Good Nutrition

A Handbook for Trainers

MSSRF
Science for Sustainable Development

M.S. SWAMINATHAN RESEARCH FOUNDATION
Chennai

GOOD NUTRITION

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Note: This manual follows the recommendations given by National Institute of Nutrition (2011) Dietary Guidelines for Indians – A Manual. Indian Council of Medical Research, National Institute of Nutrition, Hyderabad.

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Foreword

Malnutrition is a major challenge facing India. Besides under nutrition and hidden hunger caused by micronutrient deficiency, obesity and over nutrition are also on the rise. Awareness and knowledge about the nutrient content in the food we eat, balanced diet, nutrition requirement along different stages of the life cycle and the importance of hygiene and sanitation are very important for good health.

This manual brings together these aspects in one place. Development professionals working at the community level will find it a handy volume to use while imparting training on nutrition.

M S Swaminathan

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Introduction

The common nutritional problems of public health concern in India are low birth weight, protein energy malnutrition, stunting (low height for age), wasting (low weight for height), and underweight (low weight for age) in children, chronic energy deficiency in adults, micronutrient deficiencies and diet-related non communicable diseases. India is undergoing rapid transition in socio-economic, demographic, nutrition and health status. While the country is still grappling with issues of poverty, undernutrition and communicable diseases, it is increasingly facing additional challenges related to obesity and a rise in the prevalence of non communicable diseases like diabetes and high blood pressure, especially in urban areas. Table 1 gives some of the nutrition indicators for India.

Table 1: Nutritional status of population in India (figures in %)

Nutritional Status	**Year**	
	2005-06	**2015-16**
Children under 5 years		
Stunted	48.0	38.4
Wasted	19.8	21.0
Underweight	42.5	35.8
Anaemia	69.4	58.6
Adults (15-49 years)		
Body Mass Index (BMI)* below normal		
Women	35.5	22.9
Men	34.2	20.2
Overweight or obese		
Women	12.6	20.6
Men	9.3	18.9
Anaemia		
Women	55.3	53.1
Men	24.2	22.7

*BMI is a measure of nutritional status of adults; it is defined as the body mass divided by the square of the body height; it is universally expressed in units of kg/m², resulting from mass in kilograms and height in metres.
Source: NFHS 3 & 4

A proper understanding of all aspects of good nutrition is essential to address the problem of malnutrition in the community. The major cause of malnutrition is insufficient/ imbalanced intake of foods/nutrients. The Indian Council of Medical Research (ICMR) has prescribed recommended dietary allowance (RDA) of nutrients for individuals. This RDA is nutrient-centric and technical in nature. Foods not only supply nutrients but also provide a host of other components (non-nutrient phytochemicals) which have a positive impact on health. Given that

nutrients come from the food we eat, food based approaches are an important pathway for attaining optimal nutritional status.

Malnourishment is often more closely related to consumption pattern of calories and nutrients than due to lack of food. Adequate and right nutrition is important for a healthy life. Combined with adequate physical activity, a balanced diet can help maintain a healthy body and reduce risk of chronic diseases (e.g. heart disease), and promote overall health. This document discusses the concepts of food and nutrition security, nutrition at different stages of the lifecycle and non-food factors that are necessary for good health like safe drinking water, sanitation and hygiene. The content of this manual has been drawn from various published sources and aligned to facilitate easy understanding and use by practitioners at the field level.

The major objectives of this manual are to highlight:

1) The importance of adequate food and nutrients for sound physical and mental development.
2) Nutritional requirement at different stages of life.
3) The importance of non-food factors like safe drinking water, sanitation and hygiene that are necessary for food and nutrition security.

This manual is intended as nutrition education material for use by community workers and trainers, to create awareness at the community level to address the problem of malnutrition.

1. Understanding the concepts of Food and Nutrition Security[1]

Food has to meet physiological requirements of individuals in terms of quantity, quality, and safety and be socially and culturally acceptable. By definition, "Food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life[2]". The definition emphasizes on 'Availability', 'Accessibility', and 'Absorption or Utilization' of food (see Figure 1). Absorption is what leads to nutrition outcomes. Nutrition security is defined as adequate nutritional intake in terms of protein, energy, vitamins, and minerals by an individual at all times.

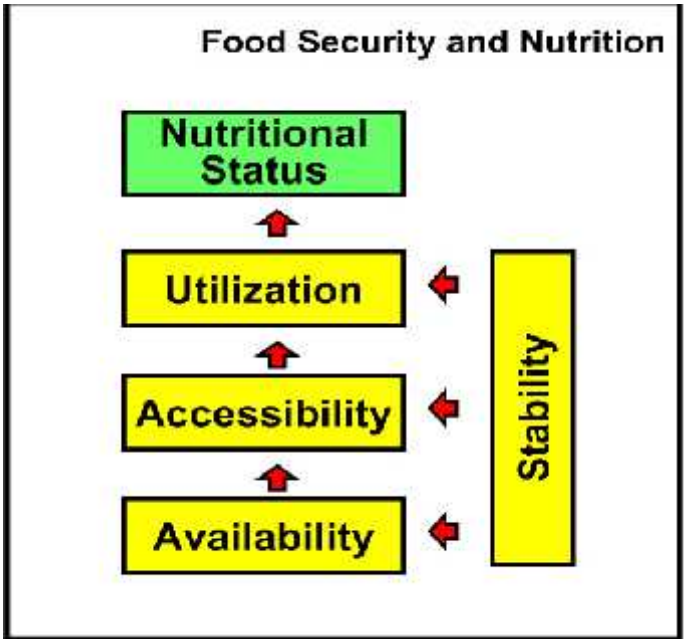

Figure 1: Categorical elements within the conceptual framework of food security

An understanding of nutrition security is incomplete without appreciation of the widely accepted conceptual framework for the analysis of malnutrition developed by UNICEF in 1990 – see Figure 2. Although it is mainly used to understand the context of undernutrition in rural areas of developing countries, it is also applicable to understand the emerging problem of overnutrition in both rural and urban contexts.

According to the framework, malnutrition occurs when dietary intake is inadequate, and immune capacity is low due to unhygienic living conditions. In developing countries, infectious diseases such as, diarrheal diseases and acute respiratory diseases are responsible for most

[1] This section draws on content from http://www.fao.org/elearning/course/fa/en/pdf/p-01_rg_concept.pdf
[2] http://www.fao.org/3/y4671e/y4671e06.htm

nutrition related health problems. Easy availability of food, appropriate health channels and a "healthy" environment are ineffective unless these resources are used effectively. The absence of proper care especially for children and the aged, in households and communities can also therefore be an underlying cause of malnutrition. The conceptual framework also recognizes that human and environmental resources, economic systems and political and ideological factors are basic causes that influence nutrition status. It relates the causal factors for undernutrition with different social organizational levels. The immediate causes affect individuals, the underlying causes relate to families, and the basic causes are related to the community and the nation. As a result, the more indirect are the causes, the wider the population whose nutritional status is affected.

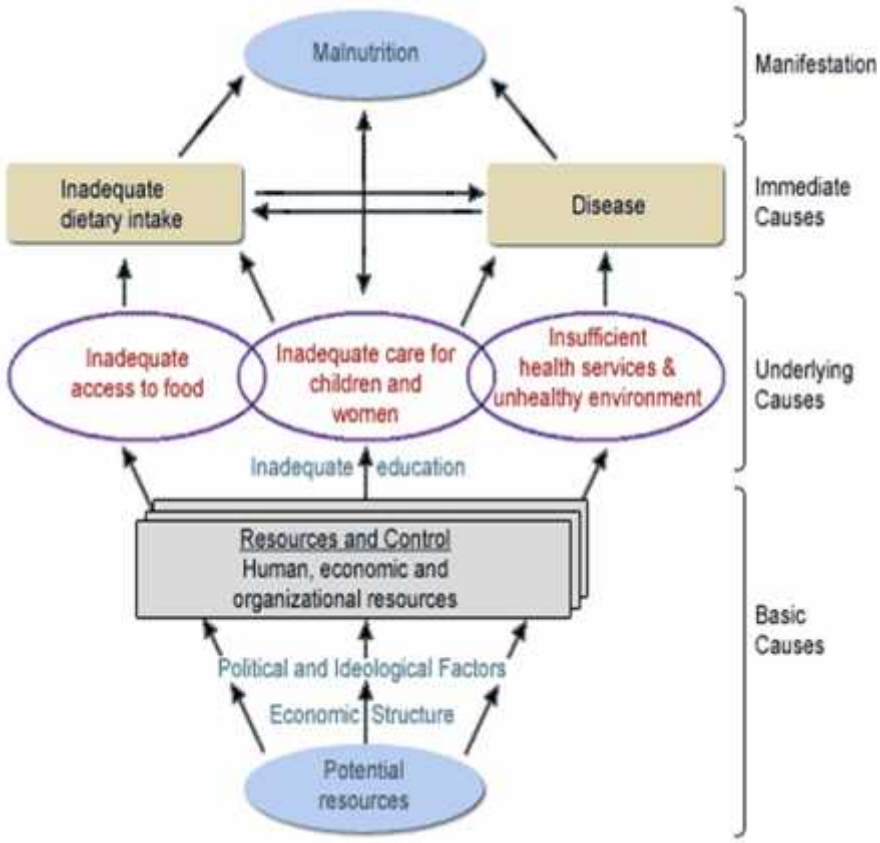

Figure 2: UNICEF Conceptual Framework

A simplified causal model linking nutritional status with ecological determinants at household level is given in figures 3 & 4. Nutritional status of an individual is an outcome of food intake and health status. However, the underlying causes of health, viz. environmental determinants and access to health services have been depicted in different boxes due to their different natures. A reduced state of health may be due in part to weak access to health care, poor

housing and environmental conditions, and is possibly worsened by malnutrition, which predispose individuals to disease. The distinction between health services and environment is necessary to select appropriate intervention strategies. Food intake and health status are influenced by four determinants, viz. food availability, caring capacity, health services and environmental conditions.

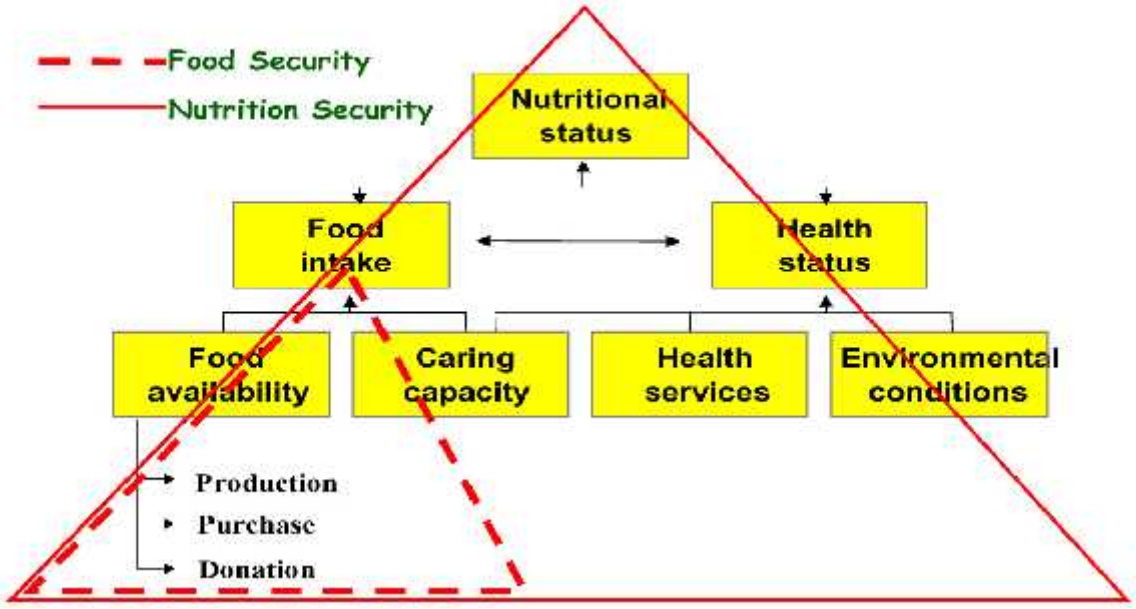

Figure 3: Conceptual Framework of Nutritional Status at Household Level

In addition, each determinant has several contributing factors as seen in figure 4,

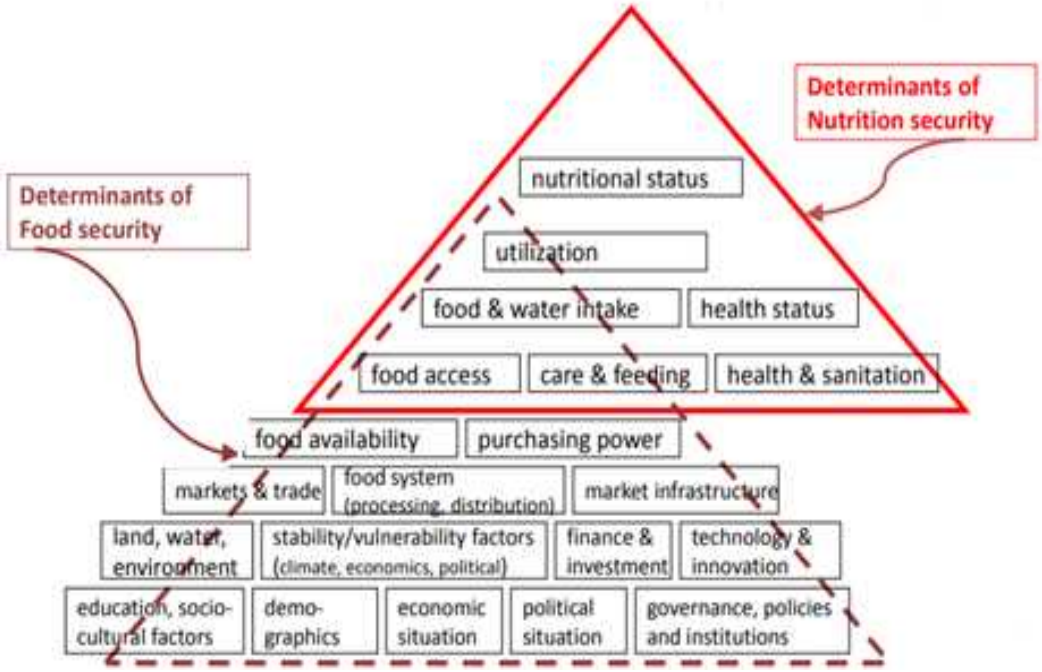

Figure 4: Determinants of Food and Nutrition Security

Nutrition includes everything that happens to food from the time it is eaten until it is used for various functions in the body. The **study of nutrition** deals with what nutrients we need, how much we need, why we need them, and where we can get them.

Nutritional status is the state of our body as a result of the foods consumed and their use by the body. Stamina for work, sound regular sleep, normal elimination and resistance to disease are indicators of good health. Poor nutritional status is evidenced by a listless, apathetic or irritable personality, abnormal body weight (too thin or fat and flabby body), pale or sallow skin, too little or too much subcutaneous fat, dull or reddened eyes, lustreless and rough hair, poor appetite, lack of vigour and endurance for work and susceptibility to infections. Poor nutritional status may be the result of poor food intake, irregularity in schedule of meals, type of work, lack of sleep and improper elimination.

The WHO (World Health Organization) has defined **health** as the 'state of complete physical, mental and social well-being and not merely the absence of disease or infirmity'.

Nutritional care is the use of knowledge of nutrition in planning meals and the preparation of these meals in an acceptable and attractive manner for consumption. It involves assessment of existing meal patterns and improving these in an acceptable manner to make them wholesome. While the nutritional plan may be general for a group of people, the actual execution has to be individualized to suit a person's needs according to his/her age and background.

2. Balanced Diet and Importance of Nutrients

Food is a basic part of our existence. Through the centuries, we have acquired a wealth of information about the use of food to ensure growth of children and youth, maintain good health through life, meet special needs of pregnancy and lactation and to recover from illness.

A study of food composition gives information on the nutritional contribution of foods. Food, nutrition and health are intimately connected aspects of our life. Food may also be defined as anything eaten in solid or liquid form, which meets the needs for energy, building, regulation and protection of the body. In short, food is the raw material from which our bodies are made. Intake of the right kind and amount of food can ensure good nutrition and health, which will be evident in our appearance, physical and emotional well-being.

Food Groups: Foods are conventionally grouped into different groups depending upon their nutritive value, for the convenience of planning meals.

1. Cereals and millets
2. Pulses
3. Vegetables (green leafy vegetables, roots and tubers, other vegetables) and fruits
4. Milk and milk products, egg, meat and fish
5. Oils & fats, and nut & oilseeds

Foods may also be classified according to their functions as shown in Table 2.

There is no such thing as a perfect or complete food. This means that there is no single food that provides enough of all the essential nutrients required to keep us healthy.

Diet is the sum of food consumed, i.e. one which provides a mixture of foods which include enough of all the essential nutrients for living. It is also concerned with the eating patterns of the individual or a group. It may also be modified and used for medically ill persons as part of their therapy (therapeutic diets).

Table 2: Classification of foods based on their function

Function	Major nutrients	Sources	Other Nutrients
Energy Rich Foods	Carbohydrates & fats	⟩Whole cereal grains and millets ⟩Fats and Oils ⟩Nuts and oilseeds ⟩Sugars	⟩Protein, fibre, minerals, calcium, iron & B-complex vitamins ⟩Fat soluble vitamins, essential fatty ⟩Proteins, vitamins, minerals ⟩Nil
Body Building Foods	Proteins	⟩Pulses, nuts and oilseeds ⟩Milk and Milk products ⟩Meat, fish, poultry	⟩B-complex vitamins, invisible fat, fibre ⟩Calcium, vitamin A, riboflavin, vitamin B12 ⟩B-complex vitamins, iron, iodine, fat
Protective Foods	Vitamins and Minerals	⟩Green leafy vegetables ⟩Other vegetables/fruits ⟩Eggs, milk and milk products and flesh foods	⟩Antioxidants, fibre and other carotenoids ⟩Fibre, sugar and antioxidants ⟩Protein and fat

Balanced diet: A balanced diet includes atleast one food item from five groups and fulfils all of a person's nutritional need of energy, protein, minerals, vitamins and fibre, which are required for the growth, development and maintenance of the body. Eating a balanced diet helps people maintain good health and reduce their risk of disease. A balanced diet should provide around 50-60% of total calories from carbohydrates, about 10-15% from proteins and 20-30% from fats. Figure 5 shows the ideal quantity of food groups that may be consumed.

Balanced Food Plate
Photo credit: LANSA

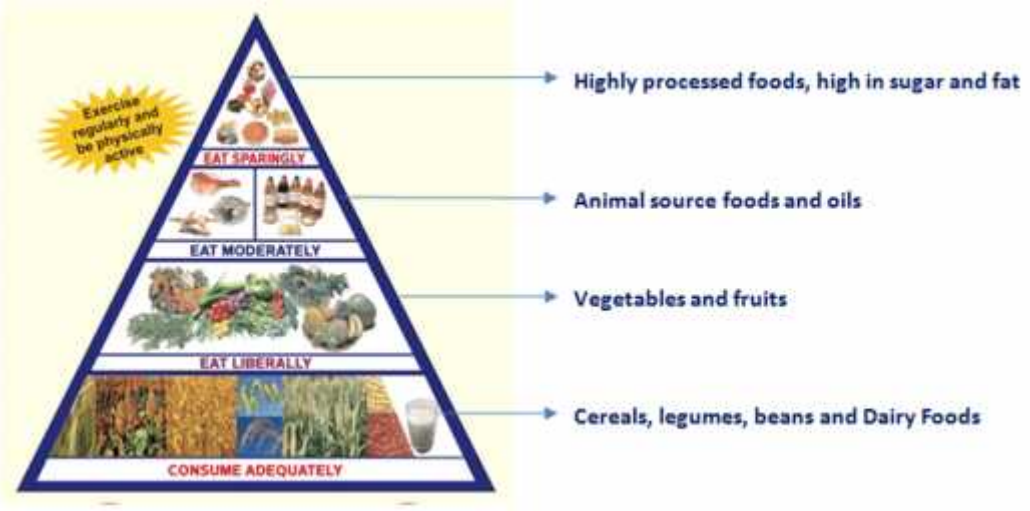

Figure 5: Food Pyramid (Source: National Institute of Nutrition (2011))

Important points to remember:

- A balanced diet consists of five essential food groups and provides all the required nutrients in proper amounts.
- Cereals, millets and pulses are major sources of most nutrients.
- Milk provides good quality protein and calcium and must be an essential item of the diet, particularly for infants, children and women.
- Jaggery/country sugar, cooking 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 from cereal/pulse/milk-based diets.
- Vegetables and fruits provide protective substances such as vitamins / minerals / phytonutrients. Fresh, locally available vegetables and fruits should be consumed in plenty.
- Choose a variety of foods in amounts appropriate for age, gender, physiological status (pregnant and lactating) and physical activity (sedentary, moderate and heavy).
- Include foods of animal origin such as milk, eggs and meat in the diet, 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.

Nutrients

Nutrients are chemical components of food that are needed by the body in adequate amounts in order to grow, reproduce and lead a normal and healthy life. These are classified according to their chemical composition. Each nutrient has its own function, but various nutrients must act in unison for effective action. Nutrients include water and five key food groups, viz. proteins, fats, carbohydrates, minerals and vitamins.

The body uses nutrients to:

- build the body, produce fluids like blood and repair tissues
- produce energy so that the body can keep alive and warm and so it can move and grow
- protect the body from disease
- help chemical processes

Figure 6 lists the contribution of different nutrients

carbohydrates	proteins	fats and oils	vitamins and minerals
Most important source of energy	Build body's muscles Repair tissue	Protect organs Keep us warm Reserve energy	Healthy immune system Strong bones and teeth

Figure 6: Contribution of different nutrients

Macronutrients

Nutrients like carbohydrates, proteins and fats are required in large quantities for a human body and are classified as macronutrients. They produce energy for normal functioning of the body.

Carbohydrates

Carbohydrates occur in foods such as sugars, starches and fibre and are major source of energy in the diet. Each gram of carbohydrate, as starch or sugar, provides 4 calories.

Functions of carbohydrates in human body

1. Carbohydrates are a source of readily available energy, which is needed for physical activities and also for cell function. The brain and the central nervous system are dependent on the constant supply of glucose from the blood to meet their energy needs.

2. Carbohydrates act as reserve fuel supply in the form of glycogen, stored in muscles and liver. The total amount of glycogen in the body is over 300g. But it must be maintained by regular intake of carbohydrates at frequent intervals, so that the breakdown of fat and protein tissue is prevented.

3. Lactose, the milk sugar, provides galactose needed for brain development. It aids absorption of calcium and phosphorus, thus helping bone growth and maintenance.

4. Lactose forms lactic acid in the intestinal tract due to the action of the bacteria (lactobacilli) present there. These lactobacilli synthesise some of the B-complex vitamins.

5. Carbohydrates are an important part of some compounds that increase resistance to infection and are also needed for nervous tissue, heart valve, cartilage, bone and skin.

6. Carbohydrates are needed for ensuring complete normal metabolism of fats.

7. A low carbohydrate diet causes loss of water from tissues as also electrolytes (especially sodium and potassium) in the urine and can lead to involuntary dehydration.

8. Dietary fibre acts like a sponge and absorbs water. It helps easy movement of food waste through the digestive tract and smooth elimination of soft, bulky stools.

Proteins

Proteins are the building blocks of our body and main solid matter in the muscles, major constituents of blood, bones, teeth, skin, nails and hair. Proteins also provide energy to our body; each gram of protein provides 4 calories.

Proteins are made up of amino acids; when amino acids are put together in different combinations, they make up thousands of different proteins in the body.

Functions of proteins in human body

1. Body building or building of new tissues: Protein is an essential part of every cell. Proteins provide amino acids needed for the formation of new cells. The amount of protein needed at various stages of life varies with the rate of growth at the particular stage.

2. Maintenance of tissues: The need for protein to maintain and repair old tissues continues throughout life. Proteins in the body tissues are not static; they are constantly being broken down and replaced by new protein.

3. Regulatory functions: Proteins in fluids such as blood help to regulate body processes. Haemoglobin, a protein and iron complex, ensures the smooth running of respiratory cycle by being the vital oxygen carrier in the red blood cells. Plasma proteins influence the exchange of water between tissue cells and the surrounding fluids and on the water balance in the body. The blood proteins combine with the carbon dioxide formed in the body and excrete it when we exhale.

4. Proteins as precursors of enzymes, hormones and antibodies: A small amount of protein (or amino acids) is needed for synthesising enzymes, hormones and antibodies. All enzymes are proteins and are essential catalysts in digestion and metabolic processes in the tissues. Hormones secreted by various glands that regulate and coordinate body processes and activities, are proteins in nature. Proteins form antibodies and white blood cells that defend body against infection and disease and thus participate in the body's immune system.

5. Transport of nutrients: Proteins are ideal carriers of nutrients across cell membranes. Proteins as lipoproteins, transport triglycerides, cholesterol, phospholipids and fat-soluble vitamins across the cell wall.

Fats

Fats are essential part of our body. Cells and tissues of our body have fat as an integral part. Fats are the best known members of a chemical group called the lipids. They supply 10–30 per cent of the total energy needs. Oils and fats are concentrated sources of energy and each gram of fat supplies 9 calories.

Fatty acids are the main building blocks of fats. About twenty fatty acids are found in foods and body tissues.

There are two types of fatty acids:

1. Saturated fatty acid has a single bond between its carbon atoms. Saturated fats are unhealthy fats.
2. Unsaturated fatty acids have one or more double bonds in their molecule. Further monounsaturated fatty acids (MUFA) have only one double bond. Polyunsaturated fatty acids (PUFA) have two or more double bonds. Unsaturated fat is considered healthier than saturated fats as they are easily digestible and have better health benefits.

Functions of fats in human body

1. Food fats are source of two groups of essential nutrients — essential fatty acids (EFA)[3] and fats that aid in the transport and absorption of fat-soluble vitamins like vitamins A, D, E and K, and their precursors.

[3] Essential fatty acids cannot be synthesized in the body and have to be supplied through diet

2. Cholesterol is an essential lipid synthesised in the liver. Some important hormones and bile acids are formed from cholesterol. Fat forms the fatty centre of cell walls, helping to carry nutrient materials across cell membranes.
3. Fat stored in various parts of the body is known as adipose tissue. The vital organs in the body are supported and protected by a web-like padding of this tissue. Fats act as a cushion for certain vital organs. Nerve fibres are protected by the fat covering and it aids relay of nerve impulses.
4. Since fat is a poor conductor of heat, a layer of fat beneath the skin helps to conserve body heat and regulate body temperature.
5. The flavour, palatability and satiety value of foods is increased by fats. The slower rate of digestion of fat as compared to carbohydrates, results in a feeling of satisfaction.
6. The fat around joints in the body acts as a lubricant and allows us to move them smoothly.

Micronutrients

Vitamins and minerals are needed in small quantities for a human body and are classified as micronutrients.

Vitamins

Vitamins are organic substances that occur in small amounts in foods. They are necessary for life and growth. Vitamins do not provide calories, but are essential in the metabolic reactions that release energy from carbohydrates, fats and proteins. They may act singly or in coordination with other compounds. Each vitamin has specific functions and so, one vitamin cannot substitute for another in the body. Vitamins may occur in pre-formed or active form in the food, or as a precursor compound which can be changed into active form in the body; for example, carotenes are present in plant foods which are converted to vitamin A or retinol in our body.

Vitamins are conveniently classified into two groups based on their solubility:

1. Fat soluble vitamins: These are vitamins that get dissolved in fat. Vitamin A, D, E and K.
2. Water soluble vitamins: These are vitamins that get dissolved in water and are not stored in significant amounts in our body; they include the B-group vitamins and vitamin C.

Tables 3 and 4 give the functions of fat and water soluble vitamins, diseases caused by their deficiency and their sources.

Table 3: Functions and sources of fat soluble vitamins

Vitamin	Function	Ailment/disease due to deficiency	Sources
Vitamin A	Helps in vision, immune, and reproductive systems. It is essential for bone growth and tooth development. It also keepour heart, lungs and kidneys working properly.	Night blindness, xerophthalmia (dryness of eyes), keratinisation of skin	Green leafy vegetables, yellow and orange fruits and vegetables like mango, papaya, yellow pumpkin, meat, poultry, egg, fish, oils
Vitamin D	Keeps bones strong, together with calcium (a mineral). Vitamin D also helps our muscles move, improves our immune function and helps reduce inflammation. Synthesis of calcitriol, an activated form of Vitamin D, a hormone for thyroid functioning and absorption of calcium and phosphorous.	Rickets (a disorder that causes bones to become soft and weak in children), osteomalacia (demineralization of bones), osteoporosis (makes bones weak and more likely to break)	Ultraviolet light from the sun, fish liver oil, fish, egg yolk, butter, mushroom
Vitamin E	Acts as an antioxidant that protects our body from free radicals, which are molecules that damage our cells. It also boosts immune system and keeps blood moving through our blood vessels without clotting.	Extremely rare severe neurological disorders	Wheat germ oil, corn germ oil, sunflower oil, rice bran oil, soybean oil, mustard oil
Vitamin K	Helps blood to clot. It also helps in making proteins for healthy bones and tissues	Impaired blood clotting, haemorrhagic disease	Cauliflower, cabbage, green leafy vegetables like spinach, turnip leaves, peas, soybean, cheese, butter, eggs and liver

Table 4: Functions and sources of water soluble vitamins

Vitamin	Function	Ailment/disease due to deficiency	Sources
B1 - Thiamine	Part of enzyme performing various functions in the body.	Peripheral nerve damage (beriberi) or central nervous system lesions	Outer coatings of food grains like rice, wheat and yeast, whole cereals, pulses, oilseeds, nuts, meat, liver, egg and fish
B2 – Riboflavin	Part of enzyme performing various functions in the body.	Mouth lesions, cracked and swollen lips and eyes problems and inflamed tongue; seborrheic dermatitis	Whole grains, legumes, pulses, green leafy vegetables, eggs, milk, meat
Niacin	Part of enzyme performing various functions in the body.	Pellagra: dermatitis, dementia (loss of memory) and diahorrea	Whole grains, nuts, legumes, liver, fish and meat
B6 - Pyridoxine	It is a co-enzyme used for the formation of heme in blood and various other components that are essential for normal functioning of body.	Disorders of amino acid metabolism; seizures in children.	Whole grains, legumes, liver and leafy vegetables, milk, meat, eggs
Biotin	Part of enzyme performing various functions in the body.	Impaired fat and carbohydrate metabolism and causes dermatitis	Whole cereals, legumes, nuts, egg, milk, meat and fish
Folic acid	Helps in formation of DNA.	Neural tube defects during fetal development; megaloblastic anemia in pregnant and children	Green leafy vegetables, pulses, eggs and liver. It is also present in coconuts, whole cereals and milk in minimum amount
B12-Cyanocobalamin	Acts as a co-enzyme; Helps in DNA synthesis, fatty acid synthesis and amino acid–methionine synthesis; normal functioning of bone marrow, intestinal tract and neurological system.	Pernicious anaemia (megaloblastic anemia with degeneration of the spinal cord)	Animal source foods and cereals
Pantothenic acid	Acts as a co-enzyme and helps in fatty acid biosynthesis	Peripheral nerve damage (burning foot syndrome)	Meat, liver, milk, while cereals, legumes, eggs
Vitamin C	Acts as antioxidant and scavenges free radicals. Prevents oxidation of carotene, vitamin E and B vitamins; helps in bone and teeth formation; helps in absorption of iron in human body and helps in immunity	Scurvy: impaired wound healing, loss of dental cement, subcutaneous hemorrhage	Fruits and vegetables

Minerals

There are atleast 25 mineral elements like iron, calcium, phosphorous and zinc that occur in our food; sixteen of these are regarded as essential to life and must be present in the diet. The essential minerals which are required in small quantities are known as trace elements; like vitamins, only small amounts of these minerals are needed to accomplish a great deal of functions in human body.

- Minerals do not provide calories.
- Unlike vitamins, they are not destroyed by heat. So cooking does not affect the mineral content in food. When food is burned down, the ash that remains is the food's mineral content.
- Minerals are part of the cells, red blood cells, bones, teeth, nails, and muscle structure.
- Minerals regulate chemical reactions in our body, including maintaining water levels inside and outside the cells, keeping a regular heartbeat, helping nerves respond normally, allowing blood to clot in wounds, and regulating the release of energy from food.

Types of Minerals

- Major minerals: calcium, phosphorus, potassium, magnesium, sodium, chlorine and sulphur.
- Trace minerals: iron, iodine, fluoride, zinc, manganese, chromium, molybdenum, copper and selenium.

Table 5 lists the functions and source of few important minerals.

Among the trace minerals, iron is an essential element for the formation of hemoglobin in red blood cells and plays an important role in transport of oxygen. In our country, anemia is a major public health problem in young children, adolescent girls and pregnant women. Nutritional anemia adversely affects work output among adults and learning ability in children.

Sources of Iron:

- Plant foods like green leafy vegetables, dried fruits and legumes contain iron
- Millets such as bajra (pearl millet) and ragi (finger millet) are good sources of iron. Meat, fish and poultry products contain iron in heme form and are absorbed easily.

A few facts about Iron absorption

- Only 3-5% of iron from plant sources is absorbed by the body.

- Fruits rich in vitamin C, like amla (gooseberry), guava and citrus, improve iron absorption from plant foods.
- Tannins in tea and caffeine content in coffee prevent absorption of iron in our body.

Table 5: Functions and sources of important minerals

Minerals	Function	Sources
Calcium	Gives bones and teeth rigidity and strength; necessary for blood clotting, muscle contraction and nerve activity	Milk, cheese and dairy products, eggs, fish, ragi (finger millet)
Iron	Formation of haemoglobin in blood	Flesh foods, eggs, green leafy vegetables
Iodine	For normal metabolism of cells and for formation of thyroxin hormone	Iodised salt, sea foods, vegetables, yogurt, cow's milk, eggs, and cheese, fish; plants grown in iodine-rich soil
Zinc	For children to grow and develop normally; wound healing, essential for the activity of several enzymes involved in protein formation and energy changes.	Maize, fish, breastmilk, meat, beans
Phosphorous	Present in bones and teeth, essential for energy storage and transfer, cell division and reproduction	Milk, cheese, bread and cereals, meat and meat products
Sodium	Maintenance of fluid balance, nerve activity and muscular contraction	Main source is salt used while cooking
Chlorine	Present in gastric juice and body fluids	Bread, cereal and meat products
Potassium	Present in cell fluids for fluid balance	Vegetables, meat, milk fruit
Magnesium	Present in bones, cell fluids for fluid balance, activation of enzymes	Milk, bread, cereal products, potatoes and vegetables.

Good cooking practices to retain nutrients in food

1. Cut fruits and vegetables have to be consumed immediately and should not be exposed to air for long time. Example: making salad or cutting vegetables and leaving them uncovered for long, causes oxidation of vitamins and minerals.
2. Washing/soaking fruits and vegetables in water after cutting, causes leaching of water soluble vitamins and minerals.
3. Throwing of excess water after cooking causes loss of vitamins and minerals in the food.
4. Cooking at high temperatures, repeated reheating of food or over cooking destroys vitamins.
5. Use of cooking/baking soda, destroys vitamins. Example: adding soda while cooking to retain bright green colour of green vegetables, soften chickpea (chana) or to cook it quickly, destroys vitamins.
6. Dehydration of foods destroys vitamins due to heat and oxidation.

7. Fat soluble vitamins are lost by oxidation, when food is deep fried; they also get dissolved in the oil used for frying.

Some common myths associated with food

- Fat free food is healthy
- Fish and milk should not be eaten together as it causes leucoderma (skin disease)
- Drinking tea will make you dark
- Eating sugar causes diabetes
- Eating salt raises blood pressure
- Fresh fruit should not be eaten at night
- Food cravings are a sign of nutrients missing from your body
- Highly processed vegetable oils are healthy
- Eat dry fruits in winter only
- Foods like meat, eggs and pulses are ‘hot foods’ and produce heat and boils.
- Fruits, vegetables, curd and milk are ‘cold foods’ and should not be given when one is suffering from common cold or sore throat

Recommended Allowances

Recommended Dietary Allowances (RDA)

RDA is defined as the average daily dietary nutrient intake level sufficient to meet the nutrient requirement of nearly all (97 to 98 per cent) healthy individuals in a particular life stage and gender group.

Recommended Dietary Intake (RDI)

RDI is the recommended level of intake of food groups that is required to meet the RDA.

It is essential to meet atleast 70% of the RDA and RDI. The requirement of RDA and RDI differ depending on age, sex and activity (see section 4: Nutrition through Life cycle).

Summary

1. Carbohydrates, proteins, fats, vitamins, minerals, water and fibre are the main groups of nutrients which together, but in variable amounts, make a balanced diet.
2. Nutrients are grouped into macronutrients and micronutrients. Carbohydrates, proteins, fats and water are macronutrients, and vitamins and minerals are micronutrients.
3. Although most foods are mixtures of nutrients, many of them contain majorly one nutrient and a little of the other nutrients. Foods are often grouped according to the nutrient that they contain in abundance.
4. Unsaturated fats are healthy fats; saturated fats are unhealthy fats.
5. Vitamins are substances present in small amounts in foodstuffs and are necessary for the body to function normally. Vitamins are also called protective foods.
6. Minerals have a number of functions in the body including developing body tissues and supporting metabolic processes. The minerals that are most important are calcium, iron, iodine and zinc.
7. In order to have a healthy life and good nutritional status, a person needs to eat a balanced diet. Knowledge of commonly used food groups and their sources is needed for this**.**

Check how much you have learnt

1. Define balanced diet.
2. List the five basic food groups
3. What is the difference between macro and micronutrients?
4. What are the functions of Vitamin C?
5. Which nutrient helps in protecting us from diseases?
6. Name two micronutrients

3. Malnutrition

Malnutrition is a major public health problem in most developing countries, including India. Malnutrition literally means bad nutrition and refers to deficiencies, excesses or imbalances in a person's intake of energy and/or nutrients. Malnutrition is primarily caused due to insufficient supply of one or more essential nutrients; or it can result from an error in metabolism during interaction between nutrients or nutrients and drugs used in treatment. Malnutrition means an undesirable kind of nutrition leading to ill-health.

The term malnutrition covers two broad groups of conditions:

1. Undernutrition is generally related to poor quality or insufficient quantity of nutrient intake, absorption, or utilization.
2. Overnutrition refers to an excessive intake of one or more nutrients, which creates a stress in the bodily function; the amount of nutrients consumed exceeds the amount required for normal growth, development, and metabolism.

Malnutrition can happen very gradually, which can make it very difficult to spot in the early stages. Some of the symptoms and signs include:

- Loss of appetite
- Weight loss
- Tiredness, loss of energy
- Reduced ability to perform normal tasks
- Reduced physical performance – for example, not being able to walk as far or as fast as usual
- Altered mood – malnutrition can be associated with lethargy and depression
- Poor concentration
- Poor growth in children

Malnutrition affects:

- Every system in the body and always results in increased vulnerability to illness, increased complications and in very extreme cases, even death.
- Immune system: Reduced ability to fight infection
- Muscles: Inactivity and reduced ability to work, shop, cook and self-care; inactivity in turn may lead to pressure, ulcers, blood clots and heart failure; reduced ability to cough may predispose one to chest infections and pneumonia
- Wound healing
- Kidneys: Inability to regulate salt and fluid can lead to over-hydration or dehydration

- Brain: Malnutrition causes apathy, depression, introversion, self-neglect and deterioration in social interactions
- Reproduction: Malnutrition reduces fertility and if present during pregnancy can predispose the baby to problems like diabetes, heart disease and stroke in later life.
- Temperature regulation: This can lead to hypothermia (low body temperature)

Consequences of malnutrition in children and adolescents

- Growth failure and stunting
- Delayed sexual development
- Reduced muscle mass and strength
- Impaired intellectual development
- Increased lifetime risk of osteoporosis

The best way to detect malnutrition is by the use of malnutrition screening tools, such as the 'Malnutrition Universal Screening Tool' ('MUST'). This tool consists of three parts:

- **Body Mass Index** (BMI), an anthropometric index of weight and height that is defined as body weight in kilograms divided by height in meters squared.
  BMI = weight (kg) / height $(m)^2$
  BMI of less than 18.5kg/m^2 suggests a significant risk of malnutrition.
- Unintentional loss of more than 10% of normal body weight in the last 3-6 months suggests a significant risk of malnutrition.
- Sudden illness and inability to eat for more than five days.

The tool assesses patients as being at low, medium or high risk of malnutrition and guides the user to develop individualised care plans for treatment if required and further monitoring.

Undernutrition

Calorie deficiency, micronutrient deficiency and protein energy malnutrition are the major types of undernutrition. These are discussed below

1. Undernutrition due to calorie deficiency

In children less than five years of age, this manifests as:

- Stunting (extremely low height for age),
- Underweight (extremely low weight for age), and
- Wasting (extremely low weight for height)

Figure 7 highlights the difference between the types of undernutrition seen in children.

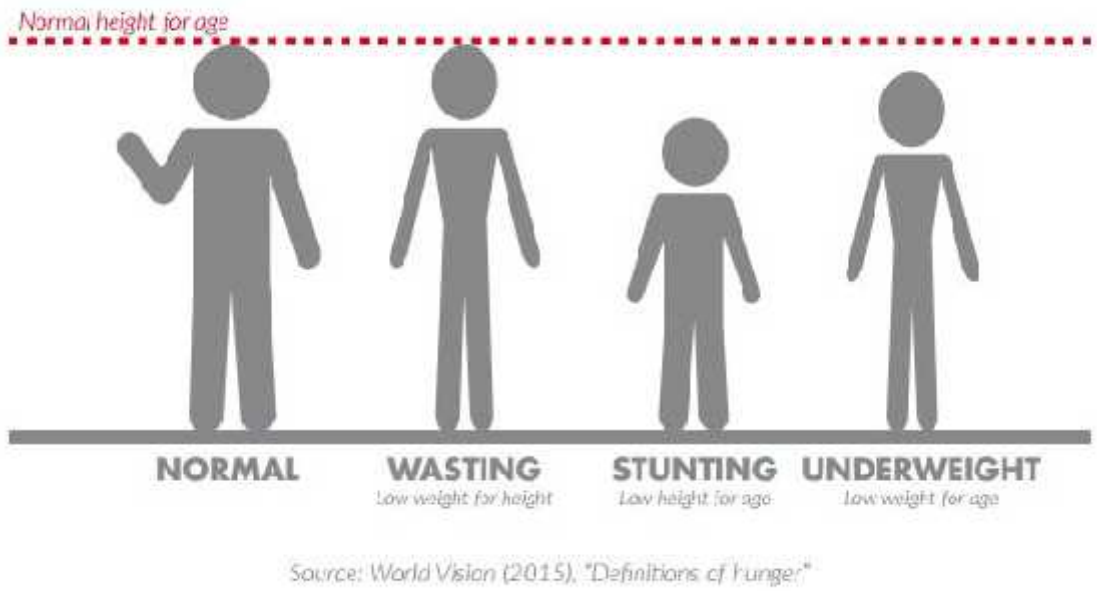

Figure 7: Types of Undernutrition in Children

BMI is the commonly accepted index for classifying adiposity in adults; it is also recommended for use with children and adolescents.

In school going children and adolescents, undernutrition is characterised by thinness or low weight for height, i.e. low Body Mass Index (BMI) for that particular age

In adults, undernutrition is referred to as chronic energy deficiency or BMI less than 18.5 kg/m^2

2. Micronutrient deficiency resulting from insufficient intake of micronutrients (a lack of important vitamins and minerals).

3. Protein-energy malnutrition (PEM), seen particularly in children less than 5 years of age

- Kwashiorkor (protein malnutrition predominant)
- Marasmus (deficiency in calorie intake)
- Marasmic kwashiorkor (marked protein deficiency and marked calorie insufficiency signs present, sometimes referred to as the most severe form of malnutrition)

Undernutrition reduces mental development and affects productivity. The extreme consequence of undernutrition in children is illness and death.

Kwashiorkor and Marasmus: The main cause of these diseases is lack of access to food. Occurrence of marasmus is higher prior to age one; occurrence of kwashiorkor increases after 18 months.

Kwashiorkor is a form of malnutrition caused by a lack of protein in the diet. Kwashiorkor affected children have oedema, an accumulation of fluid in the tissue, especially the feet and legs. It is very important to identify kwashiorkor because the risk of death for children with kwashiorkor is higher than it is in children with just wasting or thinness.

Marasmus is caused by severe deficiency of nearly all nutrients, especially protein, carbohydrates and lipids, usually due to poverty and scarcity of food. Table 6 explains the difference in symptoms of Kwashiorkor and Marasmus

Table 6: Difference between Kwashiorkor and Marasmus

Marasmus	**Kwashiorkor**
Peripheral oedema is absent	Peripheral oedema is present
Hair changes absent	Hair changes common (sparse and easily pulled out)
Skin is dry and wrinkled but no dermatosis	Dermatosis, flaky paint appearance of skin
Voracious Appetite	Poor Appetite
Absent subcutaneous fat (fat under the skin)	Reduced subcutaneous fat
Fatty liver uncommon	Fatty liver common
Better chance for recovery	Less chance for recovery

Indicators of undernutrition in different age groups

Children – less than 5 years

Underweight: *Moderate and severe* - below minus two standard deviations from median weight for age of reference population; *severe* - below minus three standard deviations from median weight for age of reference population.

Wasting: *Moderate and severe* - below minus two standard deviations from median weight for height of reference population.

Stunting: *Moderate and severe* - below minus two standard deviations from median height for age of reference population.

School going and adolescent children

Thinness in children and adolescents: BMI changes substantially as children get older, BMI-for-age is the measure used for children. *Moderate and severe*: below minus two standard deviations from median BMI for age of reference population.

Adults (>18 years)

Chronic energy deficiency: Chronic energy deficiency (CED) refers to an intake of energy less than the requirement, for a period of several months or years. Table 7 shows the classification of nutritional status of adults based on BMI standards for Asian adults given by the World Health Organisation (WHO).

Table 7: WHO classification of nutritional status based on BMI in Asian adults

BMI	Nutritional Status
< 16.0	CED III
16.0 - 17.0	CED II
17.0 - 18.5	CED I
< 18.5	Overall CED
18.5 - 23.0	Normal
23.0 - 27.5	Overweight
⎮ 27.5	Obesity

Micronutrient deficiencies

i. **Vitamin A deficiency:** Vitamin A is essential for maintenance of healthy tissues and skin and normal vision. Deficiency of vitamin A can result in the impairment of health, in the form of lesions in eye or increased susceptibility to infection of respiratory system or intestinal tract. (see Table 3)

ii. **Iron deficiency anemia:** There are various forms of anaemia. It is a condition in which the number of red blood cells or their oxygen-carrying capacity is insufficient to meet physiological needs (see Figure 8).

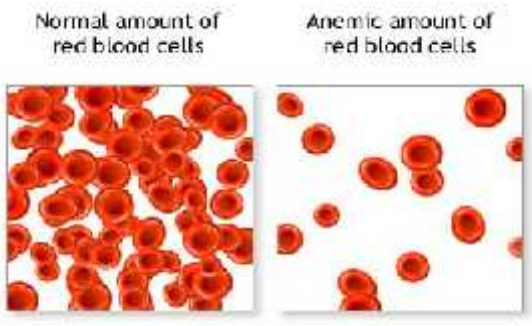

Figure 8: Identifying anaemic condition

Physiological needs vary by age, sex, altitude, smoking, and pregnancy status. Folate, vitamin B12 and vitamin A, deficiencies, chronic inflammation, parasitic infections, and inherited disorders cause anaemia. Iron deficiency anemia (IDA) in particular, is a major public health problem in developing countries.

iii. **Iodine deficiency:** Endemic goitre and cretinism are the two types of iodine deficiencies prevalent in different parts of the developing world, including India. A thyroid gland whose lobes have a volume greater than the thumb is considered goitrous. The prevalence of goitre is generally seen more among adolescents, young adults and school age children. More females are affected than males.

Overnutrition

Overnutrition leads to overweight, obesity and diet related non communicable diseases (such as heart disease, stroke, diabetes and cancer).

Overweight and obesity

Overweight and obesity are conditions when a person is too heavy for his or her height. Abnormal or excessive fat accumulation can impair health. It results from an imbalance between energy consumed (too much) and energy utilized (too little).

A number of factors can play a role in weight gain. These include diet, lack of exercise, factors in a person's environment, and genetics. Some of the factors are given below.

1. Food and activity: People gain weight when they eat more calories than they burn, through activities. This imbalance is the greatest contributor to weight gain.
2. Environment: Our surrounding influences our ability to maintain a healthy weight. For example: advertising encourages people to buy unhealthy foods like ultra processed snacks and sugary drinks.
3. Genetics: Genes plays a role in obesity.
4. Health conditions and medications: Some hormone problems may cause overweight and obesity; certain medicines may also cause weight gain.
5. Stress, emotional factors and poor sleep: Some people eat more than usual when they are bored, angry, upset, or stressed. Studies show that people who sleep less are more likely to be overweight or obese.

Overweight and obesity increase the risk of health problems and disease (see Figure 9).

Note: Dyslipidemia is a condition of abnormal amount of lipids (e.g. triglycerides, cholesterol and/or fat phospholipids) in the blood.

Figure 9: Diseases caused by obesity

Diet related non communicable diseases

Non communicable diseases (NCDs), also known as chronic diseases, tend to be of long duration and are the result of a combination of genetic, physiological, environmental and behaviour factors. Unhealthy diets and overnutrition (consumption of foods and drinks that are high in sugars and fats or junk foods, and engaging in less physical activity), are among the top risk factors for these diseases globally.

The main types of NCDs include cardiovascular diseases (such as heart attack and stroke, and often linked with high blood pressure), certain cancers, and diabetes (see Figure 10).

Figure 10: Common NCDs

Key risk factors responsible for causing most NCD's include:

1. Unhealthy diet
2. Physical inactivity/sedentary lifestyle
3. Use of tobacco
4. Harmful use of alcohol
5. Inadequate precautions for injury prevention and medical treatment
6. Lack of oral hygiene

A Few Health Tips

- Take nutritious and balanced diet (see section 1 of this manual).
- Prefer homemade foods over outside food. Avoid junk foods like chips, fast food snacks, fried food, frozen pizza and cookies.
- Eat raw fruits and vegetables whenever possible with skin, after first washing them thoroughly.
- Include healthy foods like vegetable salads and soups in diet.
- Limit consumption of sugar and ultra-processed foods. Eat freshly made food with minimum processing.
- Limit salt intake to less than 5 grams per day as it helps to prevent hypertension, and reduces the risk of heart disease. Consume iodized salt.
- You can get all the nutrients needed from low cost foods like beans and lentils, eggs, jaggery, seasonal fresh fruits and green leafy vegetables.
- Avoid replacing meals with snack foods.

Summary

Good nutrition is important for good health

Include locally available, seasonal vegetables and fruits in diet to get required vitamins and minerals

Check how much you have learnt

1. What is meant by malnutrition?
2. What are the types of undernutrition in children?
3. Vitamin A helps in maintenance of _____&_____
4. What is iron deficiency anemia and how can it be prevented?
5. What are non communicable diseases and their causes?

4. Nutrition through the Lifecycle

Good nutrition is important through the lifecycle of an individual right from the time of conception through birth, infancy, childhood, adolescence, adulthood and old age. Figure 11 highlights the consequences of lack of proper nutrition in different stage of the lifecycle.

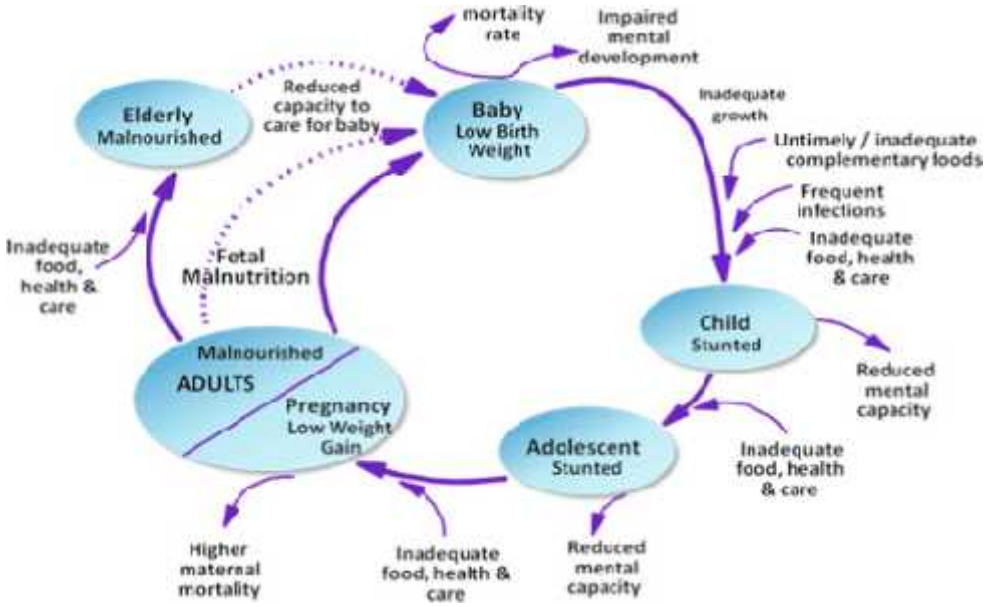

Figure 11: Importance of nutrition through the Lifecycle (Source: UN Standing Committee on Nutrition, 2000)

This section discusses the nutritional requirement at different stages of the lifecycle. Tables 10 to 15 are drawn from Dietary Guidelines for Indians – A Manual, by National Institute of Nutrition (NIN 2011).

First 1000 days of life

Maternal and child health is a basic, non-negotiable human right. The time spanning roughly between conception and an infant's second birthday is referred to as the first 1000 days (see Figure 12). This is a unique period of opportunity that is important for the optimum health, growth, and neurodevelopment of an individual. Two third of brain development occurs during this period.

Figure 12: The first 1000 days

Importance of right nutrition during first 1000 days of life

- ✓ It is essential for brain development, growth and strong immune system.
- ✓ It determines the performance of a child in school and susceptibility or otherwise to infections
- ✓ Chronic diseases like hypertension, diabetes and obesity are related to lack of proper nutrition during the first 1000 days of the child.

Nutrition during Pregnancy (from conception) and lactation

Nutritional assessment should be incorporated routinely into the medical care of pregnant women. The assessment should be comprehensive and should include what is referred to as the "ABCD" approach: Anthropometry, Biochemistry, Clinical signs, and Dietary intake. At the same time, it should be tailored to the setting and available resources. Assessments done early in pregnancy should be used to evaluate the nutritional status of the woman and to predict how well she can cope with the physiological demands of pregnancy. Pregnancy and lactation are a major nutritional drain on the mother and have to be adequately compensated.

Pregnant Woman. Photo source: https://riceinstitute.org/blog/nutrition-in-regnancy-in-india-far-worse-than-believed-coffey-in-pnas-nyt-hindu/

Demand for nutritious diet is high during pregnancy and lactation:

-) Maternal malnutrition leads to high prevalence of low birth weight infants and high maternal and infant mortality.
-) Additional foods are required to increase mother's body fat deposits and improve birth weight of infant.
-) Lactating women need more nutritious food for optimum milk output, to breastfeed.

In India, it is observed that diets of women belonging particularly to lower income groups are similar to non-pregnant and non-lactating women, even during pregnancy and lactation. The Supplementary Nutrition Programme (SNP) and nutrition awareness counselling under the Integrated Child Development Services (ICDS) aim to address this.

Why diet is important during pregnancy and lactation:

- Diet of a pregnant woman has a direct influence on the weight of the baby at birth. It should therefore contain larger quantity of nutritious foods.
- Pregnant women need an additional 300 kcal of energy, extra 15 gm of protein and 10 gm fat from mid pregnancy onwards.
- During pregnancy and lactation, additional amount of calcium is required for proper for proper secretion of breast milk and formation of bones and teeth in the infant.
- Iron deficiency anaemia during pregnancy increases maternal mortality and the incidence of low birth weight infant. Hence, consuming iron-rich food is essential.

Do's during pregnancy and lactation:

- Eat more food.
- An additional meal is preferable.
- Eat more whole grain, sprouted grams and fermented food.
- Take milk/meat/egg.
- Eat plenty of vegetables and fruits.
- Take medicine only when prescribed.
- Take iron, folate and calcium supplements regularly after 14-16 weeks of pregnancy and continue the same during lactation.
- Pregnant women need walking and other physical activity and should avoid heavy physical work, particularly during the last month of pregnancy.

Dont's during pregnancy

- Do not consume alcohol and tobacco.
- Beverages like tea and coffee bind dietary iron and make it unavailable; hence they should be restricted before and soon after a meal.

Infants (0 to 6 months): Exclusive breastfeeding

Infancy is the period of rapid growth; infant weight doubles at 6 months, triples at the age of 1 year and increases 4 times by the age of 2 years.

It is important to initiate breastfeeding immediately after birth, within the first hour. The first milk is called colostrum; it is very rich in nutrients and is very important for the infants.

Colostrum is secreted in the mother during the first 2 to 3 days after child birth. It is called as first vaccination for the baby and is:

- ✓ *Antibody rich* - protects against infection and allergy
- ✓ *White cells* - protects against infection
- ✓ *Purgative* - helps to prevent jaundice
- ✓ *Growth enabler*- helps intestine to mature; prevents allergy, builds resistance
- ✓ *Vitamin A rich* - reduces severity of infection; prevents eye disease

Principles for feeding practices

Practise

- ✓ Exclusive breastfeeding from birth to 6 months of age
- ✓ Introduction of complementary foods at 6 months of age (180 days), while continuing to breastfeed.
- ✓ Continue frequent, on-demand breastfeeding until 2 years of age or beyond.

Lactating Mother. Photo credit: LANSA

Advantage of breastfeeding

1. Benefits of breastfeeding to mother
    - ✓ Psychological (attachment, bonding, security,)
    - ✓ Easier weight loss after delivery
    - ✓ Decreased risk of illness (breast cancer, osteoporosis, haemorrhage, ovarian cancer)
    - ✓ Birth control
    - ✓ Pride, empowerment, fulfillment
2. Benefits of breastfeeding to baby
    - ✓ Better dental health
    - ✓ Increased visual acuity
    - ✓ Decreased duration and intensity of illnesses
    - ✓ Less allergies
    - ✓ Better health and less risk of illness

Table 8 shows the nutrient composition of human breast milk vis-à-vis cow, goat and buffalo milk, to highlight its richness

Table 8: Composition of human, cow, goat and buffalo milk (100ml)

Food Items	Milk buffalo	Milk cow	Milk goat	Milk human
Protein(g)	4.3	3.2	3.3	1.1
Fat(g)	6.5	4.1	4.5	3.4
Energy (kcal.)	117	67	72	65
Calcium (mg.)	210	120	170	28
Vitamin A(µg.)	48	53	55	41
Thiamine (mg.)	0.04	0.05	0.05	0.02
Riboflavin (mg.)	0.10	0.19	0.04	0.02
Vitamin C(mg.)	1.0	2.0	1.0	3.0

Source: Gopalan et al (2011)

Infants (6 months – introduction of complementary feeding along with breastfeeding)

As the infant grows, mother's milk will not be sufficient for rapid growth and development, so complementary feeding should be started on completion of six months after birth, to meet the requirement.

Complementary feeding is defined as the process of starting solid foods when breast milk is no longer sufficient to meet the nutritional requirements of infants, and therefore other foods and liquids are needed, along with breast milk. Complementary feeding is important from 6 to 23 months of age, and the infant maybe weaned from breast milk thereafter. If the mother is able, breastfeeding may continue beyond two years of the infant, for some more time.

Complementary feeding of infant
Photo credit: LANSA

Points to remember

- ✓ Practise good hygiene and proper food handling.
- ✓ Start at 6 months of age with small amounts of food and increase the quantity as the child gets older, while maintaining frequent breastfeeding.
- ✓ Gradually increase food consistency and variety as the infant grows older, adapting to the infant's requirements and abilities. Single grain cereals (mashed and in porridge form, malted form), pureed vegetables and fruits, and water in which dal has been

cooked are advisable. Adding sugar, jaggery, oil or ghee will increase the calorific value of food.

- ✓ Increase the number of times that the child is fed as the child gets older. Food items like *upma, khichidi, daliya, kheer, idly*, curd, milk can be introduced.
- ✓ Feed a variety of nutrient-rich and energy-dense foods from the family pot to ensure that all nutrient needs of the infant are met.
- ✓ Use iron rich complementary foods or vitamin-mineral supplements for the infant, as needed.
- ✓ Increase fluid intake during illness, including more frequent breastfeeding; encourage the child to eat soft, favourite foods. After illness, give food more often than usual and encourage the child to eat more.
- ✓ Never overfeed or force the child to eat.

Table 9 gives the quantity and frequency of complementary feed upto two years of age; table 10 gives the recommended food and nutrient intake for children 1 – 3 years of age.

Table 9: Quantity and Frequency of Feed recommended for children 6 to 23 months

AGE	Energy needed per day in addition to breast-milk	Texture	Frequency	Amount of food an average child will usually eat at each meal
6–8 months	200 kcal per day	Start with thick porridge, well mashed foods Continue with mashed family foods	2–3 meals per day Depending on the child's appetite, 1–2 snacks may be offered	Start with 2–3 tablespoonfuls per feed, increasing gradually to ½ of a 250 ml cup
9–11 months	300 kcal per day	Finely chopped or mashed foods, and foods that baby can pick up	3–4 meals per day Depending on the child's appetite, 1–2 snacks may be offered	½ of a 250 ml cup/ bowl
12–23 months	550 kcal per day	Family foods, chopped or mashed if necessary	3–4 meals per day Depending on the child's appetite, 1–2 snacks may be offered	¾ to full 250 ml cup/ bowl

Source: WHO (2009)

Table 10: Recommended Food and Nutrient intake for boys and girls, 1 to 3 years

Food groups (g/CU/day)		Nutrients	
Cereals & Millets	60	Protein (g)	16.7
Pulses & Legumes	30	Fat (g)	27.0
Green Leafy Veg.	50	Energy (Kcal)	1060.0
Roots & Tubers	50	Calcium (mg)	600.0
Other Veg.	50	Iron (mg)	9.0
Fruits	100	Vitamin A (µg)	400.0
\Milk & Milk Prod.-	500	Thiamin (mg)	0.5
Fats & Edible Oils	25	Riboflavin (mg)	0.6
Sugar & Jaggery	15	Niacin (mg)	8.0
		Vitamin C (mg)	40.0
		Dietary Folate (µg)	80.0

Source: NIN (2011)

Nutrition for children (4 to 6 years)

Following are a few points to remember:

Preschool children at an ICDS centre
Photo credit: LANSA

- ✓ Children have a higher energy requirement for their body size compared to adults because they are growing rapidly and are often very active.
- ✓ Several developmental changes in brain, body, visual and organ occur at this time.
- ✓ A nutrient-dense diet providing adequate energy and nutrients, which includes healthy snacks, is essential for growth and development. It is also important for children to have sufficient to drink.
- ✓ Vitamins and minerals are very important for bone health, brain development and strengthen immune system
- ✓ Young children also have small stomachs, so they need to eat in lesser quantity at frequent intervals.
- ✓ Introduce new foods at regular intervals to increase acceptance of new food
- ✓ Provide a variety of foods from different food groups
- ✓ Provide adequate green leafy vegetables, other vegetables and fruits as they are good source of vitamins, minerals and fibre
- ✓ Provide enough milk products for calcium intake
- ✓ Present food in colourful and appealing way

- ✓ Encourage the child to play actively each day
- ✓ Don't force child to eat or bribe the child with sweets and gifts

The above will apply to 3 year olds as well, whose recommended food and nutrient intake is given in table 10. Table 11 gives the recommended intake of different food groups and nutrients in a day for children in the age group of 4-6 years.

Table 11: Recommended Food and Nutrient intake for boys and girls, 4 to 6 years

Food groups (g/CU/day)		**Nutrients**	
Cereals & Millets	120	Protein (g)	20.1
Pulses & Legumes	30	Fat (g)	25.0
Green Leafy Veg.	50	Energy (Kcal)	1350.0
Roots & Tubers	100	Calcium (mg)	600.0
Other Veg.	100	Iron (mg)	13.0
Fruits	100	Vitamin A (µg)	400.0
Milk & Milk Prod.	500	Thiamin (mg)	0.7
Fats & Edible Oils	25	Riboflavin (mg)	0.8
Sugar & Jaggery	20	Niacin (mg)	11.0
		Vitamin C (mg)	40.0
		Dietary Folate (µg)	100.0

Source: NIN (2011)

Nutrition for school children (7 to 9 years)

Table 12 gives the recommended intake of different food groups and nutrients in a day for school going children 7-9 years. Following are a few points to keep in mind:

School going children; Photo credit: LANSA

- ✓ Childhood is an important time for growth and development.
- ✓ Children need a good supply of protein, and other nutrients including calcium, iron and vitamins A and D.
- ✓ Children begin to take responsibility for their own food choices around this time. It is therefore important to encourage them to eat a healthy and varied diet.
- ✓ Vitamins and minerals are very important for bone health, brain development and strengthen immune system
- ✓ Young children also have small stomachs so they need to eat in lesser quantity but should take frequent intervals.
- ✓ Introduce new foods at regular intervals to increase acceptance of new food
- ✓ Provide a variety of foods from different food groups

- ✓ Provide adequate green leafy vegetables, other vegetables and fruits as they are good source of vitamins, minerals and fibre
- ✓ Provide enough milk products for calcium intake
- ✓ Provide food in colourful and appealing way
- ✓ Encourage the child to actively play everyday
- ✓ Don't force the child to eat or bribe the child with sweets and gifts

Table 12: Recommended Food and Nutrient intake for boys and girls, 7 to 9 years

Food groups (g/CU/day)		**Nutrients**	
Cereals & Millets	180	Protein (g)	29.5
Pulses & Legumes	60	Fat (g)	30.0
Green Leafy Veg.	100	Energy (Kcal)	1690.0
Roots & Tubers	100	Calcium (mg)	600.0
Other Veg.	100	Iron (mg)	16.0
Fruits	100	Vit. A (µg)	600.0
Milk & Milk Prod.	500	Thiamin (mg)	0.8
Fats & Edible Oils	30	Riboflavin (mg)	1.0
Sugar &Jaggery	20	Niacin (mg)	13.0
		Vitamin C (mg)	40.0
		Dietary Folate (µg)	120.0

Source: NIN (2011)

Nutrition for Adolescents (10 to 17 years)

Tables 13 and 14 give the recommended intake of different food groups and nutrients in a day for adolescent children 10-17 years. Following are a few points to keep in mind:

Adolescent girl; Photo credit: LANSA

- ✓ Adolescence is a period of rapid growth and development at all levels namely physiological, psychological and social. Hormonal changes, sexual maturation and often emotional bouts occur in this age group. The growth spurt in girls occurs at 11 to 14 years and in boys at 13 to 16 years.
- ✓ Develop identity and decision making ability at this stage
- ✓ Important stage for good development for cognitive skills and bone mineralization
- ✓ The demand for energy and most nutrients are relatively high.
    - o Boys need more protein and energy than girls for growth.
    - o Girls need more iron than boys to replace menstrual losses.

- ✓ It is important to encourage an active lifestyle with a healthy, balanced diet during this time as lifelong eating pattern depends on this stage.
- ✓ Food choices largely depends a lot on family food choices, peer groups and media
- ✓ Base for good health and weight control
- ✓ Variety in meals- from each food group. Plenty of grains, fruits and vegetable, milk and moderate sugar and salt
- ✓ Involving them in making food choices
- ✓ Encourage them to eat with family and never skip breakfast
- ✓ Avoid eating in front of TV
- ✓ Avoid junk foods rich in saturated fats and cholesterol, and sweetened beverages

Table 13: Recommended Food intake for Adolescents, 10 to 17 years

Age	10 to 12 years		13 to 15 year		16 to 17 years	
Food groups (g/CU/day)	**Boys**	**Girls**	**Boys**	**Girls**	**Boys**	**Girls**
Cereals & Millets	300	240	420	330	450	330
Pulses & Legumes	60	60	75	60	90	75
Green Leafy Veg.	100	100	100	100	100	100
Roots & Tubers	100	100	150	100	200	200
Other Veg.	200	200	200	200	200	200
Fruits	100	100	100	100	100	100
Milk & Milk Prod.	500	500	500	500	500	500
Fats & Edible Oils	35	35	45	40	50	35
Sugar & Jaggery	30	30	20	25	30	25

Source: NIN (2011)

Table 14: Recommended Nutrient intake for Adolescents, 10 to 17 years

Nutrients	10 to 12 years		13 to 15 year		16 to 17 years	
	Boys	**Girls**	**Boys**	**Girls**	**Boys**	**Girls**
Protein (g)	39.9	40.4	54.3	51.9	61.5	55.5
Fat (g)	35.0	35.0	45.0	40.0	50.0	35.0
Energy (Kcal)	2190.0	2010.0	2750.0	2330.0	3020.0	2440.0
Calcium (mg)	800.0	800.0	800.0	800.0	800.0	800.0
Iron (mg)	21.0	27.0	32.0	27.0	28.0	26.0
Vit. A (µg)	600.0	600.0	600.0	600.0	600.0	600.0
Thiamin (mg)	1.1	1.0	1.4.0	1.2	1.5	1.0
Riboflavin (mg)	1.3	1.2	1.6.0	1.4	1.8	1.2
Niacin (mg)	15.0	13.0	16.0	14.0	17.0	14.0
Vitamin C (mg)	40.0	40.0	40.0	40.0	40.0	40.0
Dietary Folate (µg)	140.0	140.0	150.0	150.0	200.0	200.0

Source: NIN (2011)

Nutrition for Adults (18 to 65 years)

Tables 15 and 16 give the recommended intake of different food groups and nutrients in a day for adults 18-65 years of age, for sedentary, moderate and heavy work.

- By this stage the body growth particularly in terms of height and weight stops to a certain extent but the breakdown and repair of body tissues goes on.
- Proper nutrition ensures good health and poor diet can lead to diseases such as obesity, hypertension, cardiovascular diseases, cancer and diabetes.

- Factors like age, sex, climate, activity, body growth, and stress, affect our body's need for different nutrients.

To reduce the risk of developing these diseases, it is important to:

- Eat a balanced diet with plenty of fruit and vegetables
- Opt for healthier fats
- Get enough dietary fibre
- Keep well hydrated
- Stay active
- Avoid smoking and alcohol
- Adults should aim for a healthy body weight for their height and try to keep it at that level. The Body Mass Index (BMI) is an indicator of whether a person is underweight, overweight or normal (see section 3)

Table 15: Recommended Food intake for Adults more than 18 years of age

Food groups (g/CU/day)	Men			Women		
	Sedentary	Moderate	Heavy	Sedentary	Moderate	Heavy
Cereals & Millets	375	450	600	270	330	480
Pulses & Legumes	75	90	120	60	75	90
Green Leafy Veg.	100	100	100	100	100	100
Roots & Tubers	200	200	200	200	200	200
Other Veg.	200	200	200	200	200	200
Fruits	100	100	100	100	100	100
Milk & Milk Prod.	300	300	300	300	300	300
Fats & Edible Oils	25	30	40	20	25	30
Sugar & Jaggery	20	30	55	20	30	45

Source: NIN (2011)

Table 16: Recommended Nutrient intake for Adults more than 18 years of age

Nutrients	Men			Women		
	Sedentary	Moderate	Heavy	Sedentary	Moderate	Heavy
Protein (g)	60.0	60.0	60.0	55.0	55.0	55.0
Fat (g)	25.0	30.0	40.0	20.0	25.0	30.0
Energy (Kcal)	2320.0	2730.0	3490.0	1900.0	2230.0	2850.0
Calcium (mg)	600.0	600.0	600.0	600.0	600.0	600.0
Iron (mg)	17.0	17.0	17.0	21.0	21.0	21.0
Vit. A (µg)	600.0	600.0	600.0	600.0	600.0	600.0
Thiamin (mg)	1.2	1.4	1.7	1.0	1.1	1.4
Riboflavin (mg)	1.4	1.6	2.1	1.1	1.3	1.7
Niacin (mg)	16.0	18.0	21.0	12.0	14.0	16.0
Vitamin C (mg)	40.0	40.0	40.0	40.0	40.0	4.0
Dietary Folate (µg)	200.0	200.0	200.0	200.0	200.0	200.0

Source: NIN (2011)

Nutrition for older adults

Older adult is the term used when referring to people over the age of 65 years. Growing old also make individuals vulnerable to health problems like obesity, arthritis, osteoporosis, cancer, alzheimer's disease, diabetes, depression, hypertension and respiratory diseases.

Adult >65 years Photo Credit: LANSA

Energy requirements gradually decrease after the age of 50 as activity level falls.

Older people may eat less for different reasons, for example:

- difficulty in chewing and swallowing
- dental problems
- changes in sense of smell and taste
- difficulty in shopping, preparing and cooking food
- living alone
- financial problems
- illness

To maintain good health, it is important that older adults

- enjoy their food;
- keep active;
- have adequate nutrient intake.

Older adults should adopt a healthy, balanced diet to maintain health.

- It is also important they keep hydrated by drinking plenty of fluid.
- After menopause (when menstruation stops), women lose bone strength at an increased rate. Having a great peak bone mass (PBM) in early adulthood helps adults to start from a higher point from which bones will be lost during the ageing process.
- Older adults should have plenty of calcium intake from the diet, but also remain active and have adequate vitamin D from foods, or through the action of sunlight on the skin. Adults over 65 years who are housebound should take a daily supplement of vitamin D as skin synthesis of this vitamin requires sunshine.
- Follow a healthy eating plan that emphasizes fruits, vegetables and low fat dairy foods.
- Participate in regular weight-bearing exercise.
- Maintain a healthy body weight.
- Avoid smoking and excessive alcohol.
- Maintain hygiene and cleanliness
- Protect eyes from direct sunrays and any kind of dangerous substances.

Summary

1. Low maternal iron level in mother during pregnancy leads to difficulty during childbirth and pregnancy. The baby of an anaemic mother will not develop well and will have low birth weight. The baby will then be easily affected by different infections.
2. Exclusive breastfeeding for the first 6 months and continued to 2 years of infant's age.
3. Introduction of complementary food on completion of 6 months.
4. Adolescent boys need a lot of calories; girls need plenty of iron.
5. Elderly people are especially vulnerable to nutritional problems as they will experience difficulty in chewing, swallowing, digesting and absorbing nutrients. Supplementary micronutrients can both prevent deficiency and support immune function.

Check how much you have learnt

1. What is first 1000 days?
2. What is meant by exclusive breastfeeding?
3. When should be complementary feeding be started and why is it important to start at the right time?
4. Define BMI
5. Why proper nutrition is important for adolescent girls?
6. Consumption of calcium is important for older adults; why?

5. Water, Sanitation and Hygiene (WASH)

Lack of proper hygiene and sanitation contributes to large number of child deaths every year due to diarrhoea in many developing countries. Chronic diarrhoea can have long-term negative effects on children, in terms of both physical and cognitive development. Access to WASH, in particular safe water, adequate sanitation, and proper hygiene, can reduce disease and even death.

Drinking water purification

To avoid water borne diseases like diarrhoea, hepatitis, typhoid, etc., the drinking water must be purified. Water from other sources like open well, river or water tunnels should be purified before drinking.

Avoid:

- Defecation near river and open well.
- Washing of utensils/animals/clothes near drinking water sources.

The purpose of water treatment is to reduce or to remove all contaminants that are present in the water and to improve water quality so that it is completely safe to drink. There are several methods of small-scale water treatment that can be employed at the household level.

Household sand filter[4]

Household filters are made from locally available and inexpensive materials like clay pots. The upper pot contains layers of sand and gravel. Water is poured in at the top and, as it passes through the layers of sand, any particles within it are filtered out. The thickness of the layers should be approximately 5 cm of gravel, 5 cm of coarse sand and 10 cm of fine sand. The bottom of the upper pot should be perforated (have tiny holes in it) so the clean water can drip into the lower pot. The lower pot should have a tap to draw off the clean water easily (see Figure 13). The sand and gravel should be changed when the rate of filtration starts to slow; at minimum it should be changed every two or three months.

Figure 13: Simple filter

[4] http://www.open.edu/openlearncreate/mod/oucontent/view.php?id=201&printable=1

Cloth filtration

Cloth filtration is a common water treatment technique that is easy to use and inexpensive. Cloth filtration can be very effective against cholera and other disease-causing agents. The steps in cloth filtration are:

Figure 14: Cloth filter

- Use a large cloth, preferably made of finely-woven cotton. The cloth must be big enough to easily cover the opening of the container once it has been folded (see Figure 14).
- Fold the cloth at least four times so there are multiple layers of fabric and place this over the opening of the storage vessel.
- Fasten the cloth securely around the rim of the opening and tighten the string. If reusing the cloth, always use the same side up each time.
- Filter all water immediately at source as it is being collected.
- Always keep filtered water separated from non-filtered water.
- Rinse the filter cloth after each use, with a final rinse using cloth-filtered water, and then leave the cloth in the sun until it is dry.
- Clean the cloth regularly using soap and replace it as soon as there are any visible tears or holes.

Boiling

Boiling is a simple way of killing any bacteria and viruses present in contaminated water. Water should be heated until large bubbles are continuously coming to the surface of the water. There is a chance of boiled water to getre-contaminated once it has cooled, so store it in closed vessels.

Other methods for water purification are

1. Solar disinfection
2. Chlorine solution, also known as sodium hypochlorite solution or bleach, is the most affordable, easiest to produce, and most widely available chemical for household water treatment. Typically, the procedure is to add a capful of chlorine solution to a 25 litre water storage container, mix well and wait for 30 minutes chlorine contact time before drinking.

Points to remember

- ✓ If tap is not fitted to the earthen pot, then use long handled utensil to fetch water
- ✓ Always cover the pot containing water and keep at higher level.

Bathing Water

Bathing with unclean water can expose the body to several diseases, notably diarrheic diseases. Some preventive measures are:

- Avoid bathing in untreated / contaminated water.
- Ensure safe water supply - in rural areas this can be achieved by chlorination of water.

Sanitation

Sanitation generally refers to the provision of facilities and services for the safe disposal of human urine and faeces. Inadequate sanitation is a major cause of disease world-wide and improving sanitation is known to have a significant beneficial impact on health both in households and across communities. The word 'sanitation' also refers to the maintenance of hygienic conditions, through services such as toilet facility, garbage collection and waste water disposal. Open defecation for instance is an unhealthy practice.

Some of the harmful impacts of open defecation are:

1. *Spread of diarrheal diseases*: Open defecation causes illness and death, especially in children of developing countries. Faeces defecated in the open come back to us through many ways
2. *Loss of human dignity:* Open defecation results in loss of privacy and dignity, especially for women and girls. Safe and sustainable school latrines have been proven to be linked with continued education enrolment of teenage girls
3. *Environmental pollution:* Improperly disposed human waste is a major polluter of soil and water bodies. This contributes to the spread of disease and depletes water of oxygen that is needed to sustain aquatic life.

Personal hygiene

Personal hygiene is intimately involved with health. Many diseases develop due to lack of personal cleanliness. Parasites, worms, scabies, sores, tooth decay, diarrhoea and dysentery are caused due to lack of personal hygiene. All these diseases can be prevented by practising personal cleanliness.

Few Tips

- ✓ Head bath to be taken once or twice in a week with shampoo or any other cleansing agent
- ✓ Wash your eyes with clean water everyday.
- ✓ Wax get formed in ears and block the airway. This causes pain. Hence clean the ears once a week with cotton buds.

- ✓ Nose secretions get dried and form a crest which blocks the nose. Hence clean the nose whenever needed. When children have cold and running nose, clean the nose with soft cloth.
- ✓ Brush twice a day: morning, as soon as you get up from the bed and at night before going to bed.
- ✓ Wash your mouth with clean water after eating any food. This prevents food particles from settling between the teeth which produces bad smell, spoil the gums and leads to tooth decay.
- ✓ When you see signs of tooth decay consult a doctor. Regular and proper brushing methods prevent tooth decay.
- ✓ Take bath every day using soap and clean water to keep your skin clean.
- ✓ Wash hands with soap after doing following activities: eating food, using toilets, cleaning the nose, doing household chores etc. During these activities, many disease causing germs remain under the nails and over the skin. Washing the hands (above the wrist, in between the fingers and nails) with soap after completion of the activity and especially before cooking and eating food helps to prevent many diseases (see Figure 15).
- ✓ Cut your nails regularly.
- ✓ Avoid biting nails and nose picking.
- ✓ Avoid walking with bare feet

Figure 15: Steps to wash your hands properly

Cleanliness of house and environment

- ✓ Keep the toilets, bathrooms and surroundings clean.
- ✓ Keep the cooking area and vessels clean.
- ✓ Avoid eating/cooking rotten or infected food material.
- ✓ Wash food items such as vegetables thoroughly before use.
- ✓ Store food items properly.
- ✓ Check the labels of food items before purchase, to know the 'Best before' date.

Different types of waste

- Wet waste: kitchen waste including vegetable and fruit peels and pieces, eggshells, bones as well as cooked food (both veg and non-veg).
- Dry waste: paper, plastics, metal, glass, rubber, thermocol, fabric, leather, rexine, wood – anything that can be kept for an extended period without decomposing is classified as dry waste.
- Hazardous waste: paints, cleaning agents, solvents, insecticides and their containers, other chemicals.
- Biomedical waste: This includes used menstrual cloth, sanitary napkins, disposable diapers, bandages and any material that is contaminated with blood or other body fluids.

Dispose waste properly

How to practice waste management at home?

- Keep separate bins for dry and wet waste in the kitchen.
- Keep two bags for dry waste collection, one for paper and plastic, and another for rest of the household waste.
- Keep a paper bag for throwing sanitary waste.

Kitchen waste can be converted into compost.

Composting is the process of converting kitchen waste into a form that can be used as natural fertilizer for household plants. It is a highly effective way to treat solid waste at household level. A simple method is described here[5]:

1) Dig a hole of about 1 ft (30.5 cm) depth. The area of the hole will be determined by the amount of organic matter to be added.

[5] https://www.wikihow.com/Make-a-Compost-Pit

2) Exposing as much surface area of the compost materials as possible is the key to speeding the process.
3) Cover the materials in the pit with a fine layer of soil or shredded paper or dead leaves, then close it up with a board. Each time you insert fresh compost materials, cover the top layer with more soil or dry leaves.
4) Use the material when it has decomposed.

Note: For accelerating the pace of composting in a pit, it should be ensured that the area around it stays fairly wet.

Figure 16: Compost pit

Source: http://icytiny.club/kitchen-waste-composting-in-malayalam/

Summary

1. Personal hygiene and clean surrounding and environment is important to have a healthy life
2. Use clean, filtered and boiled water for drinking
3. Avoid open defecation
4. Dispose waste properly and keep environment clean

Check how much you have learnt

1. Why water has to be treated before drinking?
2. Give two easy methods to treat drinking water.
3. How will you keep your surroundings clean?
4. Explain how you can dispose kitchen waste safely.

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