic acid, iodine, zinc, vitamin D, riboflavin, vitamin B6 and vitamin B12 are found in children, pregnant and lactation women and people suffering heart, lung, liver and neurological diseases. Only few micronutrient deficiencies are discussed here in brief which are public health concern and also covered by national prophylaxis programmes.

8. Anemia

Anemia is most common micronutrient deficiency disease in the world. The prevalence of anemia had been highest in India for long period of time. It is common in women of reproductive age, (adolescent girls, pregnant women) and children. Low dietary intake of iron, folic acid and other nutrients are involved in high prevalence of anemia. High consumption of cereal based Indian diet and low consumption of vitamin C rich fruits and vegetable prevents absorption of iron in the body due to the presence of phytate and fiber in such diet. Vitamin C enhances the absorption of iron. Further Malaria and hook worm infestation in many endemic areas are added factors for anemia.

How do you know about iron deficiency anemia are what its symptoms:

Anemia is characterized by lack of hemoglobin present in red blood cells (RBC) diminishing the oxygen carrying capacity of the blood.

Common symptoms of Iron Deficiency Anemia (IDA) are pale eyes and skin; tiredness on slight exertion, low capacity to work and learning, poor attention span, irritability and spoon-shaped (koilonychia) in severe cases anemia. During pregnancy and growth period nutritional demands are high and poor sanitary condition aggravates the problem.

Consequences of iron deficiency anemia are visible seen in poor health and reduced capacity to work and poses serious threat the socioeconomic status of the person as well as national economy. It

also leads to high rate of premature births, low birth weight children, more number of school drop outs, high risk of nutritional deficiencies and diseases.

To control Iron Deficiency Anemia government of India has launched National Nutritional Anaemia Prophylaxis Programme (NNAPP) long ago which encompasses Distribution of iron folic acid tablets to desirable beneficiaries (children, adolescent girls, pregnant and lactating women); regular deworming and dissemination of health and nutrition education with regard to need for high intake of iron rich foods like liver, meat, egg, green leafy vegetables along with vitamin C rich foods lemon, amla, guava for better absorption of iron and reduced intake of tea (as it contains tannin which inhibits iron absorption). Inclusion of other nutrients like vitamin A, B, C and protein also play role in prevention of anemia. Iron fortified salt is also available in some parts of our country. Control of mosquitoes causing malaria is also necessary for IDA.

Iron enhancers- which improve the absorption of iron in the body.

Vitamin C rich foods like amla, guava, lime, lemon, oranges, coriander leaves

Animal foods like egg, liver, meat because they contain the form of iron that can directly be used in the body

Iron inhibitors- which reduce the absorption of iron in the body.

Tea and cola beverages- tannins present these beverages reduce the absorption of iron. E.g. consuming dates along with tea is not useful and advisable.

High fiber intake and food containing oxalates, phytates and polyphenols along with iron rich foods

Double fortified salt is also table salt commercially available. It is fortified with two minerals together namely iron and iodine. It helps to target two national problems, i.e. anemia and iodine deficiency disorders. It has been reported safe for anemic people, pregnant and children.

9. Vitamin A Deficiency (VAD)

Vitamin A Deficiency (VAD) is a deficiency disorder in which low vitamin A in the body impairs the normal functions in the body. Vitamin A Deficiency leads to poor eye sight; low immunity and growth retardation. It largely affects preschool children, pregnant women and lactating mothers around the globe. In India, 35.4 million preschool children show sub-clinical symptoms and 1.8 million suffer from xerophthalmia (eye disease, if not treated can lead to eye damage or blindness). Its common causes are:

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1. Inadequate breast feeding and poor quality of complementary feeding
 2. Low intake of vitamin A rich foods
 3. Loss of vitamin A due to poor handling of fruits and vegetables during handling, cooking, processing and storage
 4. Ignorance about importance of vitamin A in health and diseases

To control Vitamin A Deficiency (VAD), attempts are being made at national and local levels. National Vitamin A Prophylaxis Programme (NPPNB) is functioning in India in which various strategies like inclusion of vitamin rich foods and vitamin A drops are added for Indian children irrespective of their family background and nutritional status. It is implemented as one of the services of ICDS (Integrated Child Development Services) and through primary health centers and sub-centers and also by some nongovernmental organizations (NGO). Vitamin A drops is given along with immunization in two doses:

1. One ml @ 1,00,000/- IU (spoon/ dispenser provided with each bottle) is give to a child of less than 1 year of age along with DPT-1, OPV-1 and Measles
2. Two ml @ 2,00,000/- IU (spoon/ dispenser provided with each bottle) is give to a child of older than 1 year of age along with DPT-1, OPV-1.

Dietary diversification is suggested by including vitamin A rich such as egg, milk products, fish and liver, dark green leafy vegetables (spinach, methi etc), carrots, pumpkin, sweet potato, papaya, mango and apricot etc. Vitamin A rich foods can easily be incorporated in the daily diet, for example adding spinach in daily pulse preparation or chapatti at home.

It must be taken into consideration that animal foods directly provide vitamin A to the body while plant foods contain precursor of vitamin A as carotenoids which the body converts into vitamin A.

Nutrition and health education is very helpful. The communication regarding eating vitamin A rich foods through “child to child” and “child to mother” and “mother to mother” goes a long way. Further audio visual aids, multimedia and social marketing can successfully achieve the targets. Health education for cleanliness and hygiene should be provided.

Attempts to fortify fats and oils with Vitamin A at industry level are in progress.

10. Iodine Deficiency Disorders (IDD)

Iodine is a micronutrient, essential for normal body growth and mental development. Deficiency of iodine is a group of disorders resulting from inadequate dietary supply of iodine and is referred as

Iodine Deficiency Disorders (IDD). It is a preventable public health problem affecting millions of children and adults around the globe. According to Census (2011), 398.8 million of total population is at high risk of IDD particularly children below five years and pregnant women. Prevalence is high in Maharashtra, Himachal Pradesh and Karnataka and some districts around Delhi and Haryana.

Hills, floods, soil erosions, deforestation leach out iodine from top soil. Hence foods and drinking water become deficient in iodine and the people living in those areas are at high risk of IDD. Low socio-economic status compounds the problem. Certain foods like turnip, soy, mustard and rapeseed contain some goitrogens which hampers the utilization of iodine in the body. However, these compounds are usually inactivated by cooking.

Consequences of Iodine Deficiency

- Persons with IDD have low BMR, sluggishness, chronic fatigue, reduced work output, impaired mental functions, poor immune function, weak muscles and dry skin.
- Hypothyroidism is a health condition in which thyroxine hormone containing iodine is not properly manufactured and utilized in the body.
- Goiter is a stage when thyroid gland is enlarged in the neck region
- In advanced cases children may develop cretinism characterized by low IQ, hearing and speech impairment and psychomotor defects.

11. Prevention and Control of Iodine Deficiency Disorder (IDD)

Government of India through National Iodine Deficiency Disorders Control Programme (NIDDCP) has taken for universalization of salt iodization. Common salt is fortified with 30 ppm potassium iodate per kilogram of salt. Ban on the sale of non-iodized salt was also imposed. Iodized salt should be used at end of the cooking to minimize its loss.

Vitamin D deficiency is also being considered a public health problem in India despite abundant sunshine being present in the country. It is related to life style disorder and found in people of all age, gender, religions. Vitamin D deficiency tends to hamper the proper utilization of calcium and phosphorus and bone diseases like rickets, osteoporosis and osteomalacia. It is also considered to play role in other metabolic disorders.

There are others nutrients like protein, essential fatty acids, zinc, selenium, riboflavin, niacin,

thiamine, folic acid which are found deficient in large number of people in country but in sporadic manner. Addition of these nutrients in the diet can solve the deficiency problem and improve overall health and productivity.

Zinc deficiency- Zinc is an essential nutrient. Deficiency of it will prevent synthesis of enzymes needed for functioning of immune system, digestive system, growth and development. It leads to stunting, infectious diseases and also degenerative diseases.

12. Overnutrition

Overnutrition is a state of excessive fat in body indicated by overweight and obesity. Fat is accumulated in adipose tissues of the body. BMI of 23-27.5 is considered overweight and above 27.5 obesity. It is the overconsumption of food and nutrients over a period of time resulting in increase in body weight. It also modifies body shape, body composition and body functioning and often shows adverse effect on health or pathogenesis of many diseases. Now obesity itself is considered a life style disease. It is also influenced by heredity, age, gender, physiological status, stress and life style. Regular estimation of body weight helps to monitor the weight gain and take steps to control it. BMI, waist circumference (WC), skin fold thickness are also good methods to assess the degree of overweight and obesity.

Abdominal obesity – It is a central obesity where abdomen or belly is protruding characterized by deposition of excess fat around belly (visceral fat). There may not be extra fat on arms and legs. It is linked with cardiovascular diseases, insulin resistance, diabetes, hypertension, etc.

Childhood obesity- If children above the age of two have high body fat. It adversely affects normal growth and development and activity level of children. It often continues into adulthood obesity.

The cause of overnutrition or obesity is often considered an excessive intake of energy dense food in comparison to the energy expenditure in physical activities. It is a multi-faceted health problem resulting from complex interaction of genes, environment and lifestyle. These factors influence the eating and activity behaviours. Easy access and economic cost of highly processed and packaged foods, free food samples, gifts of foods, large portion size, eating ad libitum, skipping meals, unmindful eating in holidays, parties, malls, TV watching or festival also promote obesity. Lack of

knowledge about nutrition and healthy foods, working parents, staying alone, habit of comforts increases the risk of obesity and its related health problems.

Low physical activity due to sedentary life style and convenient life style, use of gadgets is the other contributing factor. It is now established that maternal undernutrition during fetal stage predispose obesity in later years.

Consequences of overnutrition

Over nourished person become fatty and often look shabby and unattractive and he or she soon develop low self esteem resulting in poor academic performance and less participation in social activities and unnecessary indulgence in eating. Vicious cycle of gaining weight goes on rotating. Social and economic burden of obesity are also high. Risk of heart diseases, respiratory disease, sleep problems, dental caries etc. The behavioural problems and nutrient deficiency disorders also increase with obesity.

Since overweight and obesity are manmade health problems hence change in human behaviour can easily prevent it. Foreseeing their consequences in present and future life, the individual and the parents, teachers, media and health professional can help in reducing the burden of obesity. Some of following steps are suggested here.

1. Consume well balanced diet ensuring inclusion of enough water, wholegrain foods, milk products, fruit and vegetables.
2. Nutrition and health education can improve food selection and eating behaviour.
3. Restrict consumption of soft drinks, energy drink, confectionary, junk food, processed foods and foods rich in sugar, fat and salt, refined flours, soda and MSG.
4. Regular vigorous exercises for 30-45 minutes including more outdoor activities
5. De -stress through yoga, meditation, music, dance or any creative hobby
6. Get sufficient Sleep at night but not in daytime.
7. Parents need to play role models for young children
8. Eat meal at regular timings and avoid skipping meals particularly breakfast
9. Learn to cook nutritious foods and also reading labels for nutrition facts
10. Take healthy packed lunch from home rather than buy from outside
11. Reduce screen time and sitting activities
12. Record body weight and other bodily symptoms regularly and act accordingly
13. Take immediate actions in case of medical problems

Currently our country is facing a great challenge of malnutrition that is adversely affecting productivity at various levels. This lesson about different types of malnutrition, their basic concepts, causes and consequences along with some strategies of combating will help the learner to tackle preventable triple burden of malnutrition in different scenario.