

Human Growth, Development and Nutrition

(M.A. / M.Sc. SEM. II, Elective Paper; unit 4)

Nutritional requirements for Normal Growth:

Nutritional requirements in infancy, childhood and adolescence

The common feature of infancy, childhood and adolescence is that all these age groups are undergoing rapid growth and development. This in turn poses a heavy demand on their nutritional requirements. Small children and infants do not have a well developed body nutrient store, and therefore are more vulnerable to infection. In addition they have a larger surface area compared to their body size. All these factors increase their basal metabolic rate (BMR), resulting in an increased requirement for nutrients.

Adolescent growth spurt

Adolescents also undergo a very rapid growth during their puberty (called the **pubertal growth spurt**). During the pubertal growth spurt, they increase rapidly both in weight and height. Therefore, they need a nutrient intake that is proportional with their rate of growth. The growth rate is very high right after birth (infancy). Then the growth rate slows down until the age of 12–14 years. At about 15–16 years (the pubertal period) there is a sharp rise in growth rate/velocity. After that, the growth rate slows down again.

Requirements for macronutrients (proteins, carbohydrates and fats) and micronutrients are higher on a per kilogram basis during infancy and childhood than at any other developmental stage. These needs are influenced by the rapid cell division occurring during growth, which requires protein, energy and fat. Increased needs for these nutrients are reflected in daily requirements for these age groups, some of which are briefly discussed below.

Increased need for nutrients

Energy

While most adults require 25–30 calories per kg, a 4 kg infant requires more than 100 kilocalories per kg (430 calories/day). Infants of four to six months who weigh 6 kg require roughly 82 kilocalories per kg (490 calories/day). Energy needs remain high through the early formative years. Children of one to three years require approximately 83 kilocalories per kg (990 calories/day). Energy requirements decline thereafter and are based on weight, height, and physical activity.

As an energy source, breast milk offers significant advantages over manufactured formula milk. Breastfeeding is associated with reduced risk for obesity, a wide range of allergies, hypertension, and

type 1 diabetes. It is also linked with improved cognitive development; and with decreased incidence and severity of infections. It is also less costly than formula feeding. The list below outlines the nutrients and other constituents of breast milk:

- Water = 87–89%
- Vitamins (particularly vitamin A)
- Fat = 3–5%
- Energy = 60–70 kcal/100 ml
- Carbohydrate (lactose) = 6.9–7.2%
- Mineral = 0.2%
- Protein = 0.8–0.9%

Higher intakes of protein and energy for growth are recommended for adolescents. For most micronutrients, recommendations are the same as for adults. Exceptions are made for certain minerals needed for bone growth (e.g. calcium and phosphorus). Evidence is clear that bone calcium accretion increases as a result of exercise rather than from increases in calcium intake. Since weight gain often begins during adolescence and young adulthood, young people must establish healthy eating and lifestyle habits that reduce the risk for chronic disease later in life.

Water

Infants and children need plenty of water to drink, particularly when ill, or exposed to extreme temperatures.

Total water requirements (from beverages and foods) are also higher in infants and children than for adults. Children have a larger body surface area per unit of body weight and a reduced capacity for sweating when compared with adults, and therefore are at greater risk of morbidity and mortality from dehydration. Parents may underestimate these fluid needs, especially if infants and children are experiencing fever, diarrhoea or exposure to very cold or very hot temperatures.

Essential fatty acids

Requirements for fatty acids or fats on a per kilogram basis are higher in infants than adults (see Box 3.4). Some fatty acids play a key role in the central nervous system. However infants and children should not ingest large amounts of foods that contain predominantly fats, so it is important to get the balance right.

Increased nutrients required during infancy, childhood and adolescence

Infancy and childhood

Increased requirements of energy, protein, essential fatty acids, calcium and phosphorus.

Adolescence

Increased requirements of energy, protein, calcium, phosphorus and zinc.

Nutritional requirements during adulthood

The nutritional needs in adults of 19–50 years of age differ slightly according to gender. Males require more of vitamins C, K, B1, B2 and B3, and zinc. Females require more iron, compared with males of similar age.

You have already seen that pregnant women and lactating mothers have particular nutrient requirements that are necessary for their own health as well as the health of their baby.

Nutritional requirements during later years

Elderly people are especially vulnerable to nutritional problems due to age related changes in their body (impaired physiological and anatomical capacity). Box 3.5 overleaf sets out some of the problems an older person might experience which could impact on their diet.

Possible nutritional issues in old age

- Problems of procuring and preparing foods
- Psychosocial problems
- Digestion problems
- Nutrient absorption problems
- Renal changes
- Memory loss (senile dementia), which may include forgetting to eat
- Sensory changes
- Physical problems like weakness, gouty arthritis and painful joints.

Specific nutrient requirements in old age

An elderly person requires less energy than a younger individual due to reductions in muscle mass and physical activity. Some daily requirements for elderly people differ from those of younger adults. For example, in order to reduce the risk for age related bone loss and fracture, the requirement for vitamin D is increased from 200 IU/day to 400 in individuals of 51–70 years of age and to 600 IU/day for those over 70 years of age. Suggested iron intakes reduce however from 18 mg per day in women aged 19–50 to 8 mg/day after age 50, due to better iron conservation and decreased losses in postmenopausal women compared with younger women.

Some elderly people have difficulty getting adequate nutrition because of age or disease related impairments in chewing, swallowing, digesting and absorbing nutrients. Their nutrient status may also be affected by decreased production of chemicals to digest food (digestive enzymes), changes in the cells of the bowel surface and drug–nutrient interactions. Some elderly people demonstrate selenium deficiency, a mineral important for immune function. Impaired immune function affects susceptibility to infections and tumours (malignancies). Vitamin B6 helps to boost selenium levels, so a higher intake for people aged 51–70 is recommended.

Nutritional interventions should first emphasise healthy foods, with supplements playing a secondary role. Although modest supplementary doses of micronutrients can both prevent deficiency and support immune functions, very high dose supplementation (example, high dose zinc) may have the opposite effect and result in immune-suppression. Therefore, elderly people also need special attention with regard to nutritional care.

Nutritional requirements throughout the life cycle: conclusion

Requirements for energy and micronutrients change throughout the life cycle. Although inadequate intake of certain micronutrients is a concern, problems also come from the dietary excesses of energy, saturated fat, cholesterol and eating refined carbohydrates, all of which are contributing to obesity and chronic disease in developed countries. Below is a summary of the number of meals required at different stages in the lifecycle that might assist you in your work in your community.

Elderly people

Need at least two and if possible more meals each day as they may not eat much at each meal. They need fewer calories than younger people, but about the same amount of protein and other nutrients. Women who have stopped menstruating need less iron than childbearing women. Old people may need soft food.

Men

Need at least two mixed meals every day and some snacks. They can get enough energy from few large meals and from bulky food.

Women

Need at least two mixed meals every day and some snacks. If they are pregnant or lactating they need as almost as much food as men, especially if they are also doing hard physical work. They need much more iron and folate than men especially when they are pregnant.

Adolescents

Need at least two large mixed meals and some snacks each day. They can eat bulky food. Boys need a lot of calories. Girls need plenty of iron. Pregnant adolescent girls are still growing so they need more food than pregnant women.

School aged children

Need at least two to three mixed meals and some snacks each day.

Children 1–5 years old

Need breast milk until they are at least two years old. They need at least three mixed meals and two snacks each day. They cannot eat large bulky meals. It is especially important for the meals to be clean and not to contain parasites or microorganisms that could cause diarrhoea or other infection.

Babies 6-12 months

Need breastmilk eight to ten times or more each day. They need small meals, which are not bulky, three to five times a day.

Babies under 6 months old

Need only breast milk at least eight to ten times each day.

As a Health Extension Practitioner, you can assist families in choosing foods that keeps energy intake within reasonable bounds, while maximising intake of nutrient-rich foods, particularly vegetables, fruits, legumes and whole grains.

Common Nutritional Disorders

Nutritional disorder is a major challenge before the health care providers in several countries. The conventional approach categorise this under malabsorption and resorts to supplementation therapy. The nutritional disorder is not due to the deficiency of nutrients and micronutrients alone, but also due to the body's inability to absorb and assimilate them from the food and its inability to synthesize them wherever possible. This is considered as a constitutional error of the individual, which is further influenced by factors such as repeated infections, poor hygiene, emotional and low socio economic conditions.

Malnutrition is not a simple nutritional issue, but associated with social and economic factors. Creating awareness about healthy diet, good living habits, hygiene, avoidance of alcohol and smoking are equally important besides community development and health education. Along with creating awareness, there is need to ensure that resources for nutritional supplements are identified, generated and maintained by the society itself. This will happen only through community participation and community empowerment.

Certain basic nutrients are required to maintain good health. The energy yielding nutrients are proteins, carbohydrates and fats. Dietary fibers, vitamins and minerals such as calcium, iron, chloride, magnesium, phosphorus, potassium and sodium are other essential supplements. Apart from these, certain micronutrients such as chromium, copper, fluoride, iodine, manganese, molybdenum, selenium, sulphur, zinc and so on are also required to keep the immune balance, haemopoetic system and maintain optimal health. All these nutritional supplements are essential at an appropriate quantity for maintaining health, enhancing immunity and speed up healing processes. Lack of essential nutrients in the body lead to diseases. Most of nutrients are readily available in the food. During certain phases of life like pregnancy, after major illnesses, the requirement of the nutrients will be different. If there is inadequate supply, it may lead to disorders such as babies with low birth weight, osteoporosis. There are also certain conditions where in the absorption of these nutrients get hampered leading to deficiencies. Thus, the quantitative or qualitative deficiency or inability to absorb the essential nutrients leads to malnutrition.

Protein Energy Malnutrition (PEM) contributes to 60% of the total 10 million deaths of children of less than five years. Two forms of PEM are kwashiorkor and marasmus, and they commonly coexist. Anaemia is another nutritional disorder. WHO has estimated that prevalence of anaemia in pregnant women is 65-75% in India². In India, anaemia appears to be the rule rather than the exception. The prevalence rate is not only in the lower socioeconomic group but it is so even among higher income educated segments of population. Five major surveys show that over 70% of pregnant women and adolescent girls in the country were anaemia. In India, anaemia is directly or indirectly responsible for 40 per cent of maternal deaths. There is 8 to 10-fold increase in MMR when the hemoglobin level falls below 5 g/dl³. The conventional approach to tackle the disorder is mainly supplementation of iron, folic acid etc. **Studies have shown this has limited results and in many cases there is inability to absorb the required micronutrient and vitamins.** There are also adverse reactions to certain supplements like iron by the body⁴. These are major challenges in tackling the PEM and anaemia in this country.

Vitamins are another category of nutrients required for proper development and growth.

Vitamin A deficiency is the leading cause of blindness in children. It also increases the risk of disease from severe infections⁵. The clinical feature of vitamin A deficiency includes those concerning the xerophthalmia, night blindness. Pellagra, Beriberi, Scurvy, Rickets and Osteomalacia are some other clinical conditions associated with vitamin deficiency.

Fluorosis is a condition resulting due to ingestion of large amounts of fluorine when the drinking water contains fluorides in excess of 3-5 ppm. Fluorides are present in the environment. Excessive systemic exposure to fluorides can lead to disturbances of bone homeostasis (skeletal fluorosis) and enamel development (dental/enamel fluorosis). The severity of dental fluorosis is also dependent upon

fluoride dose and the timing and duration of fluoride exposure.⁶ Dental and skeletal fluorosis is known health hazards. Fluoride deficiency leads to dental caries.

Obesity is emerging as another major nutritional disorder of the modern world⁷.

Nutritional disorders are major health problems affecting all age groups, both sex and different socio economic strata. With an exploding population and emergence of long term lifestyle diseases, the health care delivery system in India, is now facing serious challenges. The conventional approach on nutritional disorders is supplementation of the deficient nutrients and micronutrients. This model works well if there is deficiency due to inadequate supply, but there are several clinical conditions related to malabsorption and malassimilation where the supplementation therapy do not give the desired results. In fact, such supplementation may result in overloading the system and create unpleasant symptoms with avoidable consequences.

Prevention of Nutritional Disorders

Prevention of nutritional disorders includes proper health promotion, nutrition education on food, hygiene, family planning and good weaning practices. Specific protective measures are adequate diet; growth monitoring, early diagnosis and treatment of infections and hospitalization of the critical case that will help in tackling the problem. Dietary improvement with dark green leafy vegetables, deep yellow fruits, eggs, milk or milk products, meat, fresh fruit, exposure to sunlight, moderate exercise will go a long way to tackle the problem to a great extent.

Concept of Balanced Diet

What is a balanced diet?

A balanced diet is one which provides all the nutrients in required amounts and proper proportions. It can easily be achieved through a blend of the four basic food groups. The quantities of foods needed to meet the nutrient requirements vary with age, gender, physiological status and physical activity. A balanced diet should provide around 50-60% of total calories from carbohydrates, preferably from complex carbohydrates, about 10-15% from proteins and 20-30% from both visible and invisible fat.

In addition, a balanced diet should provide other non-nutrients such as dietary fibre, antioxidants and phytochemicals which bestow positive health benefits. Antioxidants such as vitamins C and E, beta-carotene, riboflavin and selenium protect the human body from free radical damage. Other phytochemicals such as polyphenols, flavones, etc., also afford protection against oxidant damage. Spices like turmeric, ginger, garlic, cumin and cloves are rich in antioxidants. Balanced Diet for Adults - Sedentary/Moderate/Heavy Activity is given in annexure 2 and figures 3 & 4. Also, sample menu plans for sedentary adult man and woman are given in annexure 2a and 2b respectively.

Variety of foods essential for a balanced diet

Nutritionally adequate diet should be consumed through a wise choice from a variety of foods.

- Nutrition is a basic prerequisite to sustain life.
- Variety in food is not only the spice of life but also the essence of nutrition and health.
- A diet consisting of several food groups provides all the required nutrients in proper amounts.
- Cereals, millets and pulses are major sources of most nutrients.
- Milk which provides good quality proteins and calcium must be an essential item of the diet, particularly for infants, children and women.
- Oils and nuts are calorie-rich foods, and are useful for increasing the energy density.
- Inclusion of eggs, flesh foods and fish enhances the quality of diet. However, vegetarians can derive almost all the nutrients on cereal/pulse/milk-based diets.
- Vegetables and fruits provide protective substances such as vitamins / minerals / phytonutrients.
- Choose a variety of foods in amounts appropriate for age, gender, physiological status and physical activity.
- Use a combination of whole grains, grams and greens. Include jaggery or sugar and cooking oils to bridge the calorie or energy gap.
- Prefer fresh, locally available vegetables and fruits in plenty.
- Include in the diets, foods of animal origin such as milk, eggs and meat, particularly for pregnant and lactating women and children.
- Adults should choose low-fat, protein-rich foods such as lean meat, fish, pulses and low-fat milk.
- Develop healthy eating habits and exercise regularly and move as much as you can to avoid sedentary lifestyle

Why do we need nutritionally adequate food?

Nutrients that we obtain through food have vital effects on physical growth and development, maintenance of normal body function, physical activity and health. Nutritious food is, thus needed to sustain life and activity. Our diet must provide all essential nutrients in the required amounts. Requirements of essential nutrients vary with age, gender, physiological status and physical activity. Dietary intakes lower or higher than the body requirements can lead to under nutrition (deficiency diseases) or over nutrition (diseases of affluence) respectively. Eating too little food during certain significant periods of life such as infancy, childhood, adolescence, pregnancy and lactation and eating too much at any age can lead to harmful consequences. An adequate diet, providing all nutrients, is

needed throughout our lives. The nutrients must be obtained through a judicious choice and combination of a variety of foodstuffs from different food groups.

Carbohydrates, fats and proteins are macronutrients, which are needed in large amounts. Vitamins and minerals constitute the micronutrients and are required in small amounts. These nutrients are necessary for physiological and biochemical processes by which the human body acquires, assimilates and utilizes food to maintain health and activity.

Carbohydrates

Carbohydrates are either simple or complex, and are major sources of energy in all human diets. They provide energy of 4 Kcal/g. The simple carbohydrates, glucose and fructose, are found in fruits, vegetables and honey, sucrose in sugar and lactose in milk, while the complex polysaccharides are starches in cereals, millets, pulses and root vegetables and glycogen in animal foods. The other complex carbohydrates which are resistant to digestion in the human digestive tract are cellulose in vegetables and whole grains, and gums and pectins in vegetables, fruits and cereals, which constitute the dietary fibre component. In India, 70-80% of total dietary calories are derived from carbohydrates present in plant foods such as cereals, millets and pulses.

Dietary fibre delays and retards absorption of carbohydrates and fats and increases the satiety value. Diets rich in fibre reduce glucose and lipids in blood and increase the bulk of the stools. Diets rich in complex carbohydrates are healthier than low-fibre diets based on refined and processed foods.

Proteins

Proteins are primary structural and functional components of every living cell. Almost half the protein in our body is in the form of muscle and the rest of it is in bone, cartilage and skin. Proteins are complex molecules composed of different amino acids. Certain amino acids which are termed “essential”, have to be obtained from proteins in the diet since they are not synthesized in the human body. Other nonessential amino acids can be synthesized in the body to build proteins. Proteins perform a wide range of functions and also provide energy (4 Kcal/g). Protein requirements vary with age, physiological status and stress. More proteins are required by growing infants and children, pregnant women and individuals during infections and illness or stress. Animal foods like milk, meat, fish and eggs and plant foods such as pulses and legumes are rich sources of proteins.

Animal proteins are of high quality as they provide all the essential amino acids in right proportions, while plant or vegetable proteins are not of the same quality because of their low content of some of the essential amino acids. However, a combination of cereals, millets and pulses provides most of the

amino acids, which complement each other to provide better quality proteins.

Fats

Oils and fats such as butter, ghee and vanaspathi constitute dietary visible fats. Fats are a concentrated source of energy providing 9 Kcal/g, and are made up of fatty acids in different proportions. Dietary fats are derived from two sources viz. the invisible fat present in plant and animal foods; and the visible or added fats and oils (cooking oil). Fats serve as a vehicle for fat-soluble vitamins like vitamins A, D, E and K and carotenes and promote their absorption. They are also sources of essential polyunsaturated fatty acids. It is necessary to have adequate and good quality fat in the diet with sufficient polyunsaturated fatty acids in proper proportions for meeting the requirements of essential fatty acids (Refer chapter 7). The type and quantity of fat in the daily diet influence the level of cholesterol and triglycerides in the blood. Diets should include adequate amounts of fat particularly in the case of infants and children, to provide concentrated energy since their energy needs per kg body weight are nearly twice those of adults. Adults need to be cautioned to restrict intake of saturated fat (butter, ghee and hydrogenated fats) and cholesterol (red meat, eggs, organ meat). Excess of these substances could lead to obesity, diabetes, cardiovascular disease and cancer.

Vitamins and minerals

Vitamins are chemical compounds required by the body in small amounts. They must be present in the diet as they cannot be synthesized in the body. Vitamins are essential for numerous body processes and for maintenance of the structure of skin, bone, nerves, eye, brain, blood and mucous membrane. They are either water soluble or fat-soluble. Vitamins A, D, E and K are fat-soluble, while vitamin C, and the B-complex vitamins such as thiamin (B₁), riboflavin (B₂), niacin, pyridoxine (B₆), folic acid and cyanocobalamin (B₁₂) are water-soluble. Pro-vitamin like beta-carotene is converted to vitamin A in the body. Fat-soluble vitamins can be stored in the body while water-soluble vitamins are not and get easily excreted in urine. Vitamins B-complex and C are heat labile vitamins and are easily destroyed by heat, air or during drying, cooking and food processing.

Minerals are inorganic elements found in body fluids and tissues. The important macro minerals are sodium, potassium, calcium, phosphorus, magnesium and sulphur, while zinc, copper, selenium, molybdenum, fluorine, cobalt, chromium and iodine are micro minerals. They are required for maintenance and integrity of skin, hair, nails, blood and soft tissues. They also govern nerve cell transmission, acid/base and fluid balance, enzyme and hormone activity as well as the blood-clotting processes.

Malnutrition, Undernutrition and Overnutrition:

Malnutrition is a condition that results from eating a diet in which one or more nutrients are either not enough or are too much such that the diet causes health problems. It may involve calories, protein, carbohydrates, vitamins or minerals. Not enough nutrients is called **undernutrition** or **undernourishment** while too much is called overnutrition. Malnutrition is often used to specifically refer to undernutrition where an individual is not getting enough calories, protein, or micronutrients. If undernutrition occurs during pregnancy, or before two years of age, it may result in permanent problems with physical and mental development. Extreme undernourishment, known as starvation, may have symptoms that include: a short height, thin body, very poor energy levels, and swollen legs and abdomen. People also often get infections and are frequently cold. The symptoms of micronutrient deficiencies depend on the micronutrient that is lacking.

Undernourishment is most often due to not enough high-quality food being available to eat. This is often related to high food prices and poverty. A lack of breastfeeding may contribute, as may a number of infectious diseases such as: gastroenteritis, pneumonia, malaria, and measles, which increase nutrient requirements. There are two main types of undernutrition: protein-energy malnutrition and dietary deficiencies. Protein-energy malnutrition has two severe forms: marasmus (a lack of protein and calories) and kwashiorkor (a lack of just protein). Common micronutrient deficiencies include: a lack of iron, iodine, and vitamin A. During pregnancy, due to the body's increased need, deficiencies may become more common. In some developing countries, overnutrition in the form of obesity is beginning to present within the same communities as undernutrition. Other causes of malnutrition include anorexia nervosa and bariatric surgery.

Efforts to improve nutrition are some of the most effective forms of development aid. Breastfeeding can reduce rates of malnutrition and death in children, and efforts to promote the practice increase the rates of breastfeeding. In young children, providing food (in addition to breastmilk) between six months and two years of age improves outcomes. There is also good evidence supporting the supplementation of a number of micronutrients to women during pregnancy and among young children in the developing world. To get food to people who need it most, both delivering food and providing money so people can buy food within local markets are effective. Simply feeding students at school is insufficient. Management of severe malnutrition within the person's home with ready-to-use therapeutic foods is possible much of the time. In those who have severe malnutrition complicated by other health problems, treatment in a hospital setting is recommended. This often involves managing low blood sugar and body temperature, addressing dehydration, and gradual feeding. Routine antibiotics are usually recommended due to the high risk of infection. Longer-term measures include: improving agricultural practices, reducing poverty, improving sanitation, and the empowerment of women.

There were 821 million undernourished people in the world in 2018 (10.8% of the total population). This is a reduction of about 176 million people since 1990 when 23% were undernourished, but an increase of about 36 million since 2015, when 10.6% were undernourished. In 2012, it was estimated that another billion people had a lack of vitamins, and minerals. In 2015, protein-energy malnutrition was estimated to have resulted in 323,000 deaths—down from 510,000 deaths in 1990. Other nutritional deficiencies, which include iodine deficiency and iron deficiency anemia, result in another 83,000 deaths. In 2010, malnutrition was the cause of 1.4% of all disability adjusted life years. About a third of deaths in children are believed to be due to undernutrition, although the deaths are rarely labelled as such. In 2010, it was estimated to have contributed to about 1.5 million deaths in women and children, though some estimate the number may be greater than 3 million. An additional 165 million children were estimated to have stunted growth from malnutrition in 2013. Undernutrition is more common in developing countries. Certain groups have higher rates of undernutrition, including women—in particular while pregnant or breastfeeding—children under five years of age, and the elderly. In the elderly, undernutrition becomes more common due to physical, psychological, and social factors.

Definitions

Unless specifically mentioned otherwise, the term malnutrition refers to undernutrition for the remainder of this article. Malnutrition can be divided into two different types, SAM and MAM. SAM refers to children with severe acute malnutrition. MAM refers to moderate acute malnutrition.

Undernutrition and overnutrition

Malnutrition is caused by eating a diet in which nutrients are *not enough* or is *too much* such that it causes health problems. It is a category of diseases that includes undernutrition and overnutrition. Overnutrition can result in obesity and being overweight. In some developing countries, overnutrition in the form of obesity is beginning to present within the same communities as undernutrition.

However, the term malnutrition is commonly used to refer to undernutrition only. This applies particularly to the context of development cooperation. Therefore, "malnutrition" in documents by the World Health Organization, UNICEF, Save the Children or other international non-governmental organizations (NGOs) usually is equated to undernutrition.

Protein-energy malnutrition

Undernutrition is sometimes used as a synonym of protein–energy malnutrition (PEM). While other include both micronutrient deficiencies and protein energy malnutrition in its definition. It differs from calorie restriction in that calorie restriction may not result in negative health effects. The term hypoalimantation means underfeeding.

The term "severe malnutrition" or "severe undernutrition" is often used to refer specifically to PEM. PEM is often associated with micronutrient deficiency. Two forms of PEM are kwashiorkor and marasmus, and they commonly coexist.

Kwashiorkor

Kwashiorkor is mainly caused by inadequate protein intake. The main symptoms are edema, wasting, liver enlargement, hypoalbuminaemia, steatosis, and possibly depigmentation of skin and hair. Kwashiorkor is further identified by swelling of the belly, which is deceiving of actual nutritional status. The term means 'displaced child' and is derived from a Ghana language of West Africa, means "the sickness the older one gets when the next baby is born," as this is when the older child is deprived of breast feeding and weaned to a diet composed largely of carbohydrates.

Marasmus

Marasmus ('to waste away') is caused by an inadequate intake of protein and energy. The main symptoms are severe wasting, leaving little or no edema, minimal subcutaneous fat, severe muscle wasting, and non-normal serum albumin levels. Marasmus can result from a sustained diet of inadequate energy and protein, and the metabolism adapts to prolong survival. It is traditionally seen in famine, significant food restriction, or more severe cases of anorexia. Conditions are characterized by extreme wasting of the muscles and a gaunt expression.

Undernutrition, hunger

Undernutrition encompasses stunted growth (stunting), wasting, and deficiencies of essential vitamins and minerals (collectively referred to as micronutrients). The term hunger, which describes a feeling of discomfort from not eating, has been used to describe undernutrition, especially in reference to food insecurity.

Effects

Malnutrition increases the risk of infection and infectious disease, and moderate malnutrition weakens every part of the immune system. For example, it is a major risk factor in the onset of active tuberculosis. Protein and energy malnutrition and deficiencies of specific micronutrients (including iron, zinc, and vitamins) increase susceptibility to infection. Malnutrition affects HIV transmission by increasing the risk of transmission from mother to child and also increasing replication of the virus. In communities or areas that lack access to safe drinking water, these additional health risks present a critical problem. Lower energy and impaired function of the brain also represent the downward spiral of malnutrition as victims are less able to perform the tasks they need to in order to acquire food, earn an income, or gain an education.

Vitamin-deficiency-related diseases (such as scurvy and rickets).

Hypoglycemia (low blood sugar) can result from a child not eating for 4 to 6 hours. Hypoglycemia should be considered if there is lethargy, limpness, convulsion, or loss of consciousness. If blood sugar can be measured immediately and quickly, perform a finger or heel stick.

Signs

In those with malnutrition some of the signs of dehydration differ. Children; however, may still be interested in drinking, have decreased interactions with the world around them, have decreased urine output, and may be cool to touch.

Site	Sign
Face	Moon face (kwashiorkor), simian facies (marasmus)
Eye	Dry eyes, pale conjunctiva, Bitot's spots (vitamin A), periorbital edema
Mouth	Angular stomatitis, cheilitis, glossitis, spongy bleeding gums (vitamin C), parotid enlargement
Teeth	Enamel mottling, delayed eruption
Hair	Dull, sparse, brittle hair, hypopigmentation, flag sign (alternating bands of light and normal color), broomstick eyelashes, alopecia, and overall thinning of the hair follicles
Skin	Loose and wrinkled (marasmus), shiny and edematous (kwashiorkor), dry, follicular hyperkeratosis, patchy hyper- and hypopigmentation, erosions, poor wound healing
Nail	Koilonychia, thin and soft nail plates, fissures or ridges
Musculature	Muscles wasting, particularly in the buttocks and thighs

Skeletal	Deformities usually a result of calcium, vitamin D, or vitamin C deficiencies
Abdomen	Distended – hepatomegaly with fatty liver, ascites may be present
Cardiovascular	Bradycardia, hypotension, reduced cardiac output, small vessel vasculopathy
Neurologic	Global development delay, loss of knee and ankle reflexes, poor memory
Hematological	Pallor, petechiae, bleeding diathesis
Behavior	Lethargic, apathetic, anxious

Causes

Major causes of malnutrition include poverty and food prices, dietary practices and agricultural productivity, with many individual cases being a mixture of several factors. Clinical malnutrition, such as cachexia, is a major burden also in developed countries. Various scales of analysis also have to be considered in order to determine the sociopolitical causes of malnutrition. For example, the population of a community that is within poor governments, may be at risk if the area lacks health-related services, but on a smaller scale certain households or individuals may be at an even higher risk due to differences in income levels, access to land, or levels of education.

Diseases

Malnutrition can be a consequence of health issues such as gastroenteritis or chronic illness,^[49] especially the HIV/AIDS pandemic. Diarrhea and other infections can cause malnutrition through decreased nutrient absorption, decreased intake of food, increased metabolic requirements, and direct nutrient loss. Parasite infections, in particular intestinal worm infections (helminthiasis), can also lead to malnutrition. A leading cause of diarrhea and intestinal worm infections in children in developing countries is lack of sanitation and hygiene.

People may become malnourished due to abnormal nutrient loss (due to diarrhea or chronic illness affecting the small bowel). This conditions may include Crohn's disease or untreated coeliac disease. Malnutrition may also occur due to increased energy expenditure (secondary malnutrition).

Nutrition and Metabolism

The body uses **nutrients** from food to produce energy, maintain or repair body structures and regulate or modulate **metabolism**. In turn, every disease has **ametabolic** component that can lead to a depletion of reserves and the aggravation of the clinical condition. Metabolism is the chemical process your body uses to transform the food you eat into the fuel that keeps you alive. Nutrition (food) consists of proteins, carbohydrates, and fats. These substances are broken down by enzymes in your digestive system, and then carried to the cells where they can be used as fuel. Your body either uses these substances immediately, or stores them in the liver, body fat, and muscle tissues for later use.

A metabolic disorder occurs when the metabolism process fails and causes the body to have either too much or too little of the essential substances needed to stay healthy.

Our bodies are very sensitive to errors in metabolism. The body must have amino acids and many types of proteins to perform all of its functions. For example, the brain needs calcium, potassium, and sodium to generate electrical impulses, and lipids (fats and oils) to maintain a healthy nervous system.

Metabolic disorders can take many forms. This includes:

- a missing enzyme or vitamin that's necessary for an important chemical reaction
- abnormal chemical reactions that hinder metabolic processes
- a disease in the liver, pancreas, endocrine glands, or other organs involved in metabolism
- nutritional deficiencies

You can develop a metabolic disorder if certain organs — for instance, the pancreas or the liver — stop functioning properly. These kinds of disorders can be a result of genetics, a deficiency in a certain hormone or enzyme, consuming too much of certain foods, or a number of other factors.

The more common types of nutritional and metabolic disorders include:

Gaucher's disease

This condition causes an inability to break down a particular kind of fat, which accumulates in the liver, spleen, and bone marrow. This inability can result in pain, bone damage, and even death. It's treated with enzyme replacement therapy.

Glucose galactose malabsorption

This is a defect in the transport of glucose and galactose across the stomach lining which leads to severe diarrhea and dehydration. Symptoms are controlled by removing lactose, sucrose, and glucose from the diet.

Hereditary hemochromatosis

In this condition, excess iron is deposited in several organs, and can cause:

- liver cirrhosis
- liver cancer
- diabetes
- heart disease

It's treated by removing blood from the body (phlebotomy) on a regular basis.

Maple syrup urine disease (MSUD)

MSUD disrupts the metabolism of certain amino acids, causing rapid degeneration of the neurons. If not treated, it causes death within the first few months after birth. Treatment involves limiting the dietary intake of branched-chain amino acids.

Phenylketonuria (PKU)

PKU causes an inability to produce the enzyme, phenylalanine hydroxylase, resulting in organ damage, mental retardation, and unusual posture. It's treated by limiting the dietary intake of certain forms of protein.

Public health and Nutrition

Nutrition is one of the cornerstones of maintaining a quality level of health. As a result of this, public health officials often work toward creating high levels of nutrition among the general population. The public health nutrition definition uses the application of nutrition in order to encourage a healthy, growing population. Without proper nutrition, the public becomes more vulnerable to disease, illness, and other health issues.

Nutrition is a process that involves an adequate consumption of nutrients, vitamins, and minerals to live a healthy and prosperous life. The U.S. Department of Health and Human Services discusses the importance of public health nutrition, stating that eating nutritional meals leads to a decrease in

hypertension, diabetes, heart disease, osteoporosis, and weight gain. Adequate nutrition is also linked to good brain health and intelligence.

Public health is a broad area that also promotes the overall nutritional health among a population. This can be done through a variety of ways, most notably through health services, program development, and policy advocacy. A public health nutritionist is an expert who works in this field, providing education and resources related to nutrition. A career in nutrition could mean the designing of a public nutrition program, the assessment of patients, the creation of diet-health plans, and the education of the general public in how to maintain a nutritionally balanced diet. These are all vital strategies in maintaining a high level of nutritional health among a large number of people.

Community health nutrition is an area of public health which focuses about the development of health programs that promote nutritional services. Community effort will typically work to provide promotion, patient assessment, meal plan development, food security, food safety, and healthy eating encouragement to schools and communities within an area. These programs will relay the importance of community nutrition through education and service.

Significance of Public Health and Nutrition

Why do we need to focus on this specific aspect in the field of nutrition? Malnutrition is the underlying cause of at least 50 per cent of deaths of children under five years of age. The statistics for nutrition-related problems in our country reveal an alarming situation: zz Almost one-third of the infants born in India are low birth weight babies i.e., they weigh less than 2500g or 2.5kg. Low birth weight may have adverse effects throughout their growing years and may have adverse implications even in adult life. Low birth weight may even lead to child mortality. zz There is widespread prevalence of growth retardation among preschoolers (from socio-economically disadvantaged families) and almost half the children suffer from mild and moderate under nutrition. zz A large proportion of children (and adults) suffers from micronutrient deficiencies in varying degrees of severity. The micronutrients of most concern are iron, zinc, vitamin A, iodine, folic acid, B12. If these problems are not controlled in time, they will not only affect physical growth which may lead to smaller body stature in adulthood, but may also affect mental and cognitive development. All of these, in turn, can have negative impact on productivity and quality of life. The costs of malnutrition are very high. Experts have estimated that productivity losses are more than 10 per cent of lifetime earnings for individuals and 2-3 percent of gross domestic product for the nation. This clearly indicates that if we tackle malnutrition, we can help India to develop, grow economically and become a powerful nation. India mostly faces the problem of under nutrition; however, the problem of over nutrition is also on the rise. Gradually, over the years, large numbers of persons have altered their dietary patterns and lifestyles. With respect to lifestyle, people have become more sedentary, relying

on faster means of transportation, walking less and doing less amount of outdoor or physical activity. In large cities, even children do not play enough outdoor games. Simultaneously dietary patterns have become less 'healthful'. Food choices have become less 'healthy' because processed foods, fast foods, snacks, western type foods, e.g., burgers, pizzas, biscuits, chocolates,

cakes and pastries, soft drinks, even Indian mithais, samosas, etc. (that are high in energy, sugar, fat, salt and low in other nutrients and fibre) are increasingly becoming part of the daily diet. At the same time, intake of whole grains, pulses, vegetables and fruits has reduced. All these lead to undesirable/inappropriate weight gain, overweight and obesity and ultimately lead to diseases such as hypertension, heart disease, diabetes, cancer, arthritis, among others. These diseases are non-communicable and take their toll not only on the physical health but also on quality of life, adding to the financial burden. Thus India is said to face "the double burden of malnutrition" i.e., coexistence of both undernutrition and overnutrition. Further, although communicable diseases like smallpox have been controlled, newer ones like HIV/AIDS and old ones like tuberculosis, hepatitis, malaria, are increasing in prevalence. The ultimate consequences of these communicable diseases are far worse for those who are not optimally nourished i.e., those who are undernourished and those who have lower immunity due to obesity, diabetes, HIV/AIDS, etc. This poses challenges for doctors, nutritionists and the government in terms of treatment, control and prevention. There is a tremendous need for a trained cadre of public health professionals including public health nutritionists, to address and solve these problems. Let us first acquaint ourselves with what is public health nutrition.

Fast food and its effect on physical and mental health

Fast food refers to food that can be prepared and served quickly. It can come from many places: sit-down restaurants, counter service, take-out, drive-thru, and delivery. Fast food is popular because the food is inexpensive, convenient, and tastes good. However, fast food is often made with cheaper ingredients such as high fat meat, refined grains, and added sugar and fats, instead of nutritious ingredients such as lean proteins, whole grains, fresh fruits, and vegetables. Fast food is also high in sodium (aka salt) which is used as a preservative and makes food more flavorful and satisfying.

Is fast food bad?

There is no such thing as a "bad" food, but there are some foods you should try not to have on a regular basis. Because fast food is high in sodium, saturated fat, *trans* fat, and cholesterol, it isn't something you should eat often. Eating too much over a long period of time can lead to issues such as high blood pressure, heart disease, and unwanted weight gain. Since eating a lot of trans fats can cause certain heart health problems, the FDA (Federal Food and Drug Administration) has required

that artificial trans fats from partially hydrogenated oils be removed from foods sold at restaurants by 2020.

People also often drink soda when they eat fast food which adds “empty” calories (calories that don’t make you feel full or provide any nutrients besides sugar) to the meal. It’s helpful to remember that with fast food, moderation is important.

The negative effect of fast food consumption also made sense to the group. Young adults who ate fast food more than three times a week scored higher on levels of mental distress. Fast food is typically high in saturated fats, trans fats, and omega-6 fatty acids. While in smaller doses, some of these fats are beneficial and, in fact, necessary for brain function, an excess can trigger an inflammatory response. The inflammation has links to anxiety and depression from past research. Along with the myriad negative effects on physical health ‘fast food’ is linked to a significantly increased risk for poor mental health, including anxiety and depression. Fast food nutrition should make up a minimal part of a healthy diet. Fast foods are high in fat, sodium and sugar, which can lead to obesity and a range of attendant health problems, including diabetes, heart disease and arthritis. Fast food does not contain the nutrients your body needs to stay healthy. As a result we may feel chronically fatigued and lack the energy you need to complete daily tasks. Fast food contains large amount of fat, and as fat accumulates in your body, you will gain weight and could become obese. The more weight you gain, the more you will be at risk for serious chronic illness. The high levels of fat and sodium in fast food can cause high blood pressure or hypertension. Excessive dietary sodium can also have a negative effect on renal function, even leading to kidney disease. In the short term, high levels of dietary fat lead to poor cognitive performance. You will feel tired and have trouble concentrating because your body might not be getting enough oxygen.

Not only is fast food bad for young physical health, it might just be bad for your mental health also.

- Even though the fast food may appear to be a great saver of time and money, it can determine your physical and mental health. Often viewing images of a McDonald's restaurant or other fast food restaurants, and visiting food restaurants, can cause you to impatient and less conscious of how you spend your money.
- Mental Health is much more than the absence of mental illness. It is about physical and emotional well being, which includes our wills and emotions. It is about having the capacity and physical well being contributes to our overall health fitness.
- To ensure good Mental Health, we all need some means of creative self-expression, such as art, drama, music, a sport or hobby. Our minds have a need to receive, to take in, to appreciate and enjoy, but also our minds need to express, to give out, to perform, participate, or display. If we fail to feed our minds what is needed then something else will take its place. Boredom and material conflict are often symptoms of mental starvation without

compensation taking place. However, it is only a matter of time before trouble comes in and fulfills the law of compensation. Like the body, the mind needs certain foods to function in a more healthy way.

- Physical inactivity is a major risk factor for developing coronary artery disease. It also increases the risk of stroke and such other major cardiovascular risk factors as obesity, high blood pressure, low HDL cholesterol and diabetes. The American heart Association recommends that children and teenagers should participate in at least 60 minutes of physical activity every day.
- Exercise is good for a child, because increase physical activity has been associated with an increased life expectancy and decreased risk of cardiovascular disease. Physical activity produces overall physical, psychological and social benefits. Inactive children are likely to become inactive adult.