FOOD NUTRITION & DIETETICS,834

CLASS XI

Unit 1: Food and Nutrition: Basic Concepts

Chapter 1: Nutritional status and Primary Health Care

Learning Objectives:
Students will be able to:

1. Define Food, Nutrition & Health
2. Explain the interrelationship in maintaining good health & wellbeing.
3. List the parameters for maintaining Primary Health Care.

We all know that food is a basic necessity.This unit tells you about food and some of its components. You will also be introduced to the terms nutrition and health.Food is any substance consumed to provide nutritional support for an organism. It is usually of plant or animal origin, and contains essential nutrients, such as carbohydrates, fats, proteins, vitamins, or minerals.

Foods are made up mostly of bio-chemicals which are mainly derived from living sources such as plants and animals. There are three main groups of constituents in foods: Carbohydrates, Protein and Fats and derivatives of these. The essential substances contributed by our food are called nutrients. If these nutrients are not present in our food in sufficient amounts, the result is ill health and in some cases, even death. Food also contains many substances, which are non-nutrients e.g. colouring, and flavouring substances in food. Food is therefore, a complex mixture o different nutrients and non-nutrients.

FUNCTIONS OF FOOD: Food consists in part of various nutrients. These nutrients can be classified into five major categories (based on certain similar features): proteins, carbohydrates, fats, vitamins and minerals.Food also has social and psychological functions in addition to physiological ones.

Physiological Functions: The physiological functions performed by food are the energy-giving, body-building, protective and regulatory functions. The energy-giving function of food is basically performed by two nutrient categories-carbohydrates and fats. This is why these nutrients are also referred to as the "body fuels".Food is also needed for growth and repair. For both growth and repair, proteins are necessary.The other major physiological functions performed by food are the protective and regulatory functions. Let us talk about the meaning of the term 'protective' first. Here protective refers to the role in preventing infection by ensuring proper functioning of the body systems responsible for fighting infections.

The regulatory function mentioned earlier refers to the role of food in controlling body processes. Several processes take place in the body such as the beating of the heart, maintenance of body temperature and contraction of muscles. Each of these processes is controlled. This is achieved by certain specific nutrients and is illustrative of their regulatory function. Vitamins, minerals, and proteins contribute substantially to both protective and regulatory functions. So does water.

Social Functions: Food and eating has significant social meaning. Sharing food with any other person implies social acceptance. When you share a meal with anyone else, you are expressing your acceptance of friendship and respect for that person. Food is an integral part of festivity anywhere in the world.

Joyous occasions such as birth of a child or a marriage are celebrated by having feasts and serving delicacies.

Food also has a specific significance and meaning in the religious context. Certain food items such as fruits, sweets and coconuts are offered to the deity in temples. Often sweets are prepared at temples and gurudwaras and distributed to devotees as a benediction or Prasad. Food thus becomes an integral part of the social and religious life of people.

Psychological Function: We all have emotional needs such as the need for security, love and attention. Food is one way through which these needs are satisfied. Food is also closely allied to our emotions. Food often serves as a reward. On the other hand, certain foods become associated with sickness such as khichri (a rice-dhal porridge). This type of food is generally eaten when a person suffers from fever and may, therefore, not be associated with pleasant feelings.

Nutrition: Nutrition is a scientific discipline with food as the major focus of interest. It can be defined as" The science of foods, the nutrients and other substances therein, their action, interaction and balance in relationship to health and diseases; the process by which the organism ingests, digests, absorb, transports and utilizes nutrients and disposes of their wend products."

The body needs each nutrient in specific amounts. Some are needed in relatively larger amounts-the macronutrients, and some in smaller amounts-the micronutrients. Each nutrient plays a significant role in the body and a balance should be maintained. The term balance means that the nutrients needed by the body should be provided in the right amount and proportions. Nutrients are the constituents in food that must be supplied to the body in suitable amounts. These include carbohydrates, fats, proteins, minerals, vitamins and water. Chemical substances obtained from food and used in the body to provide energy, structural materials and regulating agents to support growth, maintenance and repair of body's tissues. Nutrients may also reduce the risks of some degenerative diseases.
Let's study different aspects of nutrition.

1. Social and cultural aspects of eating: Food has a special meaning in the social and cultural context. Our ancient vedic tradition emphasizes food as the life-giver. It further attributes specific qualities to specific foods. It is important to keep a person's socio-cultural background in mind whenever we talk of improving or modifying food related practices.
2. The psychology of eating: The individual reactions to food and to the people around us can have a significant psychological influence on our eating pattern.Many factors influences our choices of foods such as advertisements and the attitude of other people around us.
3. The economics of food: Food costs money. It must be within the reach of people and it must be equitably distributed to all sections of the populations. The availability of food and its proper distribution is of great importance. It is the coordinated effort of planners, farmers, suppliers and consumers of food products to ensure equitable distribution of food products.

Study Material

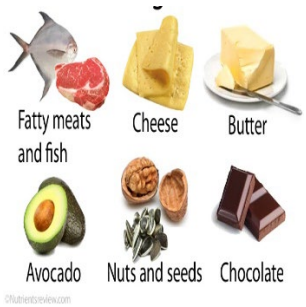
CARBOHYDRATES	FATS	PROTEINS	MINERALS & VITAMINS
Major energy giving foods that includes sugar, starches and fibres. 	A group of fatty substances including triglycerides and cholesterol that are not soluble in water. 	Major structural part of body's cells composed of nitrogen-containing amino acids, particularly rich in animal foods. 	Noncaloric, inorganic nutrients found in a wide variety of foods. 

Fig 1.1 Classes of nutrients

Health: According to WHO health can be defined as "A state of complete physical, mental, spiritual and social well-being and not merely the absence of disease or infirmity". Health is a positive state of complete wellbeing and not just absence of disease. One dimension, which is also gaining prominence, is spiritual health. Let us now examine each of these dimensions of health.

1. Physical health: The physical dimension of health is familiar to us. Physical heal is easy to detect and describe. A person is physically healthy if he or she looks alert, is responsive, energetic and vigorous.
2. Mental health: Mental health is a more complex concept than physical health. It implies freedom from internal conflicts and a good capacity to adjust to situations and people. Physical and mental health are inter-related. Physical ill health can lead to mental ill health. The reverse can also happen.
3. Social health: An individual who recognizes his/her obligations towards other members of society and is able to relate to other people around him/her can be described as socially healthy. It is impossible to realize the goal of social health if mental health has not been achieved. Similarly, a person who does not enjoy physical health would find it difficult to achieve social health.
4. Spiritual health: Spiritual health is the most difficult to define. The concept of doing good and not of not harming there: of believing in the basic forces of goodness and justice whether or not these are worshipped as God: of recognizing the needs of other and trying to fulfil them: of commitment, duty and obligation, these are all characteristics of a spiritually well person.

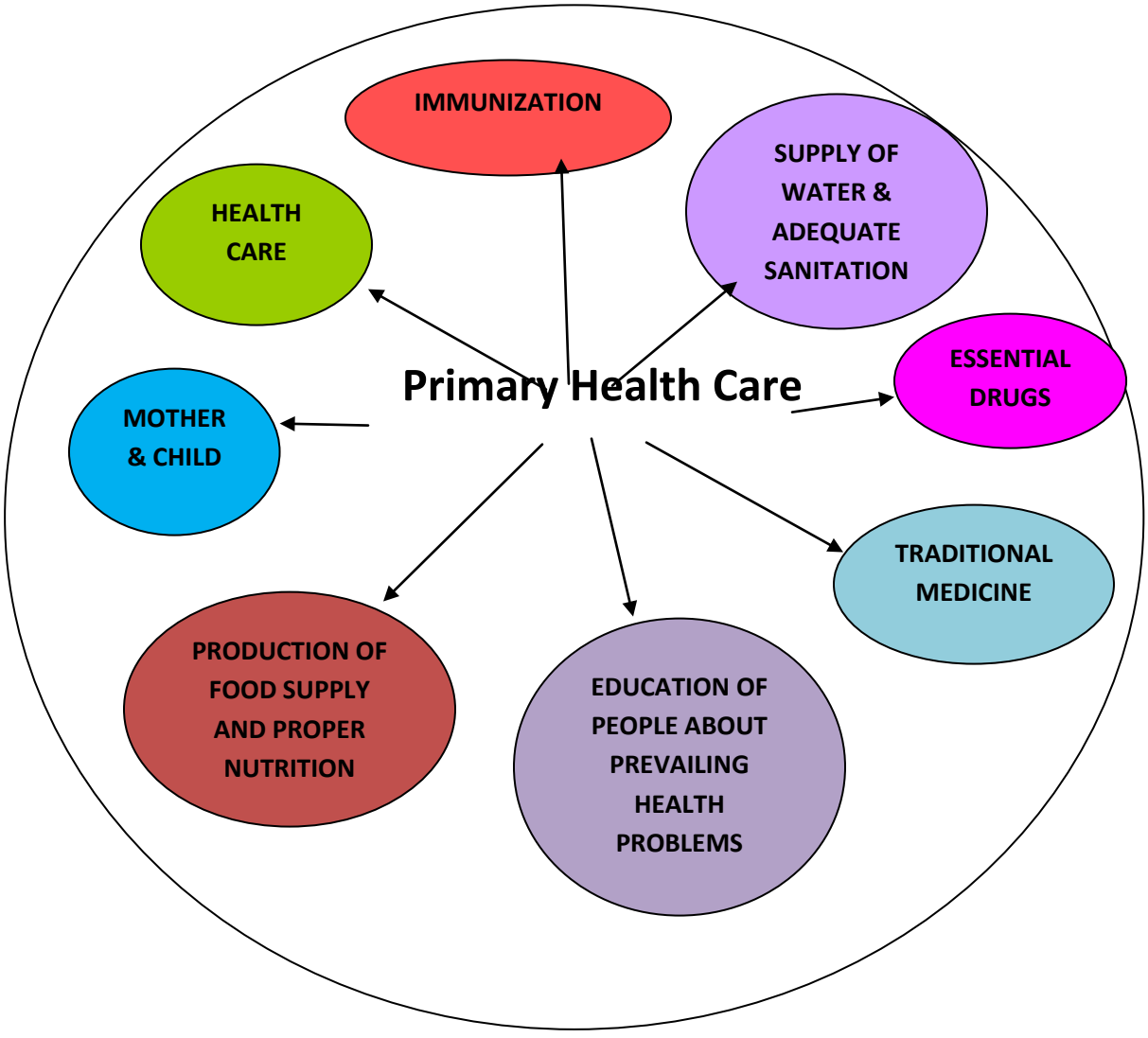
Primary Health care

Primary health care is a whole-of-society approach to health and well-being centred on the needs and preferences of individuals, families and communities. It addresses the broader determinants of health and focuses on the comprehensive and interrelated aspects of physical, mental and social health and wellbeing.

It provides whole-person care for health needs throughout the lifespan, not just for a set of specific diseases. Primary health care ensures people receive comprehensive care - ranging from promotion and prevention to treatment, rehabilitation and palliative care - as close as feasible to people's everyday environment.

The concept of primary health care has been repeatedly reinterpreted and redefined. In some contexts, it has referred to the provision of ambulatory or first-level of personal health care services. In other contexts, primary health care has been understood as a set of priority health interventions for low-income populations (also called selective primary health care). Others have understood primary health care as an essential component of human development, focusing on the economic, social and political aspects.Following components should be included in primary health care:-

1. Education of the people about prevailing health programs and methods of preventing and controlling them.
2. Promotion of food supply and proper nutrition.
3. Adequate supply of safe water and basic sanitation.
4. Maternal and child health care and family planning.
5. Immunization against major infectious diseases.
6. Prevention and control of locally endemic diseases.
7. Appropriate treatment of common diseases and injuries.
8. Provision of essential drugs.



Nutritional Status:

Nutritional status is the condition of health of an individual as influenced by the utilization of nutrients. To determine the nutritional status of an individual, following information is required:

- Kind of diet being consumed
- Type of illnesses, if any, the person has suffered from including observable signs of ill health.
- Level of nutrients and other substances in the blood and urine.

Interrelationship between nutrition and good health

Nutrition is closely interlinked with health.If the person eats the right kind of foods in the required amounts, he or she will keep good health provided no other factors intervene.It must be emphasized ,that though good food is one of the crucial factors in ensuring health,it is not the only one.The food eaten must not only be nutritious but it must be wholesome and clean and free from harmful germs. If this is not so,the person eating the food would get ill even if the food id nutritious.

Malnutrition is an impairment of health resulting from a deficiency, excess or imbalance of nutrients.In other words, malnutrition refers to both under nutrition and over nutrition. Under nutrition means a deficiency or lack of one or more nutrients and overnutrition means excess of one or more nutrients. Both under nutrition and over nutrition results in ill health

Chapter 2: Food: Basic Concept

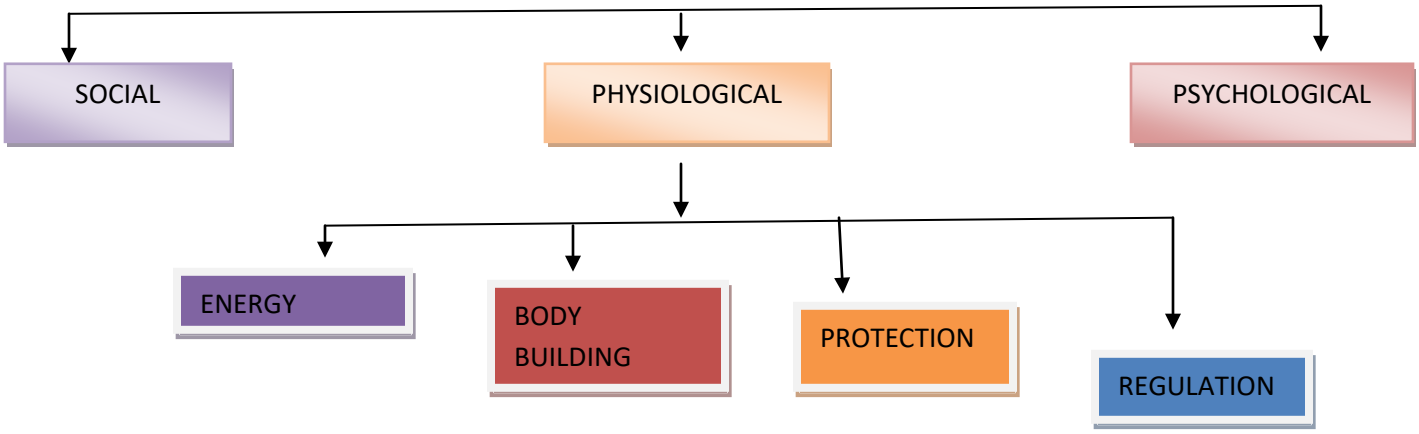
Learning Objectives:
Students will be able to:

1. Understand some of the general properties of important food constituents.
2. Explain nutrients and their functions in growth and development.

Life can be sustained only with adequate nourishment. Man needs food for growth, development and to lead an active, productive and healthy life.

1. The general composition of a food as well as the way in which the components are organized give a food its individual characteristics.
2. There are three main groups of constituents in foods: carbohydrates, proteins, and fats, and derivatives of these.
3. The above constituents occur in foods naturally.

Functions of food:



You know that nutrients are essential constituents of food that must be supplied to the body in suitable amounts. There are around 40 essential nutrients which are placed in five categories. These are carbohydrates, fats, proteins, vitamins and minerals. Let us now discuss the nature, functions, food sources of each one of them.

Carbohydrates

Carbohydrates (from "hydrates of carbon") are organic compounds essentially made of three elements i.e, carbon, hydrogen and oxygen. Carbohydrates are widely distributed in plant foods. They are mainly present in these foods in the form of three types of compounds called as sugars, starches and fiber. All these carbohydrates are made up of some basic simple units. Fibre is the non-available carbohydrate. Fiber

helps in satuiey, elimination of unabsorbed food and prevention of diseases like cancer, diabetes and heart diseases. One prominent example of a basic unit is glucose.

- Food sources: The list includes cereals and millets, roots and tubers, some fruits, sweeteners like cane sugar, jaggery and honey. Cereals and millets are the major source of carbohydrates in Indian diets. All cereals like wheat, rice and millets contain considerable amount of starch.
- Functions: Some of the important functions of carbohydrates are energy-giving, protein-sparing action and utilization of fats.though proteins can be broken down in the ody to meet the energy need,but an insufficient amount of carbohydrates in the diet will force the body to break down proteins for releasing energy. Some amount of carbohydrate is needed for the proper utilization of fat in the body.

Proteins:

Protein is the most abundant component in the human body. It is made up of compounds called amino acids, which are also referred to as the building block of proteins. The linkage of individual amino acids together in long chains forms proteins. The quality of food protein depends on the proportion of essential and non-essential amino acids. Those amino acids which cannot be manufacture by the body are called essential amino acids and those which can be manufacture by the body are called non-essential amino acids. Proteins can be divided into essential and non-essential .Proteins are essential to all life. In animals, they help form supporting and protective structures such as cartilage, skin, nails, hair and muscle. They are major constituents of enzymes, antibodies, many hormones and body fluids such as blood, milk, and egg white. Protein value of some common foods is listed below:

FOOD	AMOUNT	PROTEIN IN GRAMS
Chicken	1 breast(120gm)	22
Milk	1 cup(150ml)	4.8
Egg	1 medium size	7
Paneer	40gm(4 big piece)	9.64
Almonds	100gm	20.8
Dals	25gm (1 bowl)	5
Soya Bean	25 gm (1 bowl)	10.8
Peanut Butter	1 table spoon(15gm)	4

- Food sources: Some of the rich sources of protein are milk, milk products, flesh foods, eggs, nuts and oilseeds, cashew nuts and pulses.
- Functions: Some of the functions of proteins are body-building, regulation, protection acts as carrier molecules and energy giving molecules.

Fats & Oils:

Fats are a group of chemical compounds that contain the fatty acids. They are composed of the fatty acids and glycerol. They do not form long molecular chains, and they do not contribute structural strength to plant and animal tissues. Fats are smooth, greasy substances that are insoluble in water. Fat is mainly fuel

source for the animal or plant in which it is found or for the animal that eats it.it contains about $2^{1/4}$ times the calories found in an equal dry weight of protein or carbohydrate.
Fat always has other substances associated with it in natural foods, such as the fat-soluble vitamins A, D, E and K.

Vitamins:
Vitamins help in protecting our bodies from various kinds of diseases. They also help in keeping our eyes, gums, bones and teeth in good shape.

Minerals:
Minerals are used by the body to perform various functions like building strong bones, maintaining the heartbeat, making hormones etc. The major five minerals are Calcium, Phosphorus, Magnesium, Sodium and Potassium. Examples of mineral-rich foods include leafy vegetables, fish, beans etc.

Dietary Fibres/Roughage:
While dietary fibres do not provide any such nutrition to our bodies but nevertheless are an important component of food. They help in easy absorption of food, help in movement of bowel and prevent constipation. It helps our body get rid of undigested food. Cereals, fruits and vegetables are some of the roughage rich foods.

Water:

Water performs the essential function of absorbing nutrients from our food. It also helps in releasing waste from our body in form of sweat and urine.

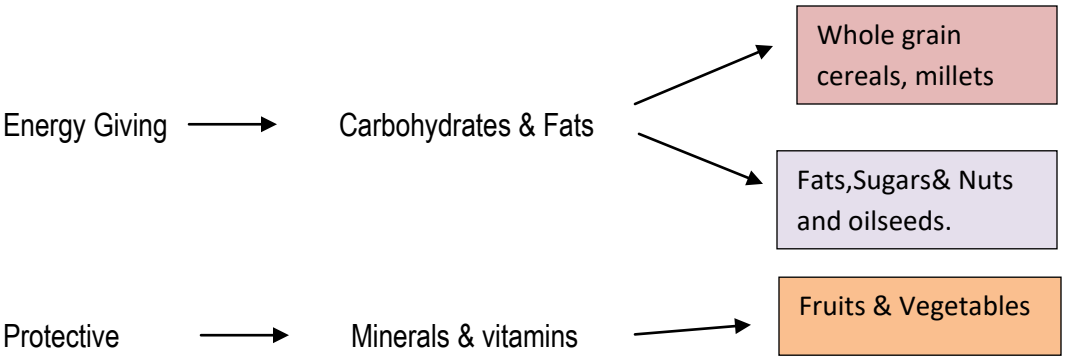
Food Groups

In the previous chapter you had studied about the components of foods called nutrients, that are needed by the body in adequate amounts in order to grow, reproduce and lead a normal healthy life. Each nutrient has its own function to perform in the body, but more than one nutrients may also perform the same function. All individuals need the same nutrients for the same body functions. Variation in the diet has to be provided according to the age, sex, activity, taste, etc. So let us see how these varieties can be brought about. For planning meals, the foods available can be broadly divided into three groups from the functional point of view. These are:

1. Energy yielding foods
2. Body building foods
3. Protective foods

Now let us see what all nutrients are provided by these three food groups:

Function	Major nutrients	Example
Body building →	Proteins	Milk,meat and chicken Pulses, nuts and oilseeds



ICMR Five Food Groups

Foods are grouped together because they provide similar amounts of the key nutrients of that food group. To meet the nutrient requirements essential for good health, you need to eat a variety from each of the five food groups daily, in the recommended amounts. It is not necessary to eat from each food group at every meal.

It is also important to enjoy a variety of foods within each of the five food groups because different foods vary in the amount of the key nutrients that it provides. 'Basic Five food group, suggested by ICMR are:

1. Cereals, millets and pulses
2. Vegetables and fruits
3. Milk and milk products, egg, meat and fish
4. Oils& fats
5. Nuts& oilseeds

FOOD GROUPS	NUTRIENTS
CEREALS & PRODUCTS: Rice,Wheat,ragi,bajra,maize,riceflakes,riceflour,sprouted cereals.	Energy,protein,invisible fat,B vitamin,iron,calcium,fiber.
PULSES & LEGUMES: Bengal gram,blackgram,cowpea,peas(dry),soyabeans.	Protein,energy,invisible fat,thiamine,riboflavin,folic acid,calcium,iron & fibre.
MILK & MEAT PRODUCTS: (I)Milk & skimmed milk,cheese& curd. (II) Chicken,liver,fish,egg& meat.	Protein,fat,riboflavin & calcium.
FRUITS & VEGETABLES: (I)Mango,guava,tomato,papaya,orange,sweetlime,watermelon. **GREEN LEAFY VEGETABLES:** (II)Amaranth,spinach,drumstickleaves,corianderleaves,fenugreek leaves. **Other vegetables:** Carrot,onion,brinjal,ladiesfinger,beans,capsicum,cauliflower,drumstick.	Carotenoids,vitamin C,Riboflavin,folic acid,iron & fibre. Riboflavin,folic acid,calcium , fibre,iron & carotenoids. Carotenoids,folic acid,calcium & fibre.
FATS&SUGARS: (I)Fats: Butter,ghee,groundnut oil,coconut oil,hydrogenated fat & cooking oils. (II) Sugar & jaggery.	Energy,essential fatty acids & fat soluble vitamins. Energy & Iron.

Chapter-3 NUTRIENTS

Learning objectives:

Students will be able to :

1) Define the term 'Nutrients'.
2) List the functions and sources of the major nutrients available in food.

WHAT ARE NUTRIENTS?

Nutrients are the constituents in food that must be supplied to the body in suitable amounts. These include carbohydrates, fats, minerals, vitamins and water. Chemical substances obtained from food are used in the body to provide energy, structural materials and regulating agents to support growth, maintenance and repair of body tissues. Nutrients may also reduce the risks of some degenerative(progressive deterioration and loss of function in organs or tissues) diseases.

Food is composed of wide distribution of nutrients which have very specific metabolic effects on the human body. Nutrients are generally divided into 2 categories, **Macronutrients** and **Micronutrients**.

Macronutrients, needed in relatively large amount constitute the majority of an individual's diet. Essential nutrients are nutrients that cannot be synthesized by human body and therefore must be derived from food sources. Essential nutrients include vitamins, minerals, amino acids, fatty acids and some carbohydrates as source of energy that are needed for growth, maintenance and activity. Macronutrients include carbohydrates, proteins, fats, macro minerals and water.

Micronutrients are vitamins and trace or microminerals. Vitamins and trace minerals are labelled as micronutrients because the body only requires them in very small amounts generally less than 100mg/day. They have preventive and therapeutic role in our diet and don't provide any energy. Vitamins are organic substances that we ingest in our body with our food that act as catalysts (substance that help to trigger other reactions in the body). Trace minerals are inorganic that once ingested play a role in variety of metabolic

processes and contribute to the synthesis of such elements such as glycogen, protein and fats.

There are 6 essential nutrients that the body needs to function properly. Nutrients are compounds in foods essential to life and health, providing us with energy, the building blocks for repair and growth and substances necessary to regulate chemical processes.

These six major nutrients are: -

- **Proteins: Body building foods.**

Functions

1. Maintenance and Growth

   The need for proteins to maintain and repair the old tissues continues throughout life.

2. Regulation of body processes.
   - Nucleo protein- contains the blue print of the synthesis of all the body proteins.
   - Catalytic protein- enzymes that facilitate each step of digestion and absorption.
   - Hormonal proteins- set or release the brakes that control metabolic processes.
   - Immune protein- maintains the body resistance to diseases.
   - Contractible proteins- regulates muscle contraction.
   - Blood protein
     a) Transport protein- ferry nutrients to the tissues e.g. hemoglobin, lipoprotein, transferrin, retinol building protein.
     b) Serum protein- serum albumin regulates osmotic pressure and maintenance of fluid balance.
3. Energy supplier.Each gram of protein yields 4kcal.

4. Proteins acts as regulatory and protective substances.

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❖ Carbohydrates: source of energy

Functions

1. Body distribution
2. Energy supplier:
   Carbohydrates are sources of readily available energy which is needed for physical activities and also for work of body cells.
3. Important for athletes:
   Best fuel for athletes as carbohydrates take less oxygen to burn than protein of fat thereby enabling them to exercise harder, both during training and competition.
4. Protein sparing action:
   The body will use carbohydrates preferentially as a source of energy when it is adequately supplied in the diet, thus sparing protein for tissue building.
5. Regulation of fat metabolism:
   Some carbohydrates are necessary in the diet so that the oxidation of fats can be processed normally. When carbohydrate is severely restricted in the diet, fats will be metabolized faster than the body can take care of the immediate products, the accumulation of which leads to dehydration, loss of body sodium and ketosis.
6. Role of gastro intestinal function:
   Lactose promotes the growth desirable bacteria some of which are useful in the synthesis of B complex vitamins. It also enhances the absorption of calcium.
   Dietary fibre yields no nutrients to the body, but aids in preventing constipation and several other functions.

❖ Fats and Oils

Functions

1. Body consumption:
   All body cells contain some fats. Ideal body consumption for females is 20-25% body fats and males is 16-19%. With ageing the proportion of fat in the body generally increases and that of protoplasmic tissue decreases.
2. Energy store:

Primary function of fat is to supply energy. Each gram of fat is equal to 9kcal. The high density and low solubility of fats make them an ideal form in which to store energy.

3. Satiety function:
   Fats reduce gastric motility and remain in stomach for longer periods thereby delaying hunger sensations and so have high satiety value.
4. Palatability:
   Fats lend palatability and flavor to diet. If fat is eliminated from the diet, the diet becomes very bulky and it is often difficult to ingest sufficient food to meet energy requirements.
5. Insulation and padding:
   The sub cutaneous layer of fat is an effective insulator and reduces losses of body heat in cold weather. Excessive layers of sub cutaneous fats, as in obesity interferes with the heat loss during warm weather. Fats also have some value as a lubricant for the gastro intestinal tract.
6. Carriers of fat-soluble vitamins:
   Dietary fat is a carrier of fat-soluble vitamin A, D, E and K. some fats are also necessary for the absorption of vitamin a and carotene.

❖ **Vitamins:** Vitamins are vital and essential for life and health. The 'vita' part of the word 'vitamin' means 'life'. They regulate metabolism,help in growth and maintenance of our body and protect against disease.vitamins are organic compounds present in minute quantities in food. Some of the vitamins are soluble in water while others are soluble in fat. They are classified into two categories: water-soluble vitamins and fat soluble vitamins. Functions of both the type of vitamins are enlisted below:

Water soluble Vitamins:

Nutrient	Function
Thiamine (vitamin B1)	Part of an enzyme needed for energy metabolism; important to nerve function
Riboflavin (vitamin B2)	Part of an enzyme needed for energy metabolism; important for normal vision and skin health
Niacin (vitamin B3)	Part of an enzyme needed for energy metabolism; important for nervous system, digestive system, and skin health

Pantothenic acid	Part of an enzyme needed for energy metabolism
Biotin	Part of an enzyme needed for energy metabolism
Pyridoxine (vitamin B6)	Part of an enzyme needed for protein metabolism; helps make red blood cells
Folic acid	Part of an enzyme needed for making DNA and new cells, especially red blood cells
Cobalamin (vitamin B12)	Part of an enzyme needed for making new cells; important to nerve function
Ascorbic acid (vitamin C)	Antioxidant; part of an enzyme needed for protein metabolism; important for immune system health; aids in iron absorption

Fat-soluble vitamins

Fat-soluble vitamins are stored in the body's cells and are not excreted as easily as water-soluble vitamins. They do not need to be consumed as often as water-soluble vitamins, although adequate amounts are needed. If you take too much of a fat-soluble vitamin, it could become toxic.

Nutrient	Function
Vitamin A (and its precursor*, beta-carotene) *A precursor is converted by the body to the vitamin.	Needed for vision, healthy skin and mucous membranes, bone and tooth growth, immune system health
Vitamin D	Needed for proper absorption of calcium; stored in bones
Vitamin E	Antioxidant; protects cell walls
Vitamin K	Needed for proper blood clotting

❖ **Minerals :**Minerals are defined as those elements which largely remain as ash when plant or animal tissues are completely burnt.they are micronutrients which perform regulatory and protective functions.

Functions: Of all the minerals found in our body the ones listed below are required by our body in larger amount.

- Calcium
  - Required for formation and maintenance of skeleton and teeth.
  - For normal contraction of muscles to make limbs move.
  - For contraction of heart for its normal function.
  - For nervous activity.
  - For blood clotting.
- Phosphorus
  - As a component of DNA and RNA.
  - as phosphate esters play a part in the cellular metabolism of carbohydrates and fats.
  - Body building as an important component of bones and teeth.
  - As a part of ATP(adenosine triphosphate) and ADP(adenosine diphosphate), which are essential for energy metabolism in the body.
- Potassium
  - Maintain acid base balance of the body.
  - Involved in muscle contraction.
  - Transmission of nerve stimuli.
  - Acts as an activator of several enzyme reactions in metabolism.
- Sodium
  - Regulation of normal muscle contraction.
  - Maintenance of normal osmotic pressure, water balance and cell permeability.
  - Transmission of nerve impulse.
  - Regulation of acid base balance.
- Chloride: It combines with sodium and potassium and helps in regulating fluid balance and acidity/alkalinity of body fluids.
- Magnesium: It helps in regulating the passage of substances into and out of the cells, activity of many enzymes, building bones and teeth, smooth muscle action and building proteins.

Minerals required by our body in smaller amount are:

- Iron
    - Hemoglobin is the principal component of the RBC and accounts for most of the iron in the body. It acts as a carrier of oxygen from the lungs to the tissues and indirectly aids in the return of carbon dioxide to the lungs.
    - It is required as a co factor for enzymes such as catalases, the cyto chromes, etc.
- Iodine

Iodine acts in the body only when it is incorporated into the hormone thyroxine.

- Thyroxine increases metabolism.
- Increases oxygen consumption of tissues.
- Converts glycogen to glucose.
- Increases the heart rate.
- Depletes the bones of calcium and phosphorus.

- Zinc
    - As a co factor of number of enzymes participate in reactions involving either synthesis or degradation of major metabolites like carbohydrates, lipids and proteins.
    - Structural role as components of several proteins.
    - As an intra cellular signal in the brain cells.
    - Required in transport process, immune function and expression of genetic information.

❖ **Water:** Water is essential for life. It is a macronutrient made of two elements-Hydrogen and Oxygen. A molecule of water contains two atoms of hydrogen and one atom of oxygen.

Functions

- It helps create saliva.
- It regulates your body temperature.
- It protects your tissues, spinal cord, and joints.
- It helps excrete waste through perspiration, urination, and defecation.
- It helps maximize physical performance.
- It helps prevent constipation.

SOURCES OF NUTIRENTS

Nutrient	Sources
Complex carbohydrate & fibre	wholemeal bread, wholegrain cereals, baked beans, pasta, potatoes, peas, other starchy vegetables
Protein	lean meat, chicken, fish, cheese, milk, eggs, bread, nuts, legumes
Fat	oils, butter, margarine, cream, meat, cheese, pastry, biscuits, nuts
Preformed Vitamin A	butter, margarine, cream, cheese, eggs, meat
Beta-carotene (converts to vitamin A)	carrots, spinach, pumpkin, broccoli, tomatoes, apricots
Vitamin D	Fatty/canned fish, butter, margarine, cream, cheese, eggs
Vitamin E	Polyunsaturated oils, polyunsaturated margarine, nuts, olive oil, fatty fish and small amounts in wholegrain cereals and green vegetables
Vitamin K	green vegetables, cheese, butter, pork, eggs
Thiamin	Wholegrain cereals, pork, bread, nuts, peas
Riboflavin	milk, meat, eggs, cheese, wholegrain, cereals, nuts, mushrooms
Niacin	fish, meat, peanuts, wholegrain cereals, nuts, mushrooms
Pantothenic acid	eggs, wholegrain cereals, peanuts, fish, meat, vegetables
Vitamin B6	Wholegrain cereals, meat, fish, peanuts, bananas
Folic acid	green vegetables, wholegrain cereals, wholemeal bread, nuts
Vitamin B12	meat, fish, eggs, cheese, milk, oysters
Biotin	eggs, cheese, milk, fish, wholegrain cereals
Vitamin C	Oranges, tomatoes, potatoes, broccoli, cabbage, Brussels sprouts, Strawberries
Calcium	cheese, milk, yoghurt, canned fish, nuts, sesame seeds (tahini), dried fruit
Phosphorus	meat, fish, poultry, eggs, milk, cheese, nuts, cereals,

	bread
Iron	meat, poultry, wholegrain cereals, wholemeal bread, eggs
Sodium	table salt, meat, milk, cheese, seafood, spinach, celery
Potassium	Potatoes, bananas, oranges, apricots, other fruit and vegetables, meat, fish, nuts
Iodine	Sea foods, milk and cereals and vegetables from areas with high iodine content in the soil, iodised table salt
Zinc	oysters, meat, fish, poultry, eggs, wholegrain cereals, peanuts

Chapter 4:Recommended Dietary Allowances

Learning objectives:

The students will be able to:

- define the terminologies and concepts used in relation to human nutritional requirements,
- discuss the concept of recommended dietary allowance,
- state the significance and uses of recommended dietary allowances, and
- present the current nutrient recommendations for Indian population.

In a family there may be infants, young children, adolescent, adults, and elderly all living under one roof. It is always a big challenge to provide a good nutritious diet for each of the member, particularly when their needs, preferences vary. So what should be the guiding factor to ensure balanced meals that meet the needs of all members? Is there a Standard or a Reference that would serve as a goal for Good Nutrition? This section focuses on this important concept of Recommended Dietary Allowances.

RECOMMENDED DIETARY ALLOWANCES: BASIC CONCEPT

Humans need a wide range of nutrients to lead a healthy and active life. The amount of each nutrient needed for an individual depends on age, body weight, physical activity, physiological state (pregnancy, lactation) etc. So basically the requirement for nutrients varies from individual to individual. So, what do we mean by the term "*Nutrient Requirement*" here?

The requirement for a particular nutrient is the minimum amount that needs to be consumed to prevent symptoms of deficiency and to maintain satisfactory level of the nutrient in the body.

For example in case of infants and children, the requirement may be equated with the amount that will maintain a satisfactory rate of growth and development. Similarly for an adult the nutrient requirement is the amount that will maintain body weight and prevent the depletion of the nutrient from the body which otherwise may lead to deficiency. In physiological condition like pregnancy and lactation, adult women may need additional nutrients to meet the demand of fetal growth along with their own nutrient needs.

Now within each group (say infants or an adults etc) there may be individual variations in the nutrient requirements. For instance, there may be a period of low intake or the quality of the diet may vary, similarly the effect of cooking and processing may be different and bioavailability of the nutrient from the diet may also vary.

Bioavailability refers to the release of nutrient from the food, its absorption in the intestine and bio-response

So how do we account for this? Well a *safety factor* is added over and above the nutrient requirement for each group to arrive at the Recommended Dietary Allowances.

REQUIREMENT + SAFETY MARGIN = RECOMMENDED DIETARY INTAKE

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The Recommended Dietary Allowances (RDA) are the levels of intake of the essential nutrients that are judged to be adequate or sufficient to meet the nutrient requirement of nearly all (97 to 98 percent) healthy individuals in a particular life stage and gender group

From our discussion above it must be clear to you that the Nutrient Requirement of an individual and the Dietary Allowance for a group or a population are distinctly different. RDA takes into account the variability that exists in the requirement of a given nutrient between individuals in a given population group. So RDA is neither minimal requirement nor necessarily optimal level of intake. Rather, RDA is the *safe and adequate level*, which incorporates margin of safety intended to be sufficiently generous (high enough) to encompass the presumed variability in requirements among individuals and meet the needs of almost all healthy people.

Further please note, RDA's do not apply to people who are suffering from disease which influence the nutrient intake. They only apply to healthy people.

Next we shall review the significance, uses of RDA's.

SIGNIFICANCE/USES OF RDA

RDA, we know, represents the level of the nutrient to be consumed daily to meet all the requirements of most of the individuals in a given population. So RDA's help us plan balanced diets which include a variety of foods derived from diverse food groups which help meet the nutrient requirements. Other than this basic use, RDA's have come to serve many important purposes. The various applications of RDA include:

- Comparison of individual intakes to the RDA allows an estimate to be made about the probable risk of deficiency among individuals,
- Modifying nutrient requirements in clinical management of diseases,
- To help public health nutritionists to compose diets for schools, hospitals, prisons etc.
- For health care policy makers and public health nutritionists to design, develop nutrition intervention programmes and policies,
- For planning and procuring food supplies for population groups,
- For evaluating the adequacy of food supplies in meeting national nutritional needs,
- For interpreting food consumption records of individuals and populations,
- For establishing Standards for the national feeding programmes implemented by the Governments for its vulnerable population,
- For designing nutrition education programmes for the masses,

- For developing new food products and dietary supplements by the industry,
- Establishing guidelines for the national labeling of packaged foods (by Food Standards Safety Authority of India (FSSAI))

So that was a comprehensive list of uses of RDA. Next let us learn about the Recommended Dietary Allowances for Indians.

Recommended Dietary Allowances (RDA) for Indian Population

For the Indian population, the dietary standards have been computed by the Indian Council of Medical Research (ICMR). These recommendations have been published as "Nutrient Requirements and Recommended Dietary Allowances for Indians" (ICMR 2010)

The recommendations are constantly revised whenever new data is available. The last recommendations were revised in 2010, based on the new guidelines of the International Joint FAO/WHO/UNU Consultative Group and based on the data on Indians that had accumulated after 1989 recommendations. Table 1(a) and Table 1(b) present these recommendations. Study them carefully. To help you understand these recommendation here are a few highlights:

1. Note, the RDA for Indians are presented for the different age categories: 0-6 months, 7 to 12 months, 1 – 3 years, 4 – 6 years, 7 – 9 years, 10 – 12 years, 13 – 15 years,16 – 18 years, adult man and women..
2. Recommendations are given for energy and all other nutrients including proteins, visible fat, calcium, iron, retinol, Beta Carotene, thiamine, riboflavin etc.
3. Recommended dietary allowances for adults are based on sex (male, female), body weight and physical activity level (i.e. Sedentary, Moderate and Heavy work) .
4. RDA for energy is expressed in kilocalories (Kcal), for proteins, fats in grams (g), and for calcium, iron, vitamins and minerals in milligram (mg) or microgram.
5. RDA for protein is based on body weight. The relationship can be expressed as 1g protein per kg body weight in the case of adults. It varies for other age categories.
6. RDA for energy and protein are given as additional intakes in pregnancy and lactation, indicated by a (" + " sign). This requirement is over and above the normal requirement of adult women. RDA for other nutrients are given as total intake figures.
7. In infancy RDA's for energy, protein, iron, thiamin, riboflavin and niacin are expressed as per kg body weight (expected for a healthy, normal growing infant of a particular age)
8. RDA for Vitamin A have been given in terms of retinol or alternatively in terms of Beta Carotene.

Summary of Recommended Dietary Allowances (RDA) for Energy, Protein, Fat and Minerals for Indians – 2010

Group	Category/Age	Body Weight (Kg)	Net Energy (Kcal/d)	Protein (g/d)	Visible Fat (g/d)	Calcium (mg/d)	Iron (mg/d)	Zinc (mg/d)	Magnesium (mg/d)
Men	Sedentary work	60	2320	60.0	25	600	17	12	340
	Moderate work		2730		30				
	Heavy work		3490		40				
Women	Sedentary work	55	1900	55	20	600	21	10	310
	Moderate work		2230		25				
	Heavy work		2850		30				
	Pregnant		+ 350	78	30	1200	35	12	
	Lactating 0-6 m		+ 600	74	30	1200	21		
	6-12 m		+520	68	30				
Infants	0-6 months	5.4	92 kcal/kg/d	1.16 g/kg/d	-	500	46 ug/kg/d	-	30
	6-12 months	8.4	80 kcal/kg/d	1.69 g/kg/d	19		05	-	45
Children	1-3 years	12.9	1060	16.7	17	600	09	5	50
	4-6 years	18.0	1350	20.1	25		13	7	70
	7-9 years	25.1	1690	29.5	30		16	8	100
Boys	10-12 years	34.3	2190	39.9	35	800	21	9	120
Girls	10-12 years	35.0	2010	40.4	35	800	27	9	160
Boys	13-15 years	47.6	2750	54.3	45	800	32	11	165
Girls	13-15 years	46.6	2330	51.9	40	800	27	11	210
Boys	16-17 years	55.4	3020	61.5	50	800	28	12	195
Girls	16-17 years	52.1	2440	55.5	35	800	26	12	235

Table 4(a) : Recommended Dietary Allowances for Indians (Vitamins)

Group	Category/Age	Body Weight (kg)	Vitamin A (µg/d)		Thiamine (mg/d)	Riboflavin (mg/d)	Niacin equivalent (mg/d)	Vitamin B_6 (mg/d)	Ascorbic Acid (mg/d)	Dietary Folate (µg/d)	Vitamin B_{12} (µg/d)
			Retinal	Beta-carotene							
Men	Sedentary work	60	600	4800	1.2	1.4	16	2.0	40	200	1.0
	Moderate work				1.4	1.6	18				
	Heavy work				1.7	2.1	21				
Women	Sedentary work	55	600	4800	1.0	1.1	12	2.0	40	200	1.0
	Moderate work				1.1	1.3	14				
	Heavy work				1.4	1.7	16				
	Pregnant		800	6400	+0.2	+0.3	+2	2.5	60	500	1.2
	Lactating 0-6 months		950	7600	+0.3	+0.4	+4	2.5	80	300	1.5
	6-12 months				+0.2	+0.3	+3	2.5			
Infants	0-6 months	5.4	350	----	0.2	0.3	710 µg/kg	0.1	25	25	0.2
	6-12 months	8.4		2800	0.3	0.4	650 µg/kg	0.4			
Children	1-3 years	12.9	400	3200	0.5	0.6	8	0.9	40	80	0.2-1.0
	4-6 years	18.0			0.7	0.8	11	0.9		100	
	7-9 years	25.1	600	4800	0.8	1.0	13	1.6		120	
Boys	10-12 years	34.3	600	4800	1.1	1.3	15	1.6	40	140	0.2-1.0
Girls	10-12 years	35.0			1.0	1.2	13	1.6			
Boys	13-15 years	47.6			1.4	1.6	16	2.0	40	150	0.2-1.0
Girls	13-15 years	46.6			1.2	1.4	14	2.0			

Boys	16-17 years	55.4			1.5	1.8	17	2.0	40	200	0.2-
Girls	16-17 years	52.1			1.0	1.2	14	2.0			1.0

Source: Nutrient Requirements and Recommended Dietary Allowances for Indians (ICMR 2010)

Now that we have a fair good idea about recommended dietary allowances surely you should be able to recommend what individuals should eat and in what amounts to ensure a balanced diet. Off course knowledge of nutrients and the rich food sources of these nutrients will form the basis for diet planning. The amount of different foods to be consumed would depend on the RDA. Higher the RDA for a particular nutrient, the more should be the consumption of food rich in that nutrient. For example, we learnt that the RDA for energy for a heavy worker (adult male) is more as compared to a sedentary male adult. To meet these increased high needs of energy we must ensure that we include more of carbohydrates and fat rich foods in the diet of the heavy adult worker. Carbohydrate rich foods such as cereals, sugars, roots and tubers and fat from oils, butter, ghee etc. will help meet the increased energy requirement.

Similarly in case of infants (6-12 months of age) when the protein needs are high (1.69 g/kg body weight/d) as compared to adults (1g/kg body wt) it would be recommended that high protein rich foods such as milk and milk products, pulses, meat and meat products may be included in the diet of the infants. A detailed review on planning balanced diet is covered in another unit.

Chapter 5: Concepts of meal planning

Learning objectives:

The students will be able to:

1. Define the terms meal planning, balanced diet and explain the concept of meal planning
2. Illustrate the factors affecting meal planning.
3. Apply guidelines in planning balanced diet

In this unit we will study about what to eat each day at each meal. You will learn to apply basic knowledge of food and nutrition that you have already acquired earlier. Good health and well being of a family is related to the sensible selection of food items in the daily diet. Let us now learn how to plan a healthy, joyful and satisfying meal for the family by understanding the basic concepts of meal planning.

WHAT IS MEAL PLANNING

You may have heard in your home from your mother that planning for meals saves time and money. Now you will understand the concept of planning a balanced diet to plan a nutritious diet for your family.

Concept of meal planning-Meal planning involves planning nutritious meals for all individuals in a family keeping in mind their age, activity, likes, dislikes and food availability. It also involves planning of balanced meals which are colorful, attractive, appetizing, and palatable and within the economic means of the individuals concerned. It further involves decision making regarding what to eat and how much to eat each day at each meal. The meals planned should not only ensure that nutrient requirements are adequately met but also be flexible enough to take advantage of easy availability and lower prices of seasonal foods and meet the needs and choices of the family members.

As the health of an individual or a family depends on how well they are fed within the given resources, effective meal planning is a great challenge to every meal manager, and if done well is a satisfying and rewarding experience.

Importance of meal planning

Meal planning helps to: -

- **Retain, enhance nutrients and minimize nutrient loss-**Meal planning is done in a way that the meals are prepared and served at fixed meal times without too much holding or reheating which helps to retain the nutrients.
- **Introduce variety and avoid monotony-**Variety can be introduced by using different ingredients chosen from different food groups, using various textures, cooking methods, spices and condiments, etc.

- **Make the food attractive and appetizing-**Garnishes and using combination of contrasting colored foods are some of the ways meals can be made attractive and appetizing.

- **Save time, energy and fuel-**Planning meals in advance helps to save time, energy and fuel as all the ingredients can be collected together from the store. For example, potatoes for dosa and samosas can be boiled, peeled and cut together, if meals are planned.

- **Plan low cost nutritious meals within the resources-**Careful planning can help save money by buying seasonal foods and cheaper substitutes that have same nutritive value.

- **Meet the individual nutritional requirements-**Meal planning can help meet the individual needs of all the family members, the same common meal can be modified to suit any member suffering from an ailment.

- **Reuse the left over in a novel way-**Careful planning can ensure no food is left over. Also, any leftover can be incorporated in the next meal in an interesting manner, without compromising on the quality. For example, left over rice can be used to make rice pudding, cutlets, lemon rice, etc.

FACTORS AFFECTING MEAL PLANNING

Good meal planning is both a science and an art. Science shows us the way to include nutritious foods into diet, while art is involved in converting raw food item into meals that are attractive, delicious and satisfying in all ways.

Following are the factors which should be kept in mind when planning meals for a family-

1. **Nutritional Needs- When planning a meal the major factor to keep in mind is that the meal must fulfill the nutritional requirements of family members.**

2. **Economic factors-** The purchase of food items and their quantity depends on the total income of a family.

3. **Size and composition of the family**

   (i) Size of the family- Size of a family refers to the total number of its members. The structure of the family whether nuclear or joint also affects the meal planning.

   (ii) Family composition-Family composition refers to the age, gender, activity, occupation, and different physical conditions of its members.

4. **Season-** Meals should be in accordance to the season. With the change in season, availability of foodstuffs and our taste also change. In summers, bottle gourd, ridge gourd, pumpkin, bitter gourd, etc. are available in abundance while carrots, radish, peas, cauliflower, etc. in winters.

5. **Food availability-** Availability of food also affects the meal planning. A housewife should make maximum use of locally produced foodstuffs because they are cheap and tasty. For example, people living in coastal areas consumes more seafood as it is easily available and cheap Including mango or watermelon in diet is of no use in winter if it is not available.

6. **Food acceptance-** Acceptance or rejection of food by a person is affected by his likes and dislikes, religious and social traditions and customs. All these factors are to be kept in mind while planning a meal.

7. **Availability of time, energy and labor saving devices-** Meal planning is greatly affected by availability of time, energy and labor saving devices with the housewife. This is important in those cases where the housewife is also working.
8. **Occasion-** Different occasions such as birthday, anniversary and festivities may have special menu to celebrate the importance of the occasion.

9. Appearance of food

- Color should be attractive. Avoid a menu of all white, yellow or greens colored food. Example- yellow dal with pumpkin vegetable.
- Include contrasting textures like soft foods and crisp food.
- Bland and spicy flavors both should be combined.
- Different shapes may be used like round, flat, shredded, sliced or diced, cubes, etc.

BALANCED DIET

In the previous chapter you have already studied about five food groups. Now will learn to incorporate various food groups in terms of nutritional quality and quantity in planning a balanced diet for a person**.** Let us now understand and define a balanced diet.

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 five basic food groups. The quantities of foods needed to meet the nutrient requirements vary with age, gender, physiological status and physical activity.

Balanced diet also has a provision for extra nutrients which can be reserved in the body to enable it to withstand short periods of low dietary intake. Hence it is very important to judiciously choose and combine variety of food stuffs from each food group.

PLANNING A BALANCED DIET

Balancing meals

Balanced meals include one food from each food group- cereals, pulses and legumes, milk and meat products, fruits and vegetables, fats and sugar Fig- A guide to healthy eating is a good representation of a balanced meal because all five food groups are included. When planning a meal, try to include "five of five." Here are a few examples of how to do it:

- Chapatti /rice are a frequent menu item for many families and consumed with dal and vegetables What food groups are missing? Its fruit and milk & its products. Add curd and a fruit for a balanced, nutrient-rich family meal.
- If you're serving porridge made with milk for breakfast, then consider adding nuts and fruit to add flavor to the porridge, and maybe a piece of paneer / boiled egg/ sprouts to boost the protein.

Fig 5(a): Healthy food plate

By taking a balanced approach to planning meals you make sure your family is getting adequate nutrition. When options from every food group are available at every meal, then even picky eaters are likely to find something they will want to eat. As children get older, use the balanced meal approach to add more interest and variety to your healthy family meals. For example, try adding more vegetables into upma /dalia/poha or adding fruit into green salad.

SAMPLE BALANCED MEAL PLAN

Meal Timing	Food Items	Household Measures
Breakfast-	Vegetable poha Milk Paneer /egg/ sprouts	1 bowl 1 glass 1 serving/1 no./1 tbsp
Mid Morning-	Fruit	1 no.
Lunch	Salad Chapati or Rice Dal / Sambhar Cauliflower potato Curd Mint Coriander Chutney	1 Plate 3 no./3 ladle 1 bowl 1 bowl 1 bowl 1tbsp
Evening	Tea/milk Sprouts/Upma/roasted gram	1cup 1 bowl/25g
Dinner	Tomato Soup/Rasam Chapati or rice Masoor dal Green vegetables Sweet dish	1 cup 3 no./3 ladle 1 bowl 1 bowl 1 bowl

UNIT 2 Nutrition through the life cycle

CHAPTER 1

***Learning Objectives*:**
The students will be able to:

1. Explain nutritional needs in infants and children.
2. Enumerate infant and young child feeding practices.
3. Plan balanced diet for infants, preschool and young children.

NUTRITION THROUGH THE LIFE CYCLE

In this chapter, we will study about the nutrient needs throughout the different stages of the human life cycle. As you all know that we need food to sustain life and health. However, nutritional needs vary from one life stage to another. During intrauterine development, infancy, and childhood, for example, recommended intakes of macronutrients and most micronutrients are higher relative to body size, compared with those during adulthood. You will be surprised to know that young children require a higher energy compared to body size to help physical and mental development. On the other hand, inactive senior citizens need lower energy than other adults to maintain their weight and stay healthy.

NUTRITION DURING INFANCY (0-1 YEARS)

Infancy is called as earliest part of childhood. During the first year of life, good nutrition is essential to healthy growth and development. It is the period from birth to one year of age. Infancy is characterized by rapid physical and social growth and development; many changes occur that affect feeding and nutrient intake. Infants are entirely dependent on their parents or caregivers for providing them with nourishment. The first year of life is also a time of great nutritional change for the child, from a diet consisting entirely of milk to one consisting of a variety of foods. Optimal nutrition has a greater importance during this time of life than during any other because of its effect on brain growth, the development of the nervous system, overall growth and development, and future health. According to World Health Organization (WHO) figures the average weight of the healthy new born is around 3.2 kg. A healthy baby doubles his birth weight by six months and becomes three times by one year of age. The normal birth length of 50-55cm also increases by another 23-25cm during the first year.

NUTRIENT NEEDS OF INFANTS

Estimates of energy and nutrient needs in infancy are summarized in the Table - . . These values are recommended by Indian Council of Medical Research (ICMR), India, 2010. These are only guidelines, and each individual infant will have individual requirements at different stages of infancy. Because of the declining growth rates during the latter part of the first year,

recommended intakes have been set for two 6-month periods, from birth to 6 months and from 6 months to 1 year.

Energy

Current RDA for energy intake in infancy is 92 kcal/kg/day from birth through 6 months of age, and 80 kcal/kg/day for the second half of the first year. The energy requirement in infancy is determined primarily by body size, physical activity, and rates of growth. Total energy needs rise during the first year, but energy needs per unit of body size decline in response to changes in rates of growth. Some infants are quiet and cuddly while others spend a considerable amount of time crying, kicking, or just exploring with motor skills they have acquired.

Protein

Protein is important for a baby's growth.Infants require protein for synthesis of new body tissue during growth, as well as synthesis of enzymes, hormones, and other physiologically important compounds. Increases in body protein are estimated to average about 1.16 g/kg/day for the first 6 months, and 1.69g/kg/day for the next 6 months. The body content of protein increases from about 11.0% to 15.0% over the first year.

Table – Recommended Energy and Protein Intake for Infants

Age in months	Reference Body weight (kg)	Energy (kcal/kg/day)	Protein (g/kg/day)	Visible fat (g/day)	Calcium (mg/day)	Iron
0-6	5.4	92	1.16	--	500	46µg/kg/day
6-12	8.4	80	1.69	19	500	05 mg

INFANT AND YOUND CHILD FEEDING PRACTICES

Eating behaviors evolve within minutes after a baby is born. The first food released for the new born from the mother is *colostrum* – a sticky, yellow fluid that and feeding should be initiated within the first hour after birth as it contains everything a baby needs to transition to life outside a mother's body.

Breastfeeding – *Breast milk* is the natural *first food* for *babies*, it provides all the energy and nutrients that the *infant* needs for *the first* months of life, and it continues to provide up to half or more of a child's nutritional needs during the second half of *the first* year, and up to one-third during the second year of life. Breast milk is a perfect food that cannot be duplicated and tailor-made for your baby. It is the most natural and nutritious way to encourage a baby's development.

Mother's milk contributes significantly to the growth and maturation of the baby's digestive system, which is not complete until around 6 months of age.

The infant should be put to breast within half an hour after normal delivery and within four hour after caesarian section Breastfeeding is the normal way of providing young infants with the nutrients they need for healthy growth and development.

Exclusive breast feeding (EBF) -means that the infant receives only breast milk up to 6 months of age. No other liquids or solids are given – not even water – with the exception of oral rehydration solution, or drops/syrups of vitamins, minerals or medicines.
Thereafter, to meet their evolving nutritional requirements, infants should receive nutritionally adequate and safe complementary foods, while continuing to breastfeed for up to two years or beyond.

Complementary feeding- When breast milk is no longer enough to meet the nutritional needs of the infant, complementary foods should be added to the diet of the child. The transition from exclusive breastfeeding to family foods, referred to as complementary feeding, typically covers the period from 6 to 18-24 months of age, and is a very vulnerable period. It is the time when malnutrition starts in many infants, contributing significantly to the high prevalence of malnutrition in children under five years of age world-wide. WHO estimates that 2 out of 5 children are stunted in low-income countries.

Complementary feeding should be timely, meaning that all infants should start receiving foods in addition to breast milk from 6 months onwards. It should be *adequate*, meaning that the complementary foods should be given in amounts, frequency, consistency and using a variety of foods to cover the nutritional needs of the growing child while maintaining breastfeeding.

Introduce a variety of foods from all food groups to cover the nutritional needs of the growing child while maintaining breastfeeding. Complementary feeding guide is given in Table below

Table - Complimentary feeding Guide

Age	**Complementary food (Breastfeeding continued)**	**Frequency of supplement**
First food (after 6 months)	Ripe banana, sweet potato - These are soft, sweet, more nutritionally dense than commercial cereals, low in allergenicity and can easily be mashed to a smooth consistency.	1 feed/ day
Next food started after 1 weak of starting the first food	Continue the above feed and include - porridge from wheat flour or ground Rice (start with only one cereal).	1 feed /day in addition to the above (total 2 feeds per day
7 th to 8th month	Continue the above two feeds and in addition- foods such as mashed dhal (High iron and protein rich) can be started. Ragi or ground millet etc , mixed with oil	Start with 1 feed /day gradually increase the frequency to 3 feeds/days (cereal and pulses) by 8 months of age
9 th to 12th month	chapatti softened in milk , green leafy vegetables can be added to dhal or khichri (add little oil to all the above preparations),	4-6 feeds day

	idli, upma, curd Rice, variety of vegetables . Fruits variety (but apple , apricot or peer should be given only after stewing) Egg, (boiled) minced meat ,fish.	

Source: NIN, ICMR, book Nutrition for Mother and Child
Note: from introduction of one food to next -- There needs to be a gap of 2 weeks.
Complementary feeding from 6 months – 1 year it is recommended that feeding is organized in 3stages on the basis of physical quality of the supplementary food used

a) Liquid supplements
b) Solid supplements –sieved or mashed well before feeding
c) Solid supplements –chopped or lumpy

Key recommendations related to infant and young child feeding may be summarized as follows:

- Initiation of breastfeeding as early as possible after birth, preferably within one hour.
- Exclusive breastfeeding in the first six months of life and no other foods or fluids.
- Appropriate and adequate complementary feeding after completion of six months.
- Complementary foods should not be confused with supplementary foods.
- Hand washing with soap and water at critical times – including before eating or preparing food and after using the toilet.
- Avoid junk food. Home food should be preferred over artificial, commercial, tinned or packaged food.
- Promote and establish Human Milk Banks.
- Full immunization and Vitamin-A supplementation with de - worming.
- Effective home based care and treatment of children suffering from severe acute malnutrition.
- Adequate nutrition and anemia control for adolescent girls, pregnant and lactating mothers.

NUTRITION DURING PRESCHOOL YEARS (1-6 YEARS)

Nutrition during preschool years is important for growth and learning and to provide energy for high activity levels. Preschool children need nutrient dense foods, providing a good quality protein, vitamins and minerals to support healthy growth and development.
Preschoolers are at an age when they start to express independence and have a typical behavior for being fussy eaters. For the mother or the care giver all it takes is a little bit of food and nutrition knowledge to provide a good nutrition.

The nutritional needs of preschoolers

Preschoolers have an established daily schedule and require regular mealtimes to be part of this. Parents and preschools should provide suitable foods at mealtimes. It is up to the child to eat from what is offered. Food should be attractively presented and should be in bite sizes so that the child can just pick up a bite and put it in their mouth. Unless the food is colorful and attractive, the child would not be interested in trying out the food and would be more interested in continuing his play. The growth between 1 to 6 years is generally slower than in the infancy and adolescence but continues gradually. The child may gain in weight 1.8-3.6 kg per year and 5-10 cm height per year. Activity also increases markedly during the second years of life as the child become increasingly mobile.

- A nutritionally adequate and balanced diet is essential for optimal growth and development.
- Appropriate diet and physical activity during childhood is essential for optimum body composition, to reduce the risk of diet-related chronic diseases in later life.
- Common infections and malnutrition contribute significantly to child morbidity and mortality.
- A child needs to eat more during and after episodes of infections. The diet should be adequate in quantity and quality of different nutrient. In addition to the amount of milk recommend, the preschool child should have two small servings of protein-rich foods like eggs and other non vegetarian foods, pulses, paneer or cheese. When the child is about 18 month old, finger food such as carrot can be given.

Nutrient needs of preschoolers

Based on recommendations of Indian Council of Medical Research, India, the nutritional intake of preschoolers can be divided into two age groups 1 to 3 years and 4 to 6 years. The nutritional requirements for total energy, protein and other nutrients are given in Table-

Table- Recommended Nutritional Intake for Preschoolers

Groups	Category/ Age	Body weight (Kg)	Energy (Kcal/d)	Protein (g/d)	Fat (g/d)	Calcium (mg/d)	Iron (mg/d)	Zinc (mg/d)	Vit-C (mg/d)
Children (Boys & Girls)	1-3 years	12.9	1060	16.7	27	600	09	---	40
	4-6 years	18.0	1350	20.1	25	600	13	7	40

In terms of food groups you need to include the following foods in your preschoolers' diet every day:

- 5-6 servings of cereals (like roti, Rice, millets etc)
- 2-3 servings of milk and its products like (glass of milk, milk shake, curd, paneer, cheese etc)
- 1 small portion of meats like chicken, fish, eggs and 1 portion of pulses like lentils, chickpeas, green gram etc
- 3-4 portions of fruits and vegetables
- The amount of food a preschooler chooses to eat will vary according to their size and activity levels.

A sample meal plan for a day is given for your reference

Meal Timing	Food Item	Amount
Early Morning	Milk	1 glass
Breakfast-	Vegetable Poha Curd	1bowl 1 bowl
Mid Morning	Banana milk shake	1 glass
Lunch	Salad Rice/ Veg.Pulav Dal/Kadhi/Sambhar Curd	5-6 slices 1 no./1 ladle ½ bowl ½ bow
Evening	Seasonal fruit Milk Cereal Pulse Halwa	1no. 1 glass 1 bowl
Dinner	Roti/Rice Paneer bhurji Dal	1 no. /1 ladle ½ bowl ½ bowl
Bed Time	Milk	1 cup

Chapter 2

***Learning Objectives*:**

After reading this unit, the students will be able to:

1. Learn nutritional needs in children and adolescents.
2. Plan a balanced diet for children and adolescents.
3. Plan a nutritious lunch box for children.
4. Illustrate factors affecting food and nutrients intake.

NUTRITION DURING CHILDHOOD AND ADOLESCENCE

Healthy eating in childhood and adolescence is important for proper growth and development and to prevent various health conditions.Childhood is the time for children to be in school and at play, to grow strong and confident with the love and encouragement of their family and an extended community of caring adults. Eating a balanced diet and regular exercise is essential for all individuals, but particularly for school-aged children. Poor nutrition compromises both the quality of life of school-aged children but also their potential to benefit from education. Good nutrition of school aged children will also make sure they grow to their full potential, and provide the stepping stones to a healthy life. The best nutritional advice to keep children healthy includes encouraging them to eat breakfast every day.

The World Health Organization (WHO) defines an adolescent as any person between ages 10 and 19. Adolescents also undergo a very rapid growth during their puberty (called the pubertal growth spurt). The nutritional requirements of young people are influenced primarily by the spurt of growth that occurs at puberty. The peak of growth is generally between 11 and 15 years for girls and 13 and 16 years for boys. The nutrient needs of individual teenagers differ greatly, and food intake can vary enormously from day to day, so that those with deficient or excessive intakes on one day may well compensate on the next. In this period of life, several nutrients are at greater deficiency risk including iron and calcium.

Iron

Among adolescents, iron-deficiency anaemia is one of the most common diet-related deficiency diseases. Adolescents are particularly susceptible to iron deficiency anaemia in view of their increased blood volume and muscle mass during growth and development. This raises the need of iron for building up haemoglobin, the red pigment in blood that carries oxygen, and for the related protein myoglobin, in muscle. The increase in lean body mass (LBM), composed mainly of muscle, is more important in adolescent boys than in girls. In preadolescent years, LBM is about the same for both sexes. Once adolescence starts, however, the boy undergoes a more rapid accumulation of LBM for each additional kilogram of body weight gained during growth, ending up with a final LBM maximum value double that of the girl. Other factors contributing to elevated iron needs are increased body weight and the beginning of menstruation for girls. All these factors should be taken into account when assessing iron needs in this group of age.

One of the most important diet considerations during adolescence is an increase in the intake of iron-rich foods such as lean meats and fish as well as beans, dark green vegetables, nuts and iron-fortified cereals and other grains. Iron from animal foods (known as haem iron) is much better absorbed than iron from non-animal sources (non-haem iron). Adolescents following vegetarian diets are therefore at an increased risk of iron-deficiency. However, vitamin C (e.g. from citrus fruits) and animal proteins (meat & fish) assist in the absorption of non-haem iron.

Calcium

The skeleton accounts for at least 99% of the body stores of calcium and the gain in skeletal weight is most rapid during the adolescent growth spurt. About 45% of the adult skeletal mass is formed during adolescence, although its growth continues well beyond the adolescent period and into the third decade. All the calcium for the growth of the skeleton must be derived from the diet. The largest gains are made in early adolescence, between about 10-14 years in girls and 12-16 years in boys.
During peak adolescent growth, calcium retention is, on average, about 200mg/day in girls and 300 mg/day in boys. The efficiency of calcium absorption is only around 30% so it is important that the diet supplies an adequate calcium intake to help build the densest bones possible. The achievement of peak bone mass during childhood and adolescence is crucial to reduce the risk of osteoporosis in later years. By eating several servings of dairy products, such as milk, curd and cheese, the recommended calcium intake can be achieved.
As well as a good dietary supply of calcium, other vitamins or minerals, like vitamin D and phosphorous, are needed for building up bones. Physical activity is also essential, particularly weight-bearing exercise, which provides the stimulus to build and retain bone in the body. Activities such as cycling, gymnastics, skating, ball games, dancing and supervised weight training for at least 30-60 minutes a day, three to five times a week can help build bone mass and density. Making the right dietary and lifestyle choices early in life will help young people develop health-promoting behaviors that they can follow throughout life.

Importance of breakfast
Breakfast is important particularly for a school child. It breaks the fast to the sleep hours and prepares a child for problem solving and memory spans in the learning period at school. Children who skip breakfast do not make up nutrient and energy deficits later in the day and tend to perform more poorly on tests of cognition than those who eat breakfast. It is not enough for children to have just a glass of milk. An ideal breakfast should have at least 3-5 foods from the basic five food groups.

Packed lunches- The packed lunch is a lunch that is packed in a Tiffin box to be eaten by the child while in school. Packed lunches have become a necessity for school going children. Taking lunch from home needs little efforts, but helps in maintaining good health. Carrying food from home is less expensive more convenient more hygienic and meets the individual requirements.

Suggested packed lunches-

- Vegetable stuffed parantha and curd
- Chapatti, dal and salad

- Dal parantha with green leafy vegetables
- Vegetable pulao, boiled egg/curd and fruit
- Cheese or paneer sandwich and fruit
- Idli, chutney and green salad
- Rice sambhar, and vegetable,buttermilk

Points to be considered in planning a packed lunch-

- The packed lunch should meet one –third daily requirement of energy, protein, fat and other nutrients of the child, to boost concentration and energy for the rest of the school day.
- Try to incorporate five food groups, though the number of dishes may be less.
- By including green leafy vegetables one-third requirement of vitamins and minerals is fulfilled.
- Good quality of protein like milk & its products would improve vegetable protein. Or combination of vegetable proteins cereals and pulses can be given for better utilization.
- Repetitiveness should be avoided in packed lunches. There should be variety.
- It is sensible to have a different food in packed lunch than what one had for breakfast.
- The food should have the correct consistency. Too watery things may leak and too dry food may not be appetizing to the child.
- Containers should be cleaned and dried before packing the food.
- Involve the child in planning, preparing or packing the lunch box.
- Make the lunch simple. Most children eat lunch quickly so that they can spend more time socializing or playing with friends.
- Pack small portions which can be finished during lunch period.

Making healthy choices

As children grow up, they because more independent about choosing their food. Children can be made healthful choices by.

- Being a role model
- Making them plant vegetables or fruit trees (children take pride in eating foods they have growth).
- Taking them to fruits and vegetables market.
- Allowing them to plan the menu with the help of food guide pyramid.
- Encouraging them to cook simple recipes (they are more likely to eat foods they have prepared).
- Pre-portioning can help in preventing over or under eating.

- Appreciate when children make healthful food choices
- Stock nutritious ready to eat snacks only at home.

The nutritional requirements of children and adolescence are summarized in Table These guidelines also recommend that individuals limit calories from solid fats (major sources of saturated and trans fatty acids) and added sugars, and reduce sodium intake.

Table: Nutritional requirements in childhood and adolescence

Groups	Category/Age	Body weight (Kg)	Energy (Kcal/d)	Protein (g/d)	Fat (g/d)	Calcium (mg/d)	Iron (mg/d)	Zinc (mg/d)	Vit-C (mg/d)
Child	7-9 years	25.1	1690	29.5	30	600	16	8	40
Boys	10-12 years	34.3	2190	39.9	35	800	21	9	40
Girls	10-12 years	35.0	2010	40.4	35	800	27	9	40
Boys	13-15 years	47.6	2750	54.3	45	800	32	11	40
Girls	13-15 years	46.6	2330	51.9	40	800	27	11	40
Boys	16-17 years	55.4	3020	61.5	50	800	28	12	40
Girls	16-17 years	52.1	2440	55.5	35	800	26	12	40

A sample meal plan

Meal Timing	Food Item	Amount
Early Morning-	Banana milk shake	1 glass
Packed Tiffin	Dal Parantha Tomato Chutney Seasonal fruit	2 no. 1tsp 1medium size
Lunch	Salad Roti /Rice Dal/Kadhi/Sambhar Beans Buttermilk/Curd	1 Plate 2-3 no. /2-3 ladle 1 bowl 1 bowl 1 glass
Evening Snack	Milk Vegetable poha/ Paushtik laddoo	1 glass 1 bowl
Dinner	Roti /Rice Spinach	2-3 no./2-3 ladle 1 bowl

	Dal/Paneer/Fish/Chicken Dessert	1 bowl 1 bowl
Bed Time	Milk	1 glass

Factors influencing food and nutrition during adolescence

Friends and families can play a significant role in preventing or stopping early-stage eating disorders by not participating in these types of discussions on the following aspects:

Body Image

Body image is how and what you think and feel about your body. It includes the picture of your body that you have in your mind, which might or might not match your body's actual shape and size.

A positive or **healthy body image** is feeling happy and satisfied with your body, as well as being comfortable with and accepting the way you look.

A negative or **unhealthy body image** is feeling unhappy with the way you look. People who feel like this often want to change their body size or shape.

A healthy body image is important. When you feel good about your body, you're more likely to have good self-esteem and mental health as well as a balanced attitude to eating and physical activity.

Peer Pressure

In sociology, a peer group is both a social group and a primary group of people who have similar interests, age, background, or social status. The members of this group are likely to influence the person's beliefs and behavior.

Peers play a large role in the social and emotional development of children and adolescents. Their influence begins at an early age and increases through the teenage years. It is natural, healthy and important for children to have and rely on friends as they grow and mature.
Peers can be positive and supportive. They can help each other develop new skills, or stimulate interest in books, music or extracurricular activities.

However, peers can also have a negative influence. They can encourage each other to skip classes, steal, cheat, use drugs or alcohol, share inappropriate material online, or become involve in other risky behaviors. The majority of teens with substance abuse problems began using drugs or alcohol as a result of peer pressure.

Media

Many foods and drinks that are marketed can contribute too much sodium, sugars or saturated fat to our eating patterns, therefore reading and understanding nutritional information in a packaged food item is important before eating to determine whether it is healthy or unhealthy food.
Children are most vulnerable to the media influence as the celebrities endorse and promote various processed food and beverages through different media channels.
Food marketing can take on many forms, such as:

- branding
- sponsorship of events
- celebrity endorsements
- contests and sales promotions
- social media posts on: Twitter, Pinterest ,Snapchat ,Facebook, Instagram
- product placement/ commercials
- on TV, movies, magazines, social media posts
-

Eating disorders

Under Eating An eating disorder is commonly defined as an all-consuming desire to be thin and/or an intense fear of weight gain. The most common signs of eating disorders among adolescents are distorted view of one's body weight, size or shape; sees self as too fat, even when very underweight.

Signs of under eating may include:

- Hiding or discarding food
- Obsessively counting calories and/or grams of fat in the diet
- Denial of feelings of hunger
- Developing rituals around preparing food and eating
- Compulsive or excessive exercise
- Social withdrawal
- Pronounced emotional changes, such as irritability, depression and anxiety

Physical signs of anorexia include rapid or excessive weight loss; feeling cold, tired and weak; thinning hair; absence of menstrual cycles in females; and dizziness or fainting. Adolescents with anorexia often restrict not only food, but relationships, social activities and pleasurable experiences.

Over Eating They may typically 'binge and purge' by engaging in uncontrollable episodes of overeating (bingeing) usually followed by compensatory behavior such as: purging through vomiting, use of laxatives, enemas, fasting, or excessive exercise. Eating binges may occur as often as several times a day but are most common in the evening and night hours.
Teenagers with bulimia often go unnoticed due to the ability to maintain a normal body weight.

Signs of over eating may include:

- Eating unusually large amounts of food with no apparent change in weight
- Hiding food or discarded food containers and wrappers
- Excessive exercise or fasting
- Peculiar eating habits or rituals
- Frequent tips to the bathroom after meals
- Inappropriate use of laxatives, diuretics, or other cathartics
- Overachieving and impulsive behaviors
- Frequently clogged showers or toilets

Most of the physical signs and symptoms associated with binge eating disorder are long-term including weight gain (often leading to obesity), high blood pressure, diabetes, irregular menstrual cycle, skin disorders and heart disease.
Similar to bulimia, binge eating disorder is commonly diagnosed if teenagers binge on average.

NUTRITION DURING ADULTHOOD

In adults requirements for energy and nutrients do not change greatly between the ages of 19 and 50 years, except during pregnancy or lactation, but do vary according to gender and activity levels. The keys to healthy eating are:

- **Enjoy the wide variety of foods**
  We need more than 40 different nutrients for good health and no single food can supply them all. That's why consumption of a wide variety of foods (including fruits, vegetables, cereals and grains, meats, fish and poultry, dairy products and fats and oils), is necessary for good health and any food can be enjoyed as part of a healthy diet.

- **Eat regularly**
  Scheduling eating times also ensures that meals are not missed, resulting in missed nutrients that are often not compensated for by subsequent meals.

- **Balance and moderation**
  Balancing your food intake means getting enough, but not too much, of each type of nutrient. If portion sizes are kept reasonable, there is no need to eliminate favourite foods. There are no "good" or "bad" foods, only good or bad diets. Any food can fit into a healthy lifestyle by remembering moderation and balance.

- **Maintain a healthy body weight and feel good**
  A healthy weight varies between individuals and depends on many factors including gender, height, age and heredity. Excess body fat results when more calories are eaten than are needed. Those extra calories can come from any source - protein, fat, carbohydrate or alcohol - but fat is the most concentrated source of calories. Physical activity is a good way of increasing the energy (calories) expended and it can also lead to feelings of well-being.

- **Don't forget fruits and vegetables**
  An increased intake of fruits and vegetables ensures daily intake of vital nutrients and the majority are naturally low in fat and calories. Nutritionists are paying much more attention to fruits and vegetables as "packages" of nutrients and other constituents that are healthful for humans. The "antioxidant hypothesis" has drawn attention to the role of micronutrients found in fruits and vegetables like vitamins C and E , as well as a number of other natural protective substances. The carotenes (beta-carotene, lutein and lycopene), the flavonoids (phenolic compounds that are widespread in commonly consumed fruits and vegetables such as apples and onions and beverages derived from plants like tea, cocoa and red wine) and the phytoestrogens (principally isoflavones and lignans), are being demonstrated to have beneficial roles in human health.’

- **Fats in moderation**

Fat is essential for good health. Fats provide a ready source of energy and enable the body to absorb, circulate and store the fat-soluble vitamins A, D, E and K. Fat-containing foods are needed to supply "essential fatty acids" that the body cannot make.

Table- Nutritional requirements in adulthood (Man)

Groups	Category/Age	Reference Body weight (Kg)	Energy (Kcal/d)	Protein (g/d)	Fat (g/d)	Calcium (mg/d)	Iron (mg/d)	Zinc (mg/d)	Vit-C (mg/d)
Men	Sedentary work	60	2320	60.0	25	600	17	12	40
	Moderate work		2730		30				
	Heavy work		3490		40				

Table- Nutritional requirements in adulthood (Woman)

Groups	Category/Age	Reference Body weight (Kg)	Energy (Kcal/d)	Protein (g/d)	Fat (g/d)	Calcium (mg/d)	Iron (mg/d)	Zinc (mg/d)	Vit-C (mg/d)
Women	Sedentary work	55	1900	55.0	20	600	21	10	40
	Moderate work		2230		25				
	Heavy work		2850		30				

A sample meal plan for a day is given for your reference

Meal Timing	**Food Item**	**Amount**
Breakfast	Milk Vegetable Poha	1 glass 1 bowl
Mid Morning	Seasonal fruit	1no.
Lunch	Salad Roti /Veg.pulav Dal/Kadhi/Sambhar Brinjal potato Vegetable Raita	1 plate 4no./4 ladle 1 bowl 1 bowl 1 bowl
Evening	Tea Roasted gram/Sprouts	1cup 1 handful
Dinner	Salad	1 plate

	Roti / Rice Mixed dal Lady finger	4no./4 ladle 1 bowl 1 bowl
Bed Time	Milk	1 glass

NUTRITION DURING OLD AGE

Beginning at age fifty-one, requirements change once again and relate to the nutritional issues and health challenges that older people face. A senior citizen is an Indian citizen who is at least 60 year old. Old age is not a disease but a biological process that no one can avoid. A little care and caution will prevent or delay many disabilities. After age sixty, blood pressure rises and the immune system may have more difficulty battling infections. The skin becomes more wrinkled and hair turns gray or white or fallen out, resulting in hair thinning. Older adults may gradually lose an inch or two in height. Also, short-term memory might not be as keen as it once was.

In addition, many people suffer from serious health conditions, such as cardiovascular disease and cancer. Being either underweight or overweight is also a major concern for the elderly. However, many older adults remain in relatively good health and continue to be active into their golden years.

Defining the specific nutritional needs

Good nutrition is often the key to maintaining health later in life. In addition, the fitness and nutritional choices made earlier in life set the stage for continued health and happiness.
Eating right and staying fit are important no matter what your age, therefore following nutrients become especially important for good health.

As we get older our bodies have different needs, therefore following nutrients become especially important for good health.

Calcium and Vitamin D

Older adults need more calcium and vitamin D to help maintain bone health. Have three servings of calcium-rich foods and beverages each day. This includes fortified cereals and fruit juices, dark green leafy vegetables, canned fish with soft bones, milk and fortified plant beverages. If you take a calcium supplement or multivitamin, choose one that contains vitamin D.

Vitamin B_{12}

Many people older than 50 do not get enough vitamin B12. Fortified cereal, lean meat and some fish and seafood are sources of vitamin B12. Ask your doctor or a registered dietitian nutritionist if you need a vitamin B12 supplement.

Fiber

Eat more fiber-rich foods to stay regular. Fiber also can help lower your risk for heart disease and prevent Type 2 diabetes. Eat whole-grain breads and cereals, and more beans and peas — along with fruits and vegetables which also provide fiber.

Potassium

Increasing potassium along with reducing sodium (salt) may lower your risk of high blood pressure. Fruits, vegetables and beans are good sources of potassium. Also, select and prepare foods with little or no added salt. Add flavor to food with herbs and spices.

Eating problems in Elderly

Eating problems are caused due to ageing process. Following dietary modification are suggested to various resolve dietary issues.

- **Chewing difficulties-** loosened teeth, ill- fitting or decreased saliva secretion can all result in chewing discomfort or difficulties. It is suggested to chop or grind, modify food texture by pureeing in blenders before eating or cook food thoroughly until tender.
- **Reduced taste-** Deterioration of taste buds leads to reduced taste. To add flavor use herbs or spices such as ginger, garlic, mint etc.
- **Dry mouth-** Caused due to reduced saliva production. Choose moist food such as congee, mashed gourd or steamed egg pudding. Drink some water to moisten the mouth before meals or chew on some fresh lemon slices to stimulate saliva secretion.
- **Poor digestion-**Reduced saliva and digestive juices may lead to poor digestion and nutrient absorption, which is often associated with symptoms such as nausea and flatulence after meals. Advise to consume small, frequent meals and chew slowly..Avoid lying down right after meals.
- **Poor appetite-** Side effect of drugs taken for illness, gastrointestinal discomfort. To treat have small, frequent meals, use herbs or spices such as ginger, garlic or dried tangerine peel etc.

A sample meal plan for a day is given for your reference

Meal Timing	Food Item	Amount
Breakfast	Milk Porridge	1 glass 1 bowl
Mid Morning	Seasonal fruit	1
Lunch	Salad, grated Roti / Rice / khichri Green leafy vegetable Curd/ Raita	1 Plate 2no./2 ladle/1 big bowl 1 bowl 1 bowl
Evening	Tea Besan paneer chilla/upma	1cup 1-2 no./1 bowl

Dinner	Mix Vegetable Soup Roti / Rice / Khichri Moong dal Pumpkin	1 bowl 2no./2 ladle/1 big bowl 1 bowl 1 bowl
Bed Time	Milk	1 cup

NUTRITION DURING PREGNANCY

A normal, full-term pregnancy is 40 weeks, and can range from 37-42 weeks. It's divided into three trimesters. Each trimester lasts between 12 and 14 weeks, or about three months.

Each trimester comes with its own specific hormonal and physiological changes. Being aware of the ways that growing baby is affecting a women's body will assist to better prepare for these changes as they happen.

The first trimester lasts from the first through the 13th week of pregnancy. Although a women may not look pregnant during the first trimester, but the body is going through massive changes as it accommodates a growing baby.

In the first few weeks following conception, hormone levels change significantly. The uterus begins to support the growth of the placenta and the fetus, the body adds to its blood supply to carry oxygen and nutrients to the developing baby, and the heart rate increases.

The first trimester is vital for the development of baby .The baby will develop all of its organs by the end of the third month, so this is a crucial time. It's important to maintain a healthy diet.

The second trimester (weeks 13-27) is the most comfortable period of time for the majority of pregnant women. Most of the early pregnancy symptoms will gradually disappear.

An abdomen will start to look pregnant, as the uterus will grow rapidly in size. While the discomforts of early pregnancy should ease off, there are a few new symptoms to get used to. Common complaints include leg cramps and heartburn. Women might feel more hungary and her weight will increase and backache may become evident.

The third trimester lasts from the 28th week through to the birth of your baby.

During the third and final trimester of pregnancy, a baby's eyes, bones, organs, brain and lungs are developing and the nutritional needs are increasing. In addition to a baby's rapid growth, a women's body is preparing to give birth. A healthy diet, packed with nutritious foods, is just as important now as it was during the first two trimesters of pregnancy.

A balanced diet is important in promoting the growth and development of the fetus and safeguarding the health of the mother. Recommended Dietary Allowances (RDA) for a pregnant women-(ICMR 2010) are given below in table for determining the nutritional needs-

Table- Nutritional requirements in pregnancy

Energy (Kcal/d)	Protein (g/d)	Fat (g/d)	Calcium (mg/d)	Iron (mg/d)	Zinc (mg/d)	Vit-C (mg/d)	Folate (µg/d)
1900+350	55+23	20+10	600+600	21+14	10+2	40+20	200+300

=2250	=78	=30	=1200	=35	=12	=60	=500

Meeting Nutritional Requirements

A diet throughout the lifecycle help women to begin pregnancy without deficiencies and meet increased demands of nutrients. Fortified foods with iron, iodine, folic acid or vitamin A may be promoted through nutrition counseling and mass media wherever available and affordable. Nutrition counseling should be done not only to pregnant women but also to their husband and other members.

Dietary diversification can be promoted by promoting kitchen gardening so as to make foods available and affordable, wherever feasible. Motivate women and their families to take small steps to improve maternal diet. Dietary diversification can be implemented by following food groups recommendations as given in Table 1. For calculations of nutritional requirements Reference women is aged between 18-29 years, non pregnant and non lactating (NPNL) and weighs 55kg with a height of 1.61m and a body mass index (BMI) OF 21.2, is free from a disease and physically fit for active work.

Dietary guidelines

- Small and frequent feedings should be taken. Fasting or missing meal should be avoided.
- Consumption of eggs and other non vegetarian foods help in meeting increased protein requirement.
- More fibre should be included in the diet to prevent constipation which is a common problem during pregnancy. 5-6 serving of fruits and vegetables should be included in the daily diet.
- Diet should be rich in calcium to prevent osteomalacia. Calcium supplements may also be taken. A minimum of 3 glasses of milk should be taken.
- Iron rich foods should be taken to prevent anemia and to build up iron stores in the foetal body. Iron supplements may be taken. Heme iron is better absorbed. Inclusion of green leafy vegetables ensures minerals like calcium and iron.
- Diet should contain optimum amount of sodium. In case of edema or hypertension, sodium is restricted.
- Raw fruits and vegetables are to be included in the diet to meet vitamin C and fibre requirement.
- Plenty of water should be taken to keep to keep the bowels regular.
- Fatty rich foods, fried foods, excessive seasoning, strongly flavored vegetables may be restricted in case of nausea and gastric distress.
- Too much of coffee or tea.
- The diet should included fish, flax seed and soybean to meet the requirement of ω-3 fatty acids.
- Fluids should be taken between meals rather than along with the meals.
- Adequate amount of calories should be taken so that enough fat is deposited during pregnancy which is required for lactation.

- Sugar substitute should be used in moderation during pregnancy as the fetus are inconclusive.
- Weight reduction regimens are not recommended because the defect of ketosis on the fetus.

Special Considerations in pregnancy

Nausea

Nausea during pregnancy is typically one of the most experienced and complained about symptoms that women report. Up to 70 percent of expectant mothers experience nausea at some point during early pregnancy

To help prevent and treat nausea during pregnancy, try avoiding foods and smells that trigger your nausea. Eating smaller meals more frequently throughout the day instead of three big meals. Drinking less water/fluids with your meals, and instead, drink them between meals. Eating drier, plain foods such as white Rice, dry toast, or a plain baked potato instead of richer, creamier foods. Sniffing ginger or lemons, or drinking ginger ale or lemonade, which can help ease.

Vomiting

Vomiting during pregnancy is a common occurrence, with as many as **60-70% of pregnant women** experiencing vomiting. The specific cause of vomiting during pregnancy is not known. The fluctuation in hormone levels during pregnancy could be one contributing factor. Hormones slow down digestion, which could trigger heartburn, indigestion, and acid reflux, which are all considered possible symptoms of pregnancy and potential triggers of vomiting during pregnancy.

Heart burn

Early in pregnancy, the body produces large amounts of the hormones progesterone, which tend to relax smooth muscle tissues throughout your body, including those in gastrointestinal (GI) tract. As a result, food sometimes moves more slowly through your system, resulting in indigestion issues of all kinds, from that bloated, gassy feeling to heartburn. To avoid heartburn do not eat and drink food at the same time. Avoid foods triggering heart burn.

Constipation

Constipation occurs when there is abdominal pain or discomfort, difficult and infrequent bowel movements, and the passage of hard stools. Unfortunately, constipation affects approximately half of all women at some point during their pregnancy.

To prevent constipation consume a high fibre diet containing whole grains and legumes, fruits and vegetables and fluids. It is advised to exercise regularly.

A sample meal plan for a day is given for your reference

Meal Timing	Food Item	Amount
Early Morning-	Tea Homemade snack	1 cup 2 no.
Breakfast-	Milk Vegetable Poha Fruit	1 glass 1 bowl 1 medium
Mid Morning-	Fruit	1 no.
Lunch-	Salad Roti/Rice Moong dal Bottle gourd Curd	1 Plate 3 no./3 ladle 1 bowl 1 bowl 1 bowl
Evening Tea-	Tea Vegetable Upma Nuts	1cup 1 bowl 5-6no.
Dinner-	Salad Roti / Rice Mixed dal Matar paneer	1 Plate 3 no./3 ladle 1 bowl 1 bowl
Bed Time-	Milk	1 glass

NUTRITION DURING LACTATION

A woman's nutritional requirement are maximum during lactation compared to any other age group, hence the diet should be balanced and meet the requirement.

Lactating or breastfeeding mothers generally need more calories to meet their nutritional needs of both baby and mother and breast milk production. 450 to 500 kilocalories (kcal) additional calories per day is recommended for well-nourished breastfeeding mothers, compared with the amount they were consuming before pregnancy (approximately 2,300 to 2,500 kcal per day for breastfeeding women verses 1,800 to 2,000 kcal per day for moderately active, non-pregnant women who are not breastfeeding).

In addition to providing nutrients, breast-milk has several special components such as growth factors, enzymes, hormones and anti-infective factors. The amount Exclusive breast-feeding (EBF) ensures safe nutrition to the infant and all round development. An average Indian woman secretes about 750 ml of milk per day during the first 6 months and 600 ml/day subsequently up to one year. Breast-milk provides good quality proteins, fat, vitamins, calcium, iron and other minerals.

Mother-infant contact should be established as early as possible (immediately after birth) by permitting the infant to suck at the breast. Mothers can breast-feed from as early as 30 minutes after delivery. Colostrum should be made available to the infant immediately after birth. Feeding honey, glucose, water or dilute milk formula before lactation should be avoided and the infant

should be allowed to suck, which helps in establishing lactation. Colostrum should not be discarded, as is sometimes practiced.

Weight gain beyond that desirable for body size, should be avoided. When he baby is weaned, the mother must reduce her food intake in order that obesity may be avoided.

Table- Nutritional requirements in lactation

	Energy (Kcal/d)	Protein (g/d)	Fat (g/d)	Calcium (mg/d)	Iron (mg/d)	Zinc (mg/d)	Vit-C (mg/d)	Folate (µg/d)
0-6 months	1900+600 =2500	55+19 =74	20+10 =30	600+600 =1200	21	12	40+40 =80	200+100 =300
6-12 months	1900+520 =2420	55+13 =68	20+10 =30	600+600 =1200	21	12	40+40 =80	200+100 =300

A sample meal plan for a day is given for your reference

Meal Timing	**Food Item**	**Amount**
Early Morning-	Tea Homemade snack	1 cup 2 no.
Breakfast-	Milk Porridge Nuts/ Dates	1 glass 1 bowl 5-6 no.
Mid Morning-	Seasonal fruit	1 no.
Lunch	Salad Roti/ Rice Dal/Kadhi/Sambhar Green Leafy vegetable Vegetable Raita	1 Plate 3 no./ 3 ladle 1 bowl 1 bowl 1 bowl
Evening Tea	Tea/ Milk Paushtik Ladoo	1cup 1no.
Dinner	Salad Roti/ Rice Dal/Sambar Bottle gourd Sweet dish	1 Plate 3 no. / 3 ladle. 1bowl 1 bowl 1 bowl

Unit 3 : Public Health and Nutrition: Basic Concept

Chapter 1: Human development index and Sustainable development goals

Human Development Index (HDI): Basic Concepts

The Human Development Report (2016) released by the United Nation Development Programme (UNDP) ranks India 131 out of 188 countries. Every year UNDP ranks countries based on human development index. What is the Human development Index and how is it measured?

Human Development Index is a statistical tool which ranks countries by level of human development i.e. measure of a countries overall achievement in its social and economic dimensions. You may be wondering what these social and economic dimensions are? The social and economic dimensions of a country are based on: i) the health of the people, ii) level of education attainment, and iii) the standard of living. Refer to Figure 1

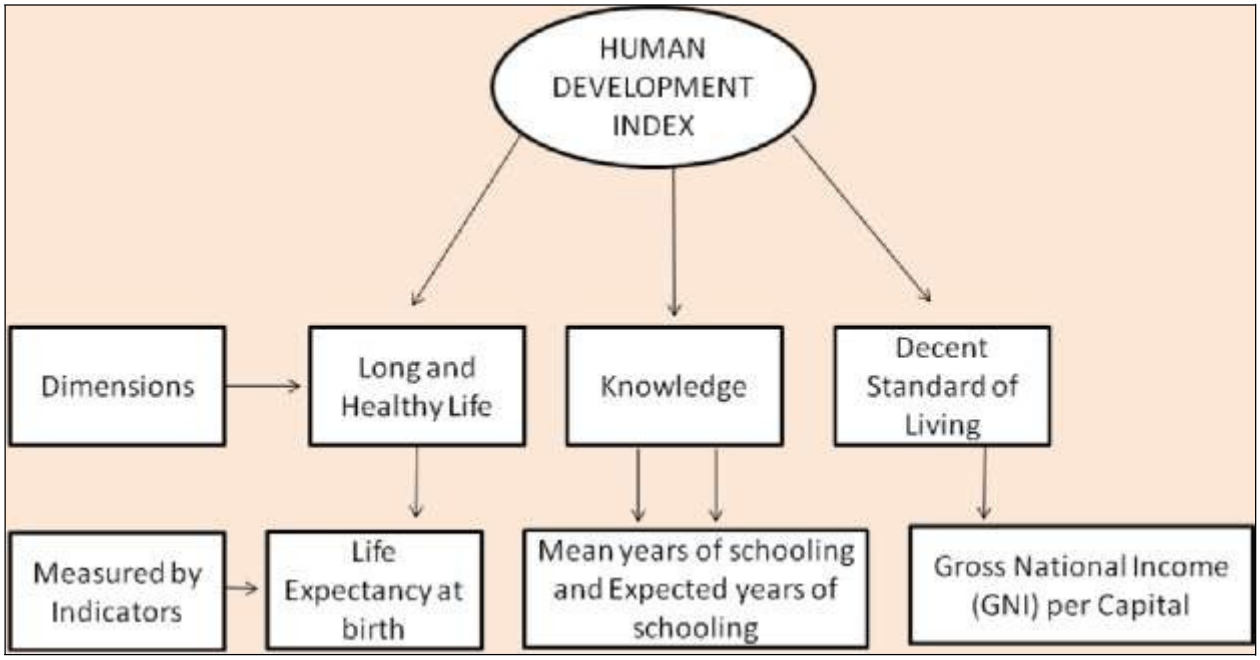

Figure 1(a): Components of human development index

The calculation of the human development index therefore combines four major indicators namely

1. Life expectancy at birth: Number of years a new born infant could expect to live if prevailing pattern of age specific mortality rates at the time of birth stays the same throughout the infant's life.
2. Expected years of schooling for education:
3. Mean years for schooling for education: average number of years of education

received by people age 25 and older, and

4. Gross National Income per Capita for Standard of living.

The HDI is a measure for assessing progress in human development based on a long and healthy life, access to knowledge and access to decent level of living. .These indicators are then combined to generate an HDI score between zero and one. India's human development index (HDI) value of 0.624 puts it in the "Medium Human development" category. The world's top three countries in HDI are Norway (0.949), Australia (0.939) and Switzerland (0.939).

The next topic of interest is Sustainable Development Goals (SDG). These goals are an attempt to galvanize global effort towards social mobilization for a healthy community. Let's get to know them.

Sustainable Development Goals (SDG's)

Many of you may have heard or read about the Millennium Development Goals (MDG's) which were the anti-poverty initiative set up in 2000 by United Nation. Eight goals were set out in this Millennium declaration adopted globally which was largely successful but many shortfalls remained in this 15 year effort.

The SDG's replace the MDG's. In September 2015, the United Nation (UN) General Assembly adopted the 2030 agenda for Sustainable Development. This new agenda emphasized a holistic approach to achieve sustainable development for all which included 17 goals featuring 169 targets to be implemented from 2015 to 2030. These goals are adopted by member countries of UN, including India.

What are these 17 Goals?

Refer to Figure 9 which illustrates these 17 goals. Having read the Goals you would have realized that that all SDG's are interconnected. They are a universal call to end poverty.

Figure1(b): Sustainable development goals

But as a student of Nutrition, the goals and targets which should concern us the most include the following three as also highlighted in Box 2.

Goal 2: End hunger;

Goal 3: Good Health and well-being; and

Goal 6: Clean Water and Sanitation.

The target of reducing by 2030, all forms of malnutrition, including stunting and wasting in children under 5 years of age, is critical for India.

BOX 2: TARGETS FOR GOAL 2, 3 AND 6

Goal 2: End Hunger

Achievefoodsecurityandimproved nutrition and promote sustainable agriculture

TARGETS

- By 2030, end hunger and ensure access by all people, in particular the poor and people in vulnerable situations, including infants, to safe, nutritious and sufficient food all year round.
- By 2030, end all forms of malnutrition, including achieving by 2025, the internationally agreed targets on stunting and wasting in children under 5 years of age, and address the nutritional needs of adolescent girls, pregnant and lactating and older persons.

Goal 3: Good Health and Well Being

Ensurehealthy lives and promote well- being for all ages

- By 2030 reduce the global materna mortality ratio to less than 70 per 100000 live births
- By 2030 end preventable death of newborns and children under 5 years of age, with all countries aiming to reduce neonatal mortality to at least as low as 12 per 1000 live births and under-5 mortality to at least as low as 25 per 1000 live births
- By 2030, end the epidemic of AIDS, tuberculoses, malaria and combat hepatitis, water borne diseases and other communicable diseases

Goal 6: Clean Water and Sanitation

Ensure availability and sustainable management of water sanitation for all

TARGETS

- By 2030, achieve universal and equitable access to safe and affordable drinking water for all
- By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations

Chapter 2: Malnutrition

We begin our study with a brief understanding of public health nutrition. What is public health nutrition and as a public health nutritionist what activities one would be involved with? Let's find out.

Public Health Nutrition: Basic Concept

Nutrition, as you may be aware, is one of the major determinants of the health and well-being of individuals in a society. So an area of study which emphasizes the application of food and nutrition knowledge, policy and research to the improvement of health of populations is called public health nutrition. It is primarily concerned with improving nutrition in population groups. Study of public health nutrition may, therefore, include an understanding of:

- the most critical social, behavioural and food and nutrition factors that affect health,
- nature, causes and consequences of nutrition problems, malnutrition in a society,
- nutritional requirements and dietary guidelines for populations,
- design, planning, implementation and evaluation of nutritional programmes and how they can improve the nutritional status of the population,
- how nutrition related and food related public policies affect health especially in vulnerable groups,
- Nutrition education for behaviour changes etc.

The activities mentioned above are by no means a complete list of activities undertaken within the public health nutrition domain. But surely they give you an idea about this area of study.
It may be emphasized that public health nutrition is a vast field and has many aspects to it. At this stage we are not required to dwell on these various activities.

Nutritional problems, malnutrition - their causes, consequences, you have learnt form a major part of study of public health nutrition. So let us begin our study of this unit with a review on the concept, definition, causes and consequences of malnutrition.

Malnutrition: Basic Concept, Causes and Consequences

When you think of malnutrition what picture comes to your mind? Yes very often we picture malnutrition as undernutrition. We tend to picture a thin starved individual as malnourished. Malnutrition, in fact is "poor nutrition". But what we fail to understand is that malnutrition is an

impairment of health resulting not only from a deficiency or lack of food/nutrients but also when there is excess or imbalance of nutrients in the diet.

So when we talk of malnutrition we refer to both:

- Under nutrition: not getting enough nutrients, and
- Overnutrition: getting more nutrients than the body needs.

Nutrients are essential substances present in food necessary of bodily functions including proteins, carbohydrates, fats, vitamins and minerals

Figure 2(a) illustrates the concept:

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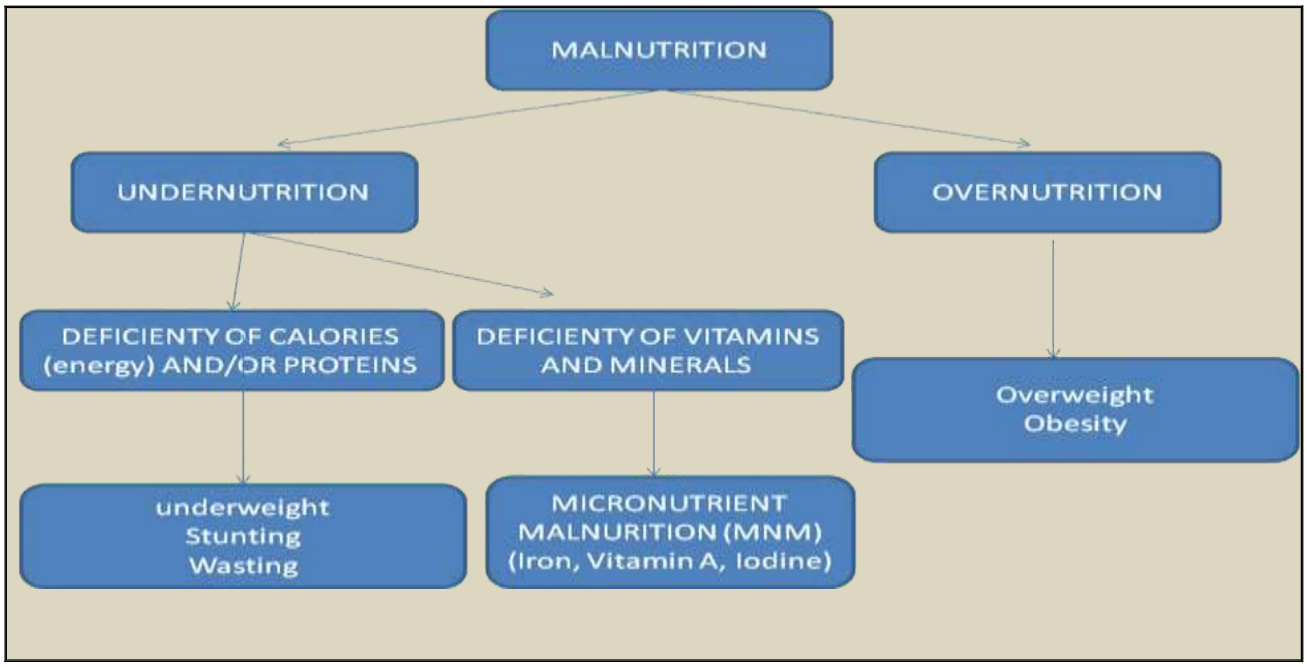


Figure 2(a): Malnutrition

Under nutrition is a condition which occurs when there is lack of adequate energy, protein and/or micronutrients (like iron, vitamin A etc.) in the diet. The basic requirement of nutrients for growth, development, body maintenance is not met leading to poor growth or protein energy malnutrition or deficiency diseases like anemia, permanent blindness etc. Overnutrition , on the other hand, is a form of malnutrition that occurs when we take more (or excess) of a nutrient than the body needs every day. Consumption of excess energy is an example of over nutrition leading to overweight or obesity. Overweight and obesity are defined as "abnormal or excessive fat accumulation that present a risk to health".

What are the factors contributing to malnutrition? Let us review.

Causes of Malnutrition

There can be many underlying causes of malnutrition. A conceptual framework on the causes of malnutrition was developed in 1990 by UNICEF. The framework shows that causes of malnutrition are multi-sectoral and classified as - Basic, underlying and Immediate as highlighted in Figure 2(b).

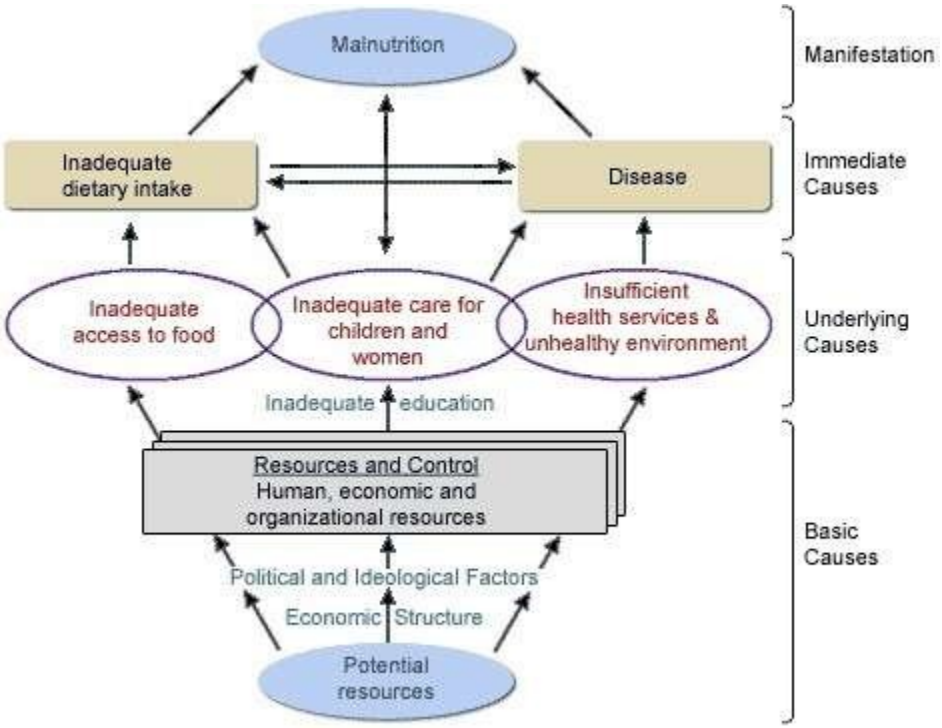


Figure 2(b): Causes of Malnutrition - UNICEF Framework

Immediate causes of malnutrition are at individual level including inadequate dietary intake and frequent illness and diseases. An individual's dietary intake and exposure to disease are affected by underlying factors at household/family level such as lack of availability of, access to and/or utilization of diverse diet, inadequate care and feeding practices for children combined with unhealthy household and surrounding environment and inaccessible and inadequate health care. Basic causes including the social, economical and political factors that neglect human rights, perpetuates poverty, denying the access of vulnerable populations to essential resources. These function at the Society level.

The causes of undernutrition and overnutrition are in many ways similar and interlinked. Factors such as poverty, lack of knowledge and access to adequate diet, poor infant and young child feeding practices, inadequate health care etc can lead to undernutrition as well as overweight and obesity.

Next let us get to know the consequences of malnutrition

Consequences of Malnutrition

The consequences linked with malnutrition can be devastating. Before we study the consequences let us get to know who are more likely to be suffering from malnutrition. Malnutrition affects first and foremost children under age of two, but young children under five years of age, adolescent, pregnant, lactating mothers, the elderly and the chronically ill are also vulnerable.

Malnutrition increases the risk of mortality (death) and morbidity (illness). In the long term chronic malnutrition during pregnancy and early childhood manifest as stunted growth (low height for age) and wasting (low weight for height). Children who are malnourished in the early years of life fail to grow and develop to their full potential, both physically and mentally. The consequences of stunting extend to adulthood increasing the risk of poor pregnancy outcome (i.e. the newborn is of low birth weight), impaired cognition that results in poor school performance, reduced economic productivity and earning. Stunted growth in early years increases the risk of overweight later in life and subsequently non communicable diseases such as cardiovascular diseases, diabetes, and hypertension.

Diets that are inadequate in terms of micronutrients (iron, iodine, Vitamin A) can lead to serious illness, including anaemia (iron deficiency), mental retardation and permanent blindness. People who suffer from malnutrition have fewer defenses against diseases i.e. have low immunity. They fall ill faster and easily and are less able to recover quickly and completely from the disease. Malnutrition increases the risk of infection and with infection there is reduced appetite, malabsorption which in turn increases the body's need for nutrients and leading to malnutrition creating a vicious cycle of malnutrition and infection.

Summary of the consequences of malnutrition are illustrated in Figure 2(c).

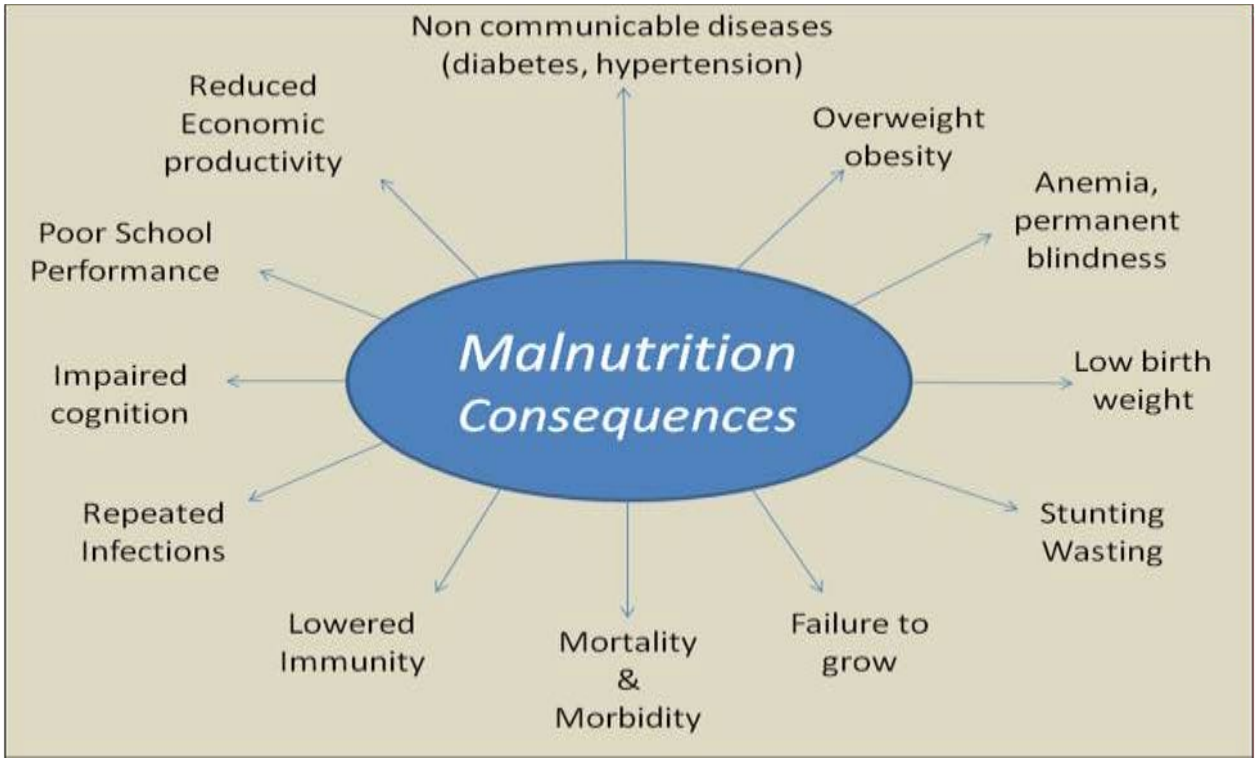


Figure 2(c): Consequences of malnutrition

Having considered the consequences of malnutrition it is important for us now as public health/ nutrition students to be able to assess/identify individuals who are suffering from malnutrition or identify population groups or individuals who are at risk of malnutrition. How do we identify which individual is of optimal health, who is underweight or overweight or obese or suffering from a nutrient deficiency? How do we get to know the severity and magnitude of the nutritional problem? Are there any indicators? How do we assess the nutritional status? Our next section deals with this. But before we start the new section, here are few checks your progress exercises.

CHAPTER 2: METHODS FOR ASSESSMENT OF NUTRITIONAL STATUS

Nutritional status of individuals is influenced by the diet (food intake) and the utilization of the nutrients but also by some internal external environmental factors. By studying these factors we can determine the nutritional status. Certain methods are used to assess nutritional status. We tend to classify them as direct methods and indirect methods. Here we will only focus on the Direct Methods of nutritional status assessment.

> Nutritional status refers to the state of health of an individual as it is affected by the intake and utilization of nutrients (proteins, carbohydrates, fats, vitamins and minerals.

Direct methods used for assessment of nutritional status may be summarized as ABCD:

Anthropometric Measurements

Biochemical assessment

Clinical Methods, and

Dietary assessment

A. Anthropometric Measurements

The term Anthropometry literally means: Anthro = Man and Pometry = Measure

Anthropometry is the measurement of human body at various ages and level of nutritional status.

The most commonly used measurements include:

- Measurement of body weight,
- Measurement of standing height or crown heel length,
- Measurement of body circumferences, and
- Body fat (Skinfold measurement)

In children the three most commonly used anthropometric indices to assess their growth status are weight for age, Height/length for Age and Weight for Height. Let us briefly review each of these anthropometric indices.

i) Weight for Age

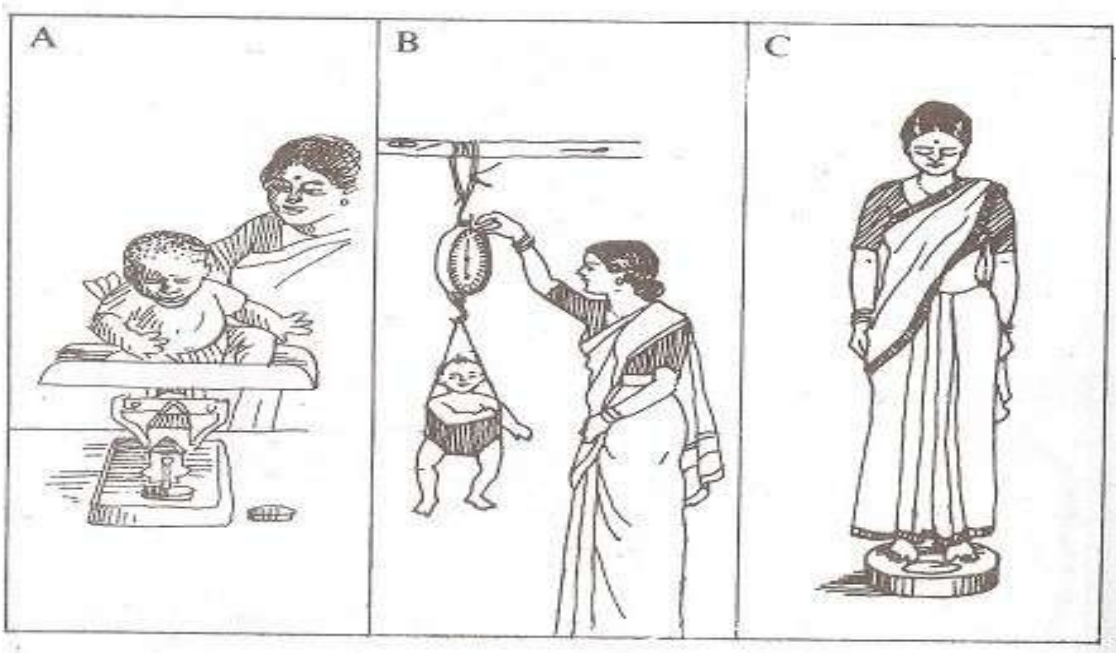
Body weight indicates body mass and is a composite of all body constituent such as water, mineral, fat, protein and bone. Repeated measurement of weight at regular period is a sensitive indicator of change in nutritional status. So any small changes or rapid changes in body weight of individuals, particularly children detected over a short period of time which may be due to poor diet and/or short duration illness and/or infection (such as diarrhoea) etc., indicates potential malnutrition. Weight is, therefore, indicative of short term malnutrition.

Along with weight, appropriate age assessment is also necessary for assessment of nutritional status. Why? Because we all know that body measures such as weight, height etc. increases with age. So if the correct age is not known it might not be possible to have an accurate assessment.

So Weight-for- Age is used as a measure of nutritional status. A low weight for age is referred to as underweight.

LOW WEIGHT FOR AGE is indicative of UNDERWEIGHT and of Short term malnutrition

Various types of weighing instruments are available to measure weight as highlighted in Figure 3(a).

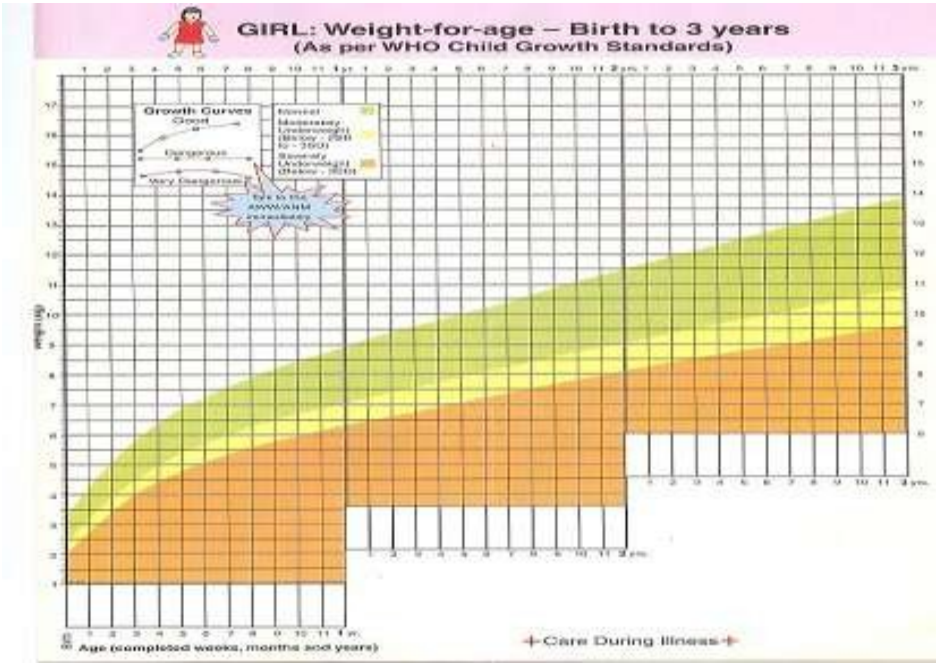


a) Balance Beam b) Spring Scale c) Electronic scale

Figure 3(a): Weighing Scale

The next question then you may ask is how do we know that the actual weight measurement obtained for an individual is normal or appropriate for his/her age? For this we need to compare the actual obtained weight with a set of values called STANDARDS. In India for children we use the WHO GROWTH Standards (2006) to compare the data. These Standards are primarily average body measurements of well nourished and healthy children (belonging to well-to-do-society) who are medically and socially well protected and these values are used for purpose of comparison. Tables providing the WHO Standard measurements are given in Annexure 1 at the end of this unit for your reference.

Alternatively weight obtained can be plotted against age on a graph/chart so that growth pattern can be followed graphically in comparison to reference standards. This process is called Growth Monitoring. The charts used are Growth Charts which are designed as a means of monitoring and interpreting changes in weight over time. Refer to Figure 3(b) which illustrates the Growth chart



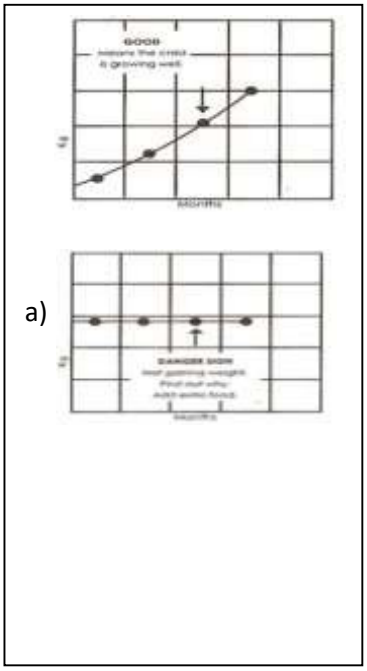


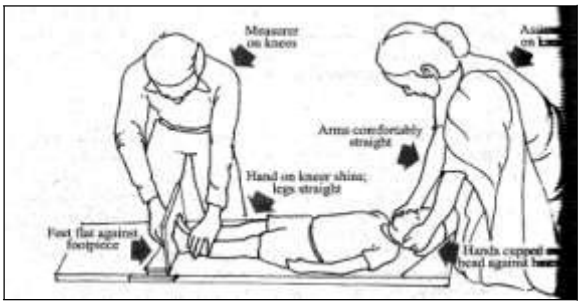
Figure 3(b): Growth Chart

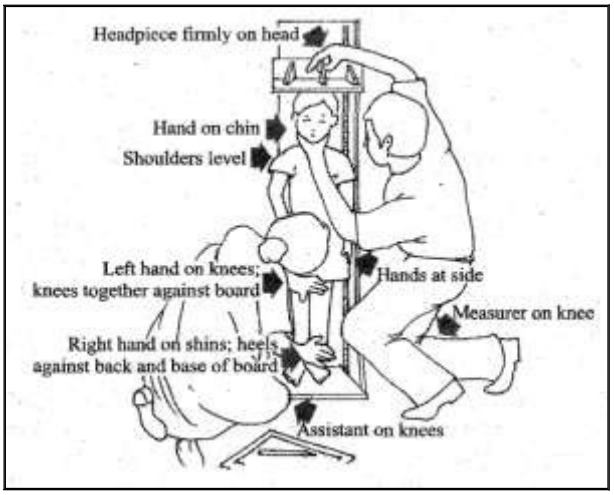
If plotted weight-for-age of a child falls on green band, then the child's growth is NORMAL; if it falls on the yellow band, child is moderately underweight, and if the plotted weight is on the orange band, the child is severely underweight. The growth curve should continue to go up every time the child is weighed .Straight or downward curve indicates poor growth and needs attention.

Next we move on to the second anthropometric measurement i.e. Height/Length.

ii) Length/Height for Age

Length or height is a commonly used measure to assess nutritional status. Length or height reflects the total increase in the size of the individual up to the moment it is determined. In case of infants and children less than 2 years of age length is measured known as crown heel length. The instrument used is called the Infantometer as illustrated in Figure 3(c). In case of children who are more than 2 years of age or in case of adult's standing height is measured. A portable anthopometric rod or tape can be used for measuring height.





a) Length measurement using Infantometer b) Anthropometry Rod

Figure 3(c): Height Measurement

But unlike weight, height changes very slowly to be used by itself to detect changes in growth pattern within a short time period. Hence it is not a very sensitive measure to assess short duration malnutrition. Height is affected by long term nutritional deprivation i.e. a deficiency of one or more nutrient over a long period of time, resulting in stunting - a low height for age. Stunting is consequence of chronic food deficiency. So if you come across a child who has low height for his age in all probability it reflects the cumulative effect of chronic food deficiency (particularly protein and energy insufficiency) and infection over a long period since and even before birth.

LOW HEIGHT FOR AGE is indicative of STUNTING and of chronic malnutrition

A third parameter used in anthropometry is Weight for Height measurement.

iii) Weight-for-Height

By relating the weight of a child to its height or length an objective measure of the child's degree of THINNESS can be obtained. Thinness indicates in most cases a recent and severe process of weight loss which is often associated with acute starvation or insufficient food intake and/or severe infection/disease such as diarrhoea, measles etc. So when weight of the child is low for the height it is called WASTING. Weight-for-Height is a very good index for short duration malnutrition, (like weight for age). Weight-for-Height Standards are available which are included in Annexure 1. In situations where accurate age assessment is not possible or required, this age-independent indicator can be used to assess nutritional status

LOW WEIGHT for HEIGHT is indicative of WASTING and of short duration malnutrition

So we have seen that weight, height and age together and weight and height independent of age are good indicators of child's nutritional status. Recent evidence (National Family Health Survey - 4 , 2015-16) suggests that 38.4% of Indian children under 5 years of age are stunted, 35.7% are underweight and 21% wasted, with 7.5% severely wasted as illustrated in Figure 3(d). Rural children are even worse off. as compared to urban children.

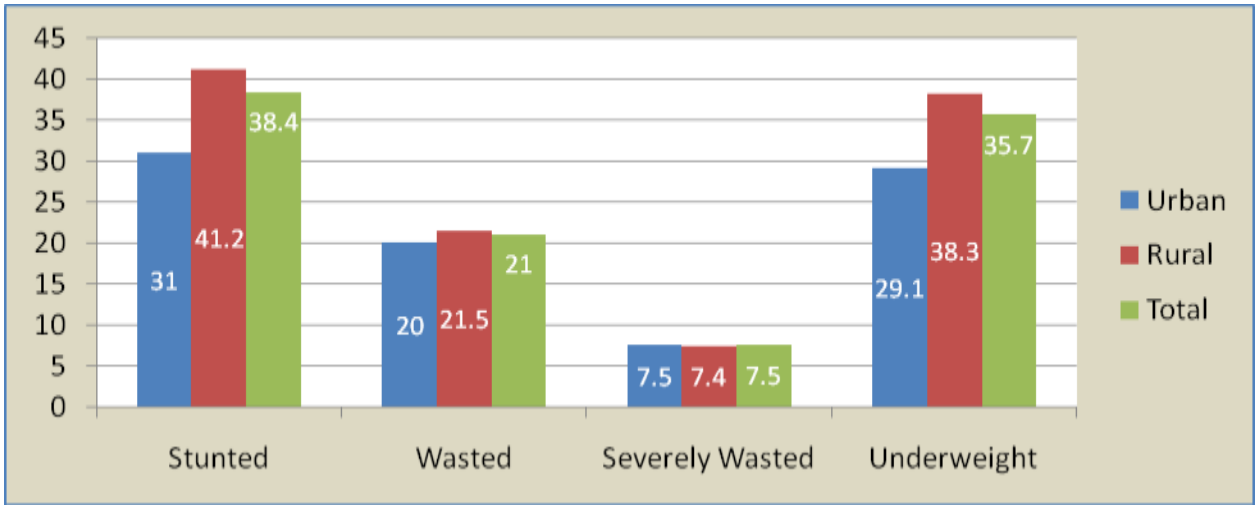


Figure 3(d): Nutritional status of Indian children under 5 years of age Source: (NFHS-4, 2015-2016)

So far we have looked at anthropometric measurements for infants and young children. Next, a review of indices for adults and adolescents follows.

iv) Anthropometric Indices in Adults

In case of adults, Body Mass Index (BMI) is used to assess nutritional status. BMI is a simple index of weight-to-Height used to classify underweight, overweight and obesity in adults. BMI gives a measure of the body fat based on weight in relation to height and applies to most adult men and women aged 20 and over. BMI is defined as the weight (in kg) divided by the square of the Height in meters (kg/m^2).

$$BMI = \frac{\text{Weight (kg)}}{\text{Height (m)}^2}$$

For example if an adult women weigh's 60 kg and her height is 155 centimeters, then BMI for the women would be: $BMI = 60 /(1.55)^2 = 24.97\, kg/m^2$.

The BMI can be interpreted as under:

- BMI < 17.0 indicates moderate and severe thinness
- BMI < 18.5 indicates underweight
- BMI 18.5–24.9 indicates normal weight
- BMI ≥ 25.0 indicates overweight
- BMI ≥ 30.0 indicates obesity

Recent data suggests (NFHS 4, 2015-16) that 22.9% adult Indian women and 20.2 % adult men are underweight. On the other hand, 20.7% women and 18.9% men are overweight or obese. Evidence suggests that high BMI is associated with diabetes and high risk of cardiovascular morbidity and mortality.

iii) Nutritional Indices for Older Children and Adolescent

For children and adolescent, 5 to 19 years of age, BMI is used to assess nutritional status and calculated the same way as for adults. But here BMI is compared with typical values for other children of the same age and sex (WHO Growth Standards 2007). BMI is compared against the percentile for children of the same age and sex. Why? Because, in this group the body fat changes with age and also the body fat differs between boys and girls. BMI- for-age percentile used to classify children and adolescent into different grades of malnutrition are given in Table 1.

Table 1: BMI for Age percentile for Children 5 to 19 years

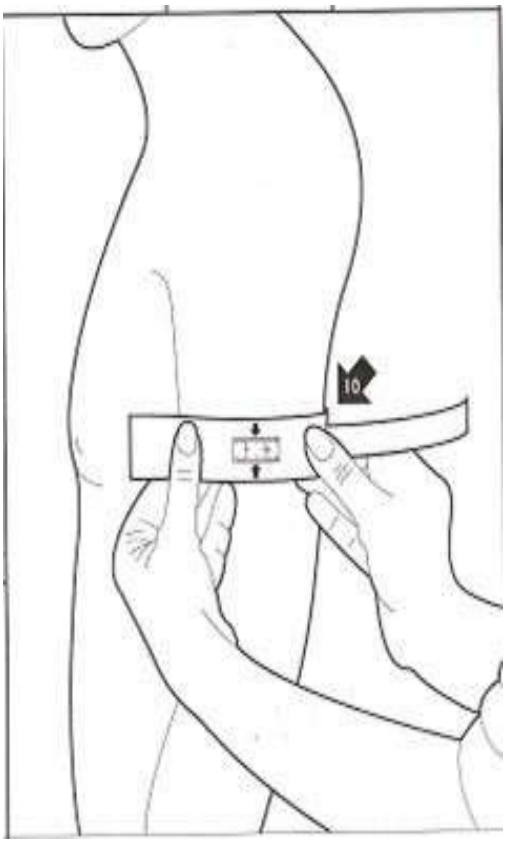
BMI-for-Age Percentile	
Less than 5th percentile	Underweight
5th percentile to less than the 85th percentile	Healthy weight
85th percentile to less than the 95th percentile	Risk of overweight
95th percentile or greater	Overweight

BMI-for-age Standards are given which are included in Annexure 1.

Information regarding other anthropometric measures such as body circumference measurements and body fat measurement is provided in Box 1, under Other Anthropometric Measurements heading.BOX 1: OTHER ANTHROPOMETRIC MEASUREMENTS

Mid-Upper Arm circumference (MUAC) Measurements

Mid-upper arm circumference (MUAC) is commonly measured to assess nutrition status of infants and children. Arm circumference basically includes bone, fat and muscle. Arm circumference increases with age, but between one to five years it does not change much and remains fairly constant. So measuring the MUAC is useful in identifying malnutrition in Children. How? Fat and muscle, you might be aware, are the body's energy and protein reserve. These reserves are reduced in the body when there is not enough food or the body does not absorb the nutrients. So in children suffering from protein energy malnutrition, in early childhood, poor musculature and wasting is common features. Measuring the arm circumference, therefore, is a useful measure for assessing thinness or muscle wasting in children.



The arm circumference can be measured using flexible fibre glass tape and can be interpreted as under:

MUAC less than 110mm (11.0cm), indicates Severe Acute Malnutrition (SAM). The child should be immediately referred for treatment.

MUAC of between 110mm (11.0cm) and 125mm (12.5cm), indicates Moderate Acute Malnutrition (MAM). The child should be immediately referred for supplementation.

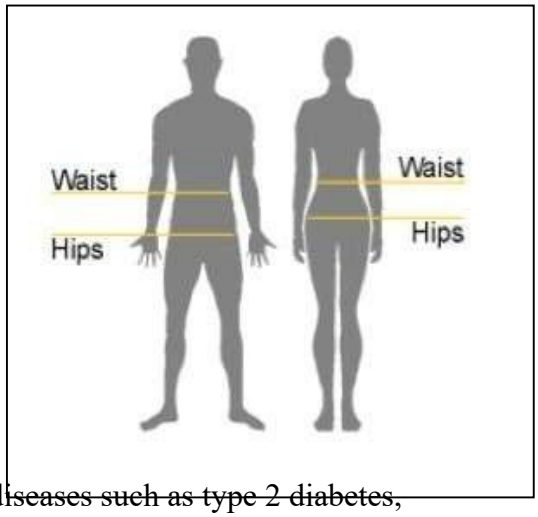
MUAC of between 125mm (12.5cm) and 135mm (13.5cm), indicates that the

BOX 1: OTHER ANTHROPOMETRIC MEASUREMENTS

Waist and Hip Circumference Measurement

Waist circumference (WC) as a tool is used to assess abdominal fat and health status primarily in adults. WC predicts risk over and above that of BMI regarding which we learnt earlier. Waist is measured around the navel in a standing position using a flexible Non-stretchable tape.. Waist circumference at which there is a high risk of ill health is as follows:

HIGH RISK
Men: > 102 cm Women : > 88cm



A high waist circumference indicates a high risk of obesity linked diseases such as type 2 diabetes, hypertension and Coronary Heart disease. Measuring hip circumference (along the widest portion of thehip) along with waist circumference and calculating the waist-hip ratio (WHR) is a good indicator of abdominal obesity. WHR =Waist/Hip

According to World Health Organization. (WHO), a healthy WHR is:

- 0.9 or less in men, and
- 0.85 or less in women

A WHR of >1.0 for men and >0.85 for women is an indicator of abdominal obesity.

Fat Fold Thickness: Assessment of Body Fat

Skinfold thickness measurements have been commonly used to determine percentage of body fat among individuals. We have learnt earlier that BMI provides a simple and useful population- level measure of body fat for all ages of adults. However it can only be considered as a rough guide because it may not correspond to the same body fat percentage in different individuals. Fat distribution in and around the body varies with age, sex, nutritional and health status and ethnicity. BMI does not measure fat directly but relies only on body weight and height and does not take into account overall body composition including body fat, muscle. So under conditions when there is insufficient intake of calories over a long period of time there is reduction in the thickness of the fat layer under the skin. Alternatively when there is excessive intake over a long period of time there can be accumulation of fat under the skin.

Skinfold measurement, therefore, is a simple means of measuring subcutaneous fat i.e. fat under the skin, which is also known a skinfold thickness and is indicative of fat or fat reserves in the body. Fat fold can be measured at triceps (muscle found in the upper arm region), biceps, subscapular or suprailiac region. How can we measure skinfold thickness? Various kind of skinfold calipers are available for measuring skinfold thickness as highlighted in Figure.

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B. Clinical Assessment

Clinical examination is one of the simplest and most practical methods used to assess nutritional deprivation. Nutritional deprivation here refers to deficiency of vitamins, minerals, proteins, energy and other nutrients. When there is nutritional deficiency it is associated with physical signs and symptoms what we refer to as clinical signs which can be valuable aids in detecting malnutrition. Clinical signs are changes (specific and non specific) in the body which are indicative of nutritional deficiency and/or excess. General clinical examination with special attention to organs like mouth, eyes, skin, nails, tongue, muscle, bone etc. is useful. Therefore knowledge of relevant signs and their detection helps in establishing nutritional diagnosis.

Table 2 presents some of the commonly occurring signs and symptoms of nutritional deprivation with their related body parts/system which can be used for the purpose of physical examination in nutritional surveys.

Table 2: -Physical signs indicative or suggestive of malnutrition

Body Area	Normal Appearance	Signs Associated with Malnutrition
General	Healthy and alert	Underweight/overweight, short stature, decreased activity level, wasting.
Hair	Shiny; firm; not easily plucked	Lack of natural shine; hair dull and dry; thin and sparse; depigmented, color changes (flag sign); can be easily plucked, altered texture
Face	Skin color uniform; smooth, pink, healthy appearance; not swollen	Skin color loss (depigmentation); skin dark over cheeks and under eyes; lumpiness or flakiness of skin of nose and mouth; swollen face; enlarged parotid glands; scaling of skin around nostrils
Eyes	Bright, clear, shiny; no sores at corners of eyelids; membrane healthy pink and moist.	Eye membranes are pale (pale conjunctivae); redness of membranes (conjunctival injection); Bitot's spots; redness and fissuring of eyelid corners; dryness of eye membranes; cornea has dull appearance; comea is soft; scar on cornea.

Lips	Smooth, not chapped or swollen	Redness and swelling of mouth or lips (cheilosis); especially at corners of mouth (angular fissures and scars)
Tongue	Deep red in appearance; not swollen or smooth	Swelling; scarlet and raw tongue; magenta (purplish color) of tongue; smooth tongue; swollen sores; hyperemic and hypertrophic papillae; and atrophic papillae
Teeth	No cavities; no pain; bright	May be missing or erupting abnormally; gray or black spots (fluorosis); cavities (caries)
Gums	Healthy; red; do not bleed; not swollen	"Spongy" and bleed easily; recession of gums
Glands	Face not swollen	Thyroid enlargement (front of neck); parotid enlargement (cheeks become swollen)
Skin	No signs of rashes, swellings, dark or light spots	Dryness of skin; sandpaper feel of skin; flakiness of skin; skin swollen and dark; red swollen pigmentation of exposed areas; dermatitis in nasolabial folds, excessive lightness or darkness of skin; black and blue marks due to skin bleeding; lack of fat under skin
Nails	Firm, pink	Nails are spoon-shape (koilonychia); brittle, ridged nails
Muscular and skeletal systems	Good muscle tone; some fat under skin; can walk or run without pain	Muscles have "wasted" appearance; baby's skull bones are thin and soft; round swelling of front and side of head; swelling of ends of bones; small bumps on both sides of chest wall (on ribs)-beading of ribs; baby's soft spot on head does not harden at proper time; knock-knees or bow-legs; bleeding into muscle; person cannot get up or walk properly

Clinical assessment is fast and easy to perform, but the limitation is that they do not help in detecting early cases of deficiency as the signs and symptoms appear after prolonged biochemical changes have set in.

Next let us learn about biochemical assessment method of nutritional status.

C. Biochemical Assessment

Biochemical assessment i.e. laboratory tests based on blood and urine can be important indicators of nutritional status. Biochemical assessment deals with measuring the level of essential dietary constituents (i.e. nutrient concentration, metabolites) in the body fluids (normally blood and urine) which is helpful in evaluating the possibility of malnutrition. For example, Anemia is the most widespread of all the nutritional deficiencies found among individuals in our country. It is largely due to iron deficiency. So the measure of the haemoglobin (Hb) in the blood is helpful in evaluating the possibility of iron deficiency. Similarly a measure of the level of iodine in the urine reflects the iodine status in a community. Also stool examination for the presence of ova and/or intestinal parasites gives useful information.

The advantages of using biochemical assessment are that it is useful in detecting early changes in body metabolism or nutritional status much before the appearance of overt clinical signs and symptoms. It is precise and accurate. But it can be time consuming and expensive. It requires trained personnel and facilities.

D. Dietary Assessment

From our study so far it must be clear that diet or food intake is a major life-style factor which influences our nutritional status. Dietary assessment, therefore involves reviewing the intake of food and the nutrients and comparing the amount consumed with reference value to see whether deficiency or excess is likely. So when a systematic inquiry into the food supplies and food consumption of individuals and population groups is made, we call it a diet survey.

Diet surveys can be undertaken at an individual and/or family/household level. Dietary intake can be assessed by subjective self report such as food recall, diaries or food frequency questionnaires. Primarily, there are a wide range of methods used in diet surveys. At this stage it is not important to study each of these, but for your reference we have highlighted them inBox2.

BOX 2: METHODS OF DIET SURVEY

National level	Institutional level (Used for Hostel, hospital, Canteen, Jail, Orphanages etc.)	Family/Household Level	Individual Level
Food Balance Sheet (FBS)	- Inventory Method - Weighment Method	- Inventory Method - Weighment Method - Consumption Expenditure Survey	-Food Record or Diary -Diet history -24-hour dietary recall - Food Frequency Questionnaire

The 24-hour recall method is probably the most widely used method of dietary assessment. Based on a structured interview the person recalls food and beverage intake during the previous 24-hour period, most commonly, from midnight to midnight the previous day. The individual recalls what was eaten, how much was eaten, how was the food prepared, when was it eaten and other such details. To help the individual recall this information the interviewer/surveyor may carry standard measuring instruments such as cup, spoon, glass, bottle etc. Food models, pictures may also be used to help respondents judge and report portion size which helps improve accuracy. A schedule of 24-hour recall method of diet survey is available which is attached at Annexure 2 for kind reference. You can assess your 24-hour dietary intake using this schedule.

Yes while using this method you may have noticed that it is quick and easy and depends on short-term memory. But recording one day dietary intake only may not be truly representative of your usual, habitual intake. You may have eaten less or more on this day of assessment as compared to your usual pattern. Therefore, repeated 24-hour recalls i.e. dietary intake data for 2- 3 consecutive days, preferably 2 working days and one holiday is recommended for more accurate data.

We end our study on dietary assessment here. We hope in this section you must have got a good review of the nutritional status assessment methods.

Going through this section you may have realized that children in our country are not in good health. Almost one third of our children are underweight, stunted and are at risk of death and disease/illness. At the global level too many children from other developing countries like India live under the Poverty line and have no access to health facilities, clean water, and good nutritious food to live a long healthy life. Towards this end a global initiative called Sustainable Development Goals have been

adopted to set the tone and direction for development and aid for the next 15 years starting 2015. The last section in this Unit deals with SDG and also Human development Goals (HDI).

Before we move on to learn about these initiatives let us recall what we have learnt so far. Here we have included a knowledge assessment- 2 exercise. Attempt these questions and check your progress.

UNIT 4: Public Health and Nutrition Disorders

Chapter 1: Major Deficiency Disorder: (PEM in the context of underweight, stunting, wasting, SAM; Nutritional Anemia with special reference to Iron Deficiency Anemia; Vitamin A Deficiency (Xeropthalmia); Iodine deficiency Disorders; Zinc Deficiency; Prevalence, causes, consequences and its control.

Chapter 2: Other Nutrition Problems: Vitamin B complex deficiencies, Vitamin-C deficiency, Vitamin D Deficiency.

Chapter 3: overweight/obesity: Definition/classification (WHO), causes and consequences.

Chapter 4: Non Communicable Diseases (Diabetes, CVD, cancer) concept, prevalence, causes (Behavioral) and consequences.

CHAPTER 1

***Learning Objectives*:**

After reading this unit, the students will be able to:-

1. Understand the concept of public health nutrition.
2. Define Protein Energy Malnutrition (PEM) and conditions of underweight, stunting, wasting and Severe Acute Malnutrition (SAM) in children.
3. Learn causes and consequences of vitamin and mineral deficiency and apply nutritional management strategies for its prevention.

In this chapter we will study about Public health nutrition (PHN). It is defined as the science and art of preventing disease, prolonging life and promoting health through the medium of nutrition. The aim is to achieve greater health and well-being for everyone by making healthier food and nutrition-related choices. Thus, the focus is on the promotion of good health through nutrition and the primary prevention of nutrition related illness in the population like protein energy malnutrition and other nutritional deficiency diseases and disorders.

Protein Energy Malnutrition (PEM)

You must have read in daily newspapers that child malnutrition is a major health problem in India and globally, leading to morbidity and mortality, impaired intellectual development and working capacity, and increased risk of adult disease. Protein Energy Malnutrition (PEM) occurs in three clinical forms, viz. kwashiorkor, marasmus and marasrnic-kwashiorkor. In addition, a large number of children suffer from various sub-clinical forms of PEM like underweight (low weight for age), stunting (short stature or low height for age) 'and wasting (thinness). In fact, the proportion of clinical cases of PEM in a given community reflects only the-proverbial "tip of iceberg". In

other words, for every clinical case there are many more children suffering from underweight, stunting and wasting.

The World Health Organization (WHO) defines malnutrition as "the cellular imbalance between the supply of nutrients and energy and the body's demand for them to ensure growth, maintenance, and specific functions."

Malnutrition in children: Child growth is internationally recognized as an important indicator of nutritional status and health in populations.
Now we will learn about the various sub clinical form of malnutrition that is:

Wasting: Wasting refers to low weight-for-height and the child is thin for his/her height but not necessarily short. It is also known as acute malnutrition. Wasting in children is a symptom of acute under nutrition, usually as a consequence of insufficient food intake or a high incidence of infectious diseases, especially diarrhea.

Stunting: Stunted growth refers to low height-for-age, when a child is short for his/her age but not necessarily thin. It is also known as chronic malnutrition, and carries long-term developmental risks. Stunting is the impaired growth and development that children experience from poor nutrition, repeated infection, and inadequate psychosocial stimulation.

Under-weight: Under-weight refers to low weight-for-age, when a child can be either thin or short for his/her age. This reflects a combination of chronic and acute malnutrition.

Stunting and Under-weight children are most likely to suffer from impaired development and are more vulnerable to disease and illness.

Mothers should monitor their babies' growth from birth by taking them monthly to the local clinic where they will be weighed and have

their growth plotted on a chart. This should ensure that correct information and advice are provided to mothers support the appropriate growth of their babies.

Box: **Three standard indices of physical growth that describe the nutritional status for children under five years of age: Wasting; stunting and underweight.**

Indicator	**What it measure/What it is used for**
Low weight-for-height	**WASTING** (acute malnutrition)
Low height-for-age or Low length-for-age	**STUNTING** (chronic malnutrition)
Low weight-for-age	**UNDERWEIGHT** (acute or chronic malnutrition, or both)

The Fig: given below provides a snapshot of malnutrition in children compared with a normal child.

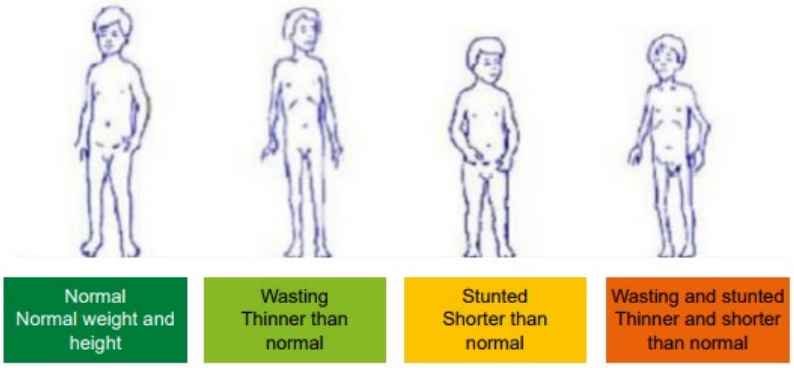


Fig- Malnutrition in children

Severe Acute Malnutrition (SAM)

Malnutrition is a major health concern in Indian children, not only in rural areas, but in urban slums too. Now we will study about it. Severe Acute Malnutrition (SAM) is the most extreme and visible form of under nutrition. Its face is a child – frail and skeletal-who requires urgent treatment to survive. WHO and UNICEF define Severe Acute Malnutrition (SAM) for children aged 6 months to 60 months as:

- very low weight for the height
- visible severe muscles loss
- mid upper arm circumference (MUAC) below 115mm/ 11.5 cm (Fig)
- nutritional edema; and characterized by swollen feet, face and limbs

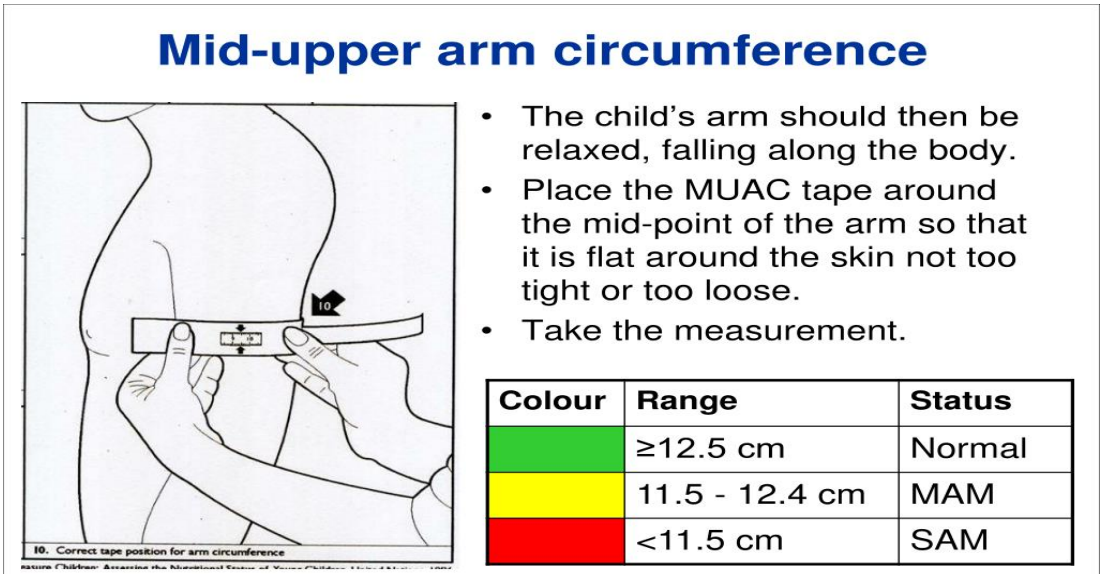


Fig: Measuring Mid upper arrn circumference (MUAC) in children.

MAM: Moderate acute malnutrition, SAM: Severe acute malnutrition

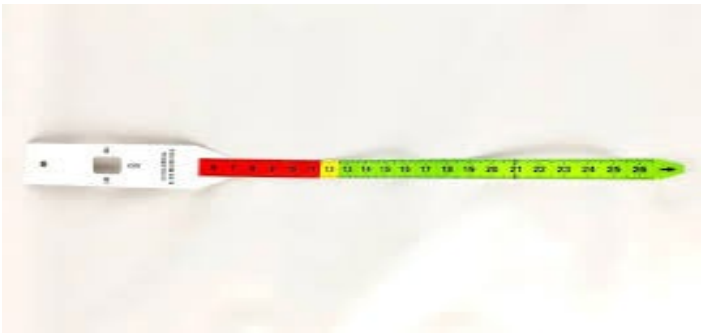


Fig ; Mid arm circumference measuring tape for children 6-59 months

Severe Acute Malnutrition (SAM) is a major cause of death in children under 5, and its prevention and treatment are critical to child survival a development.

Fig: Checking for edema (swelling in feet)

Management of Severe Acute Malnutrition (SAM)

The Ministry of Women and Child Development in India has been running the Integrated Child Development Services (ICDS) since 1975 to address child malnutrition. ICDS tracks the underweight or weight-for-age status of children up to 6 years of age through a network of informal preschools called Anganwadi centers. Each center is staffed with a community-based worker and helper who provide nutritional supplementation to children and pregnant women, basic informal education to children and health education to mothers.

Nutritional management of SAM usually includes two types of nutritional formulas termed as F-75 and F-100 formulas. These formulas are made by preparing a mixture of milk, sugar, cereal and vegetable oil in specified amounts. These formulas are given to SAM patients under strict medical supervision. F-75 formula is given in the starting stage and contains 75 kcal of energy and 0.9 g protein per 100ml. F-100 formula is given in a later stage and contains 100 kcal of energy and 2.9g proteins per 100ml.

IRON DEFICIENCY ANEMIA

Anemia is a condition in which a person lacks sufficient healthy hemoglobin, the substance carrying oxygen in red blood cells. This disease is very common, and can result in the person feeling tired, weak, dizzy, and short of breath.

Nutritional deficiency anemia mainly results from a lack of iron, but a lack of folic acid, vitamin- B12 and vitamin- A can also cause anemia, and a low vitamin C intake can contribute.

Nutritional deficiency anemia can happen because of a lack of nutrients in the diet or because of an illness or medical condition that make it hard to absorb nutrients.

Population groups at high risk of anemia are infants and under 5 children, school age children (6-14 yrs), adolescent girls (10 to 19 yrs) and women of child bearing age (15-44 yrs).

Fig describes intergenerational cycle of anemia in women. According to Intergenerational cycle of Anemia - An adolescent girl who enters the reproductive age with low iron stores and becomes pregnant during adolescence or later is at greater risk of giving birth to a low birth weight and preterm baby. The baby is also born with low iron stores and due to poor infant feeding practices is more likely than ever to enter adolescence with low iron stores in the body. Thus this vicious cycle of iron deficiency anemia continues.

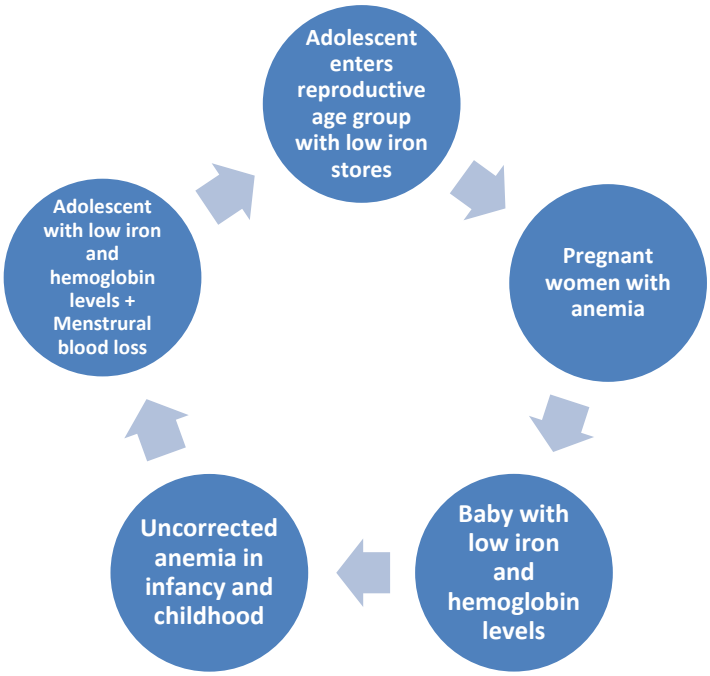


Fig- Intergenerational cycle of anemia in women.

Prevalence - According to the National Family Health Survey 4 (NFHS-4) of India, conducted in 2015/16, anemia prevalence across all ages is extremely high in India; varying from 30 percent to 69 percent.

Causes

A few major causes of iron deficiency anemia are given below:

- Increased iron demand during pregnancy.
- Daily diet poor in iron rich foods and other essential nutrients (VitaminB12, Folic Acid) required for hemoglobin synthesis.
- Diets low in “iron enhancers” (citrus fruits, sprouts etc.) and excess of “iron inhibitors” (tea, coffee, phytates, calcium rich foods etc.).
- Worm infestation (Hookworm)

- Menstrual blood losses.

Consequences

Iron deficiency anemia leads to following consequences:

- Reduced physical development- Chronic fatigue decreased work output and decreased work capacity.
- Impaired sexual and reproductive development- Irregular menstruation, low pre-pregnancy iron stores and low birth weight babies and pre-term delivery.
- Reduced cognitive development-Diminished concentration, disturbance in perception and poor learning ability.

Food Sources of Dietary Iron

Dietary iron is available in two forms: heme iron, found in animal muscle and blood, and non-heme iron, found both in animal products and plant foods. (Fig :)

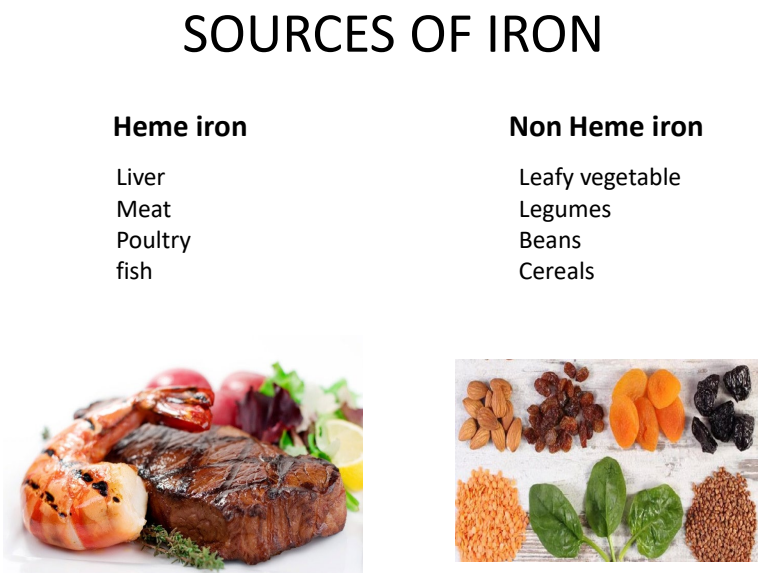


Fig : Food sources of Heme and Non-heme iron

Healthful sources of iron include greens and legumes. Although the myth persists that meat is a preferred iron source, a balanced vegetarian diet containing legumes, fortified or whole grains, and green vegetables easily provides adequate iron. (Fig)

- **Fruits and vegetables aid the absorption of nonheme iron**. Fruits and vegetables contain vitamin C and organic acids (e.g., citric acid) that keep iron in a reduced form, increasing absorption of nonheme iron when consumed in the same meal.
- **Tea, coffee, and cocoa should not be consumed with meals if poor iron status is suspected**. Polyphenols in these beverages inhibit the absorption of nonheme iron. Black tea appears to be the most strong in this regard.

Fig: Dietary sources of iron

National Programs for Iron deficiency Anemia Control

- **National Iron Plus Initiative in 2013** –Supplementation throughout life cycle bi-weekly iron supplementation for preschool children 6 months to 5 years, children from 1st to 5th grade in schools ,school children (5–10 years) ,adolescents (10–19 years) pregnant, lactating women and women in reproductive age.

- **Intensified National Iron Plus Initiative (I-NIPI) -** The reduction of anemia is one of the important objectives of the POSHAN Abhiyaan launched in March 2018. Complying with the targets of POSHAN Abhiyaan and National Nutrition Strategy set by NITI Aayog, the Anemia Mukt Bharat strategy has been designed to reduce prevalence of anemia by 3 percentage points per year among children, adolescents and women in the reproductive age group (15–49 years), between the year 2018 and 2022 by the Ministry of Health and Family Welfare Government of India.

The National Iron+ Initiative will reach the following age groups for supplementation or preventive programming:

•Bi-weekly iron supplementation for preschool children 6 months to 5 years

•Weekly supplementation for children from 1st to 5th grade in Govt. & Govt. Aided schools •Weekly supplementation for out of school children (5–10 years) at Anganwadi Centres

•Weekly supplementation for adolescents (10–19 years)

•Pregnant and lactating women

•Weekly supplementation for women in reproductive age

Management of Iron Deficiency Anemia (IDA)

Iron deficiency anemia may be prevented or corrected by following methods:

Nutrition education-The education of the people to promote dietary intake of iron rich foods is the foremost requirement for alleviating the problem of iron deficiency anemia in all age groups.

Dietary diversification is encouraging the consumption of micronutrient rich foods – dark green leafy vegetables, lentils and vitamin C rich fruits – which may be available but are under-

utilized by the deficient population.

Food fortification refers to the addition of micronutrients to processed foods. In many situations, this strategy can lead to relatively rapid improvements in the micronutrient status of a population, and at a very reasonable cost, especially if advantage can be taken of existing technology and local distribution networks.

Supplementation are highly concentrated vitamins and minerals produced by pharmaceutical manufacturers in the form of capsules, tablets or injections and administered as part of health care or specific nutrition campaigns.

VITAMIN –A DEFICIENCY (VAD)

In this chapter we will learn about vitamin A. It is a fat soluble vitamin required for vision, repair, reproduction and growth. This occurs in two forms, as retinol in animal based food i.e. meat liver, fish, egg-yolk, milk, cheese, butter and ghee and as beta- carotene in plant based food i.e. green leafy vegetables, yellow fruits and vegetables like mango ,papaya, pumpkin and carrots. (Fig)

Carotene is converted into retinol in the intestine, which is then absorbed and stored in the liver.

Prevalence The current prevalence of subclinical vitamin A deficiency among children below 6 years of age in India is 57% and clinical is 0.7%.

Fig : Food sources of Vitamin A

Causes

A few major causes of vitamin A deficiency are:

- Prolonged dietary deprivation-in endemic areas such as southern and eastern Asia, where rice devoid of beta-carotene is the staple food.
- Breast milk of a lactating mother with vitamin A deficiency contains little vitamin A ,which provides a breast-fed child with too little vitamin A.
- Decreased bioavailability of provitamin A carotenoids.
- Interference with absorption, storage, or transport of vitamin A.

Consequences

The consequences of vitamin A deficiency can be described as given below:

- VAD leads to ocular manifestation that included under the term “xerophthalmia” (xerosis=dryness; dry eye) night blindness, conjunctival xerosis, bitot’s spots, corneal xerosis, corneal ulcer, keratomalcia are the stages of ocular manifestation.
- VAD can impair growth, weaken the immune system and thus

increase susceptibility to infection.

- Higher risk of respiratory infection and diarrhea.
- Pregnant women having serum retinol level <20 μg/dl (<0.70 μmol/l), which is indicative of VAD, during the third trimester of pregnancy are at a higher risk of preterm delivery and maternal anemia.

Vitamin A deficiency Control- Vitamin A is an important micronutrient for maintaining normal growth, maintaining visual and reproductive function. Diet surveys have shown that the intake of vitamin A is significantly lower than the recommended daily allowances in young children, adolescent girls and pregnant women. National prophylaxis programme against Nutritional blindness was initiated as centrally sponsored scheme was launched in 1970. In the fifties and sixties many states reported that blindness due to Vitamin A deficiency was one of the major causes of blindness in children below 1-5 years.

Aim of the programme is to decrease the prevalence of vitamin A deficiency.

The objectives of the programme are:

- **Prevention of vitamin A deficiency**
  a) Promoting consumption of vitamin A rich foods.
  b) Creating awareness about the importance of preventing vitamin A deficiency.
  c) Prophylactic vitamin A as per the following dosage schedule:
     - 100000IU at 9 months with measles immunization
     - 200000 IU at 16-18 months, with DPT booster
     - 200000 IU every 6 months, up to the age of 5 years

Thus, a total of 9 mega doses are to be given from 9 months of age up to 5 years

- **Treatment of vitamin A deficient children**
  a) All children with xerophthalmia are to be treated at health facilities.
  b) All children having measles, to be given 1 dose of vitamin A if they have not received it is in the previous months.
  c) All cases of severe malnutrition to be given on additional dose of vitamin A.

Community base Prevention Strategies

- **Nutrition education-**The education of the people to promote dietary intake of vitamin A and B – carotene rich foods is the foremost requirement for alleviating the problem of vitamin A deficiency in all age groups.
- **Horticultural interventions including home gardening-**Ensuring an adequate supply of carotene rich foods for the population is one of the most important prerequisites for promoting the dietary intake of vitamin A.
- **Prevention of infection-**Vitamin A deficiency is often precipitated by infections including measles, diarrhea and acute respiratory infection.
- **Selective fortification-**The first food fortified with vitamin A in India was vanaspati. All hydrogenated fats, by legislation are expected to be fortified with vitamins A and D. Selective fortification of food with vitamin A is recommended.

  Food Safety and Standards Authority of India (FSSAI) has notified the Food Fortification Regulations, 2018, while food business operators (FBOs) need to comply with the provisions of these regulations by January 1, 2019.The new

standards now provide a minimum and maximum range for fortification of staples like wheat flour (atta), maida, rice, salt, vegetable oil and milk, while the dosage of the micronutrients has been adjusted to provide 30 to 50 per cent of the daily requirements. In milk and oil, the unit of dosage has been changed to microgram Retinol Equivalent for Vitamin A and microgram for Vitamin D from IU. In wheat flour and rice fortification, other sources of iron have been added, while vanaspati fortification has been excluded.

IODINE DEFICIENCY DISORDER (IDD)

Iodine is a trace mineral required for optimal mental and physical development and is a key constituent of thyroid hormones. It is required daily in very minute quantities (100 – 150 micrograms) for normal human growth and mental development. Iodine deficiency is the single largest cause of preventable brain damage globally. Iodine deficiency disorders (IDDs) include goitre, cretinism, hypothyroidism, abortion, stillbirth, brain damage, learning disabilities, mental retardation, psychomotor defects, hearing and speech impairment.

Prevalence- Iodine deficiency disorders (IDDs) constitute a significant public health problem globally. In India, the entire population is prone to IDDs due to deficiency of iodine in the soil of the sub-continent and thus both animal and plant source food grown on the iodine-deficient soil.

Causes - The causes of IDDs are indirectly attributed to low iodine content in the soil and hence in the consumed food, inadequate utilization due to presence of goitrogens (glucan) in food like cabbage,cauliflower and millets.

Consequences Severe iodine deficiency is related with

various adverse effects, including goiter, cretinism, neonatal hypothyroidism, growth retardation, and increased risks of pregnancy loss and infant mortality**.** Supplementation of iodine through salt in the form of iodised salt in the diet has proved cost effective in controlling and eliminating IDD.

Fig- Iodine Deficiency Disorders; Goitre and Cretinism

Iodine deficiency disorder Control –National Iodine Deficiency Disorders Control Programme (NIDDCP)

Realizing the magnitude of the problem, the Government of India launched a 100 per cent centrally assisted National Goitre Control Programme (NGCP) in 1962. In August, 1992 the National Goitre Control Programme (NGCP) was renamed as National Iodine Deficiency Disorders Control Programme (NIDDCP) with a view of wide spectrum of Iodine Deficiency Disorders like mental and physical retardation, deaf mutisim, cretinism, still births, abortions etc. The goal of the programme is

- To bring the prevalence of IDD to below 5% in the country.
- To ensure 100% consumption of adequately iodated salt (15ppm) at the household level.

ZINC DEFICIENCY

Zinc is a mineral. It is called an "essential trace element" because very small amounts of zinc are necessary for human health. Since the human body does not store excess zinc, it must be consumed regularly as part of the diet. Zinc performs many factions as a part of every cell in the body and so zinc is essential for normal growth, development, reproduction, and immunity. Zinc is present in all cells, tissues, organs fluids and secretion although about 90% body's zinc is in muscles and bone.

Prevalence- In India mild to moderate deficiency of zinc may be widely prevalent due to cereal pulse based diets, low in zinc and high in phytates that may cause zinc deficiency. Phytate, or phytic acid, is a naturally occurring compound found in all plant foods like beans, grains, nuts, and seeds. The chief concern about phytates is that they can bind to certain dietary minerals including iron, zinc, manganese and, to a lesser extent calcium, and slow their absorption. Phytates in your everyday meals should not be an issue for you as long as you're eating a balanced diet. Though all age groups of the population are at risk of zinc deficiency but infants and young children, pregnant and lactating women are the most vulnerable.

Causes A few causes of zinc deficiency are

- **Inadequate dietary intake-**low zinc diet**,** protein energy deficiency**,** vegetarianism**,**
  patients on low or protein restricted diet.
- **Malabsorption -** celiac disease, pancreatic insufficiency
- **Increased body losses** –starvation**,** burns**,** choric blood loss**,** excessive sweating**,** parasitic infection**,** sickle cell anemia

Consequences The consequences of zinc deficiency may be following as listed below:

- Poor maternal zinc status has been associated with fetal loss, birth deformities in child, intrauterine growth retardation, low birth weight, Growth retardation, prolonged labor and preterm or post-term deliveries.
- Immune dysfunction and infection
- Skin lesions
- Decreased wound healing
- Sickle cell anemia
- Neurological diseases
- Infertility
- Liver disease

Zinc deficiency control – Home based methods of preventing zinc deficiency are modifying eating habits and cooking practices. Adoption of cooking practices like fermentation for making idli, dhokla etc , soaking and germination of pulses and grains reduces the phytate content. Likewise, a simple intervention such as taking a piece of guava or Indian gooseberry (amla) fruit after food or while taking iron tablets would double the availability of iron and zinc in the body**.**

CHAPTER 2

***Learning Objectives*:**

After reading this unit, the students will be able to:

1.Learn about role of vitamin B complex, vitamin C and vitamin D in our body.

2. Acquire knowledge of their dietary sources and management strategies.

Vitamins are mainly grouped into two categories: fat soluble and water soluble. In this unit we will study about water-soluble vitamins, which include all of the B vitamins and vitamin C. These vitamins are easily absorbed into the body. If you consume more of a water-soluble vitamin than you need, the excess will be excreted, not stored. This means the risk of an overdose is low, but you have to constantly refill your stock. We will also study about an important fat-soluble vitamin, vitamin D, which requires bile acids to help absorb them, but your body keeps stocks of the excess for ready use.

VITAMIN-B COMPLEX

Vitamin B complex is composed of eight water-soluble vitamins:

1. Thiamine
2. Riboflavin
3. Niacin
4. pantothenic acid
5. Pyridoxine

6. Biotin
7. Folic acid
8. Cobalamin

Vitamins B- complex play a vital role in maintaining good health and well-being. As the building blocks of a healthy body, B vitamins have a direct impact on your energy levels, brain function, and cell metabolism.

Table: Summary of vitamin functions, deficiency and its sources

Vitamin	Functions	Deficiency	Sources
Thiamin (Vitamin B1)	Normal growth , coenzyme in carbohydrate metabolism and normal function of heart, nerves and muscle	**Beriberi** (deficiency disease); gastrointestinal: loss of appetite, gastric distress, indigestion, deficient hydrochloric acid; central nervous system: fatigue, nerve damage, paralysis; cardiovascular: heart failure, edema of the legs	Liver, whole or enriched grains, legumes, wheat germ
Riboflavin (Vitamin	Normal growth and energy and coenzyme	**Ariboflavinosis**; wound aggravation	Milk, meats, enriched cereals,

B2)	in protein and energy metabolism	cracks at the corners of the mouth, a swollen red tongue, eye irritation and skin eruptions	green vegetables
Niacin (Vitamin B3)	Coenzyme in energy production and normal growth	**Pellagra** (deficiency disease), weakness, loss of appetite, diarrhea, scaly dermatitis, neuritis andconfusion	Fortified cereals and grains
Pantotheni c acid (Vitamin B5)	Formation of coenzyme A; fat, cholesterol, protein, and heme formation	Unlikely because of widespread distribution in most foods	Meats, eggs, milk, whole grains, legumes, vegetables
Pyridoxine (Vitamin B6)	Coenzyme in amino acid metabolism: protein synthesis, heme formation, brain activity, carrier for amino acid absorption	Anemia, hyperirritability, convulsions and neuritis	Wheat germ, legumes, meats, poultry, seafood
Biotin (Vitamin B7)	Coenzyme A partner; synthesis of fatty acids, amino acids, and purines	Hair loss (alopecia) and a scaly red rash around the eyes, nose and mouth	Liver, egg yolk, soy flour, nuts
Folic acid (Vitamin B9)	Coenzyme in DNA and RNA synthesis; red blood cells maturation	**Megaloblastic anemia** (large immature red blood cells), poor growth, neural tube defects	Liver, green leafy vegetables, legumes, yeast, fortified orange juice

Cyanocobalam (vitamin B12)	Coenzyme in synthesis of heme for haemoglobin; myelin sheath formation to protect nerves	**Pernicious anemia**; poor nerve function	Liver, lean meats, fish, seafood

Fig: Foods rich in B complex vitamins

VITAMIN-C

Vitamin C is a water-soluble vitamin. It can be synthesized by many mammals, but not by humans. The highest vitamin C content is found in green and red peppers, broccoli, citrus fruits, strawberries, melons, tomatoes, raw cabbage, potatoes, and leafy greens such as spinach, turnip, and mustard greens. Meat, fish, poultry, eggs, and dairy products contain much smaller amounts, and cereal grains contain essentially none. Losses of vitamin C occur when foods are cooked in large amounts of water, exposed to extensive heating, or exposed to air.

Fig: Vitamin C rich foods

Dietary deficiency of vitamin C may lead to Scurvy with following symptoms (Fig):

Fig: Symptoms of vitamin C deficiency (scurvy)

Bleeding and swelling of gums, Joint pain, particularly in legs, Weakness or fatigue, Weakness or fatigue and swelling on wounds.

VITAMIN D

Vitamin D is necessary for various body functions. Vitamin D is a fat-soluble vitamin that our body produces when the skin gets exposed to sunlight.

The major source of Vitamin D is the endogenous synthesis in skin on exposure to sunlight, namely, ultraviolet B (UV-B) radiation of wavelength 290–320 nm. Main dietary sources are fish, fortified

food, and supplements. Vegetables and grains are poor sources. (Fig)

Synthesis of vitamin in skin on exposure to UV-B is also affected by latitude, solar zenith angle, atmospheric pollution, ozone layer, and melanin pigmentation.

Prevalence The prevalence of Vitamin D deficiency is reported worldwide, both in sunshine deficient and sunshine sufficient countries. Still, it is the most underdiagnosed and undertreated nutritional deficiency in the world.

Fig: Vitamin D rich Foods

Causes: Vitamin D deficiency is quite extensive in India. Apart from little intake in diet, people with liver, kidney and skin disorders also have Vitamin D deficiency. There are many reasons for it being so common in our country.

- Increased indoor lifestyle, thereby preventing sufficient exposure to sunlight. This is mainly in the urban population due to modernization.
- Pollution can slow down the synthesis of Vitamin D in the skin by UV rays
- Changing food habits add to low dietary calcium and Vitamin D intake

- Phytates and phosphates which are there in fiber rich diet, can lessen Vitamin D stores and increase calcium requirement
- Increased skin pigmentation and application of sunscreens
- Cultural practices such as the burqa and purdah system

Consequences: The commonly known consequences of Vitamin D deficiency are rickets in children and osteomalacia and osteoporosis in adults. In children, it causes defective mineralization of bone due to imbalance between calcium and phosphorous in the bone, resulting in rickets and external skeletal deformity. It also causes muscle weakness and bone pain. In adults, inadequate dietary intake of Vitamin D leads to poor absorption of calcium from diet and increased calcium resorption from the bone and kidney and reduces bone mineral density resulting in osteoporosis and osteomalacia, muscle weakness and increased risk of falls.

Even though we are attentive of the causes of Vitamin D deficiency, we are not able to prevent it to a great extent. India being a tropical country has adequate sunshine. Most of the Indian population live in areas with adequate sunlight throughout the year and are expected to have adequate Vitamin D. Contrary to this, the prevalence of Vitamin D deficiency is high in India.

This is due to the skin complexion, poor exposure to sunlight, sunscreen creams, Indian dietary habits and lower intake of Vitamin D fortified foods

Vitamin D and sun exposure It is advised to have sun exposure between 11.00 am and 2.00 pm for maximum vitamin D production in our body.

The table summarizes the function , deficiency and sources of vitamins we have studied so far.

Table: Summary of vitamin functions, deficiency and its sources

Vitamin	Functions	Deficiency	Sources
Ascorbic acid (Vitamin C)	Antioxidant;,collagen synthesis, helps prepare iron for absorption and release to tissues for red blood cell formation and metabolism	Scurvy (deficiency disease), sore gums, hemorrhages, especially around bones and joints, anemia, tendency to bruise easily, impaired wound healing and tissue formation and weakened bones	Citrus fruits, kiwi, tomatoes, melons, strawberries, dark leafy vegetables, chili peppers, cabbage, broccoli, chard, green and red peppers, and potatoes
Cholecalciferol (Vitamin D)	Absorption of calcium and phosphorus, calcification of bones and teeth and growth	Rickets and growth retardation in children, osteomalacia (soft bones) in adults	Synthesized in the skin with exposure to sunlight, fortified milk, fish oils

CHAPTER 3

***Learning Objectives*:**

After reading this unit, the students will be able to:

1. Explain the importance of healthy weight
2. Explain overweight, obesity and Body Mass Index (BMI) and its health risks
3. Illustrate various factors causing rising trends of overweight and obesity

In this chapter you will learn why is maintaining a healthy weight important reaching to prevent and control many diseases and conditions. If you are overweight or obese, you are at higher risk of developing serious health problems, including heart disease, high blood pressure, diabetes, breathing problems, and certain cancers. That is why maintaining a healthy weight is so important: It helps you lower your risk for developing these problems, helps you feel good about yourself, and gives you more energy to enjoy life.

Body mass index (BMI) is a useful measure of overweight and obesity. BMI is an estimate of body fat and a good gauge of your risk for diseases that can occur with more body fat. The BMI is defined as the body mass (weight) divided by the square of the body height, and is universally expressed in units of kg/m^2, resulting from mass in kilograms and height in meters. The World Health Organization (WHO) regard a BMI of less than 18.5 as underweight and a BMI of 25 or more as overweight and a person with a BMI of 30 or more is generally considered obese.

BMI Formula: weight (kg) / [height (m)] ^{2}

With the metric system, the formula for BMI is weight in kilograms divided by height in meters squared. Since height is commonly measured in centimeters, divide height in centimeters by 100 to obtain height in meters.

Example: Weight=63kg, Height=160 cm (1.60m)

Calculation: 63 ÷ (1.60 x 1.60) = 24.60 kg/m^2 this BMI IS in normal category which is 18.5- 25.5

WHO classification of BMI

Classification	BMI Kg/m2
Underweight	**<18.50**
Severe thinness	**<16.00**
Moderate thinness	**16.00-16.99**
Mild	**17.00-18.49**
Normal range	**18.50-24.99**
Overweight	**≥25.00**
Pre-obese	**25.00-29.99**
Obese	**≥30.00**
Obese class I	**30.00-34.99**
Obese class II	**35.00-39.99**
Obese class III	**≥40.00**

Source: Adapted from WHO 1995, 2000 and 2004.

Causes of obesity

The fundamental cause of obesity and overweight is an energy imbalance between calories consumed and calories expended.

Maintain energy balance-. The amount of energy or calories you get from food and drinks (energy IN) is balanced with the energy your body uses for things like breathing, digesting, and being physically active (energy OUT):

- The same amount of energy IN and energy OUT over time = weight stays the same (energy balance)
- More energy IN than OUT over time = weight gain
- More energy OUT than IN over time = weight loss

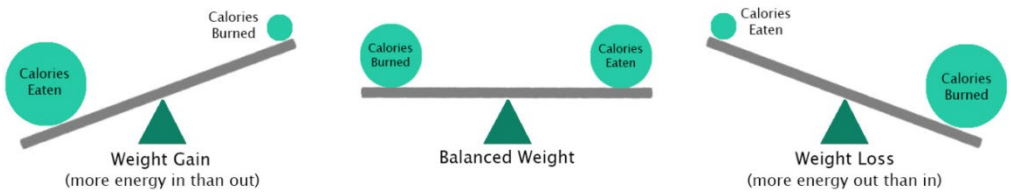


Fig: Energy balance

Lack of physical activity and exercise is second important factor related to obesity. Many people have jobs that involve sitting at a desk most of the day. They also rely on their cars rather than walking, or cycling.

Following are the other factors causes of obesity-

- Socio economic status
- Obesogenic environment
- Genetics factors
- Insufficient sleep
- Endocrine factors
- Medication
- Stress
- Smoking and alcohol

Changes in dietary and physical activity patterns are often the result of environmental and societal changes associated with development and lack of supportive policies in sectors such as health, agriculture, transport, urban planning, environment, food processing, distribution, marketing, and education.

Consequences of overweight or obese

People who are overweight or obese, compared to those with a normal or healthy weight, are at higher risk for many serious diseases and health conditions, including the following-

A. Health Effects

- Diabetes
- Heart disease
- High blood pressure
- Osteoarthritis (a breakdown of cartilage and bone within a joint)
- Breathing problems
- Some cancers (colon, kidney, gallbladder, breast, and liver)

B. Psychological effects

- Mental illness such as clinical depression, anxiety, social isolation and other mental disorders
- Negative self-image

C. Difficulties in day-to-day living

- Normal tasks become harder when you are obese, as movement is more difficult
- You tend to tire more quickly and you find yourself short of breath
- Public transport seats, telephone booths, and cars may be too small for you
- You may find it difficult to maintain personal hygiene
- Low quality of life

Currently in India, childhood obesity is also one of the most serious public health challenges of the 21st century, particularly in urban settings.

Overweight and obese children are likely to stay obese into adulthood and more likely to develop non-communicable diseases like diabetes and cardiovascular diseases at a younger age.

Overweight and obesity, as well as their related diseases, are largely preventable. Prevention of childhood obesity therefore needs high priority.

CHAPTER 4

***Learning Objectives*:**
After reading this unit, the students will be able to:

1. Define non communicable diseases
2. Learn about the risk factors leading to its rising prevalence
3. Learn about the consequences of these diseases.

NON COMMUNICABLE DISEASES (NCDs)

In this chapter you will learn about non communicable diseases (NCD). The term indicates that they that these disease cannot be transmitted from one person to another. NCDs are also known as chronic diseases, as they tend to be of long duration and are the result of a combination of genetic, physiological, environmental and behavior factors. The main types of NCDs we will be studying in this chapter are diabetes, cardiovascular diseases and cancer. Let us now begin with Diabetes.

DIABETES MELLITUS

You must have seen a member in your family or any known person not eating sugar or sugary foods saying that I am having sugar problem. This is medically termed as Diabetes mellitus. It is a syndrome with disordered metabolism and inappropriate high blood glucose level .When high blood glucose levels are observed in blood in a women during pregnancy it is termed as gestational diabetes. It is a diabetes that develops in a few women during pregnancy.

Diabetes is a chronic disease that occurs when the **pancreas** is no longer able to m

Insulin is a hormone made by the pancreas that acts like a key to let glucose from the food we eat pass from the blood stream into the cells in the body to produce energy. All carbohydrate foods are broken down into glucose in the blood. Insulin helps glucose get into the cells.

Not being able to produce insulin or use it effectively leads to raised glucose levels in the blood (known as **hyperglycemia**). Over the long-term high glucose levels are associated with damage to the body and failure of various organs and tissues.

Types of diabetes

Thus, there are three main types of diabetes – **type 1, type 2 and gestational diabetes**.

- **Type 1 diabetes** can arise at any age, but occurs most commonly in children and adolescents. When you have type 1 diabetes, your body produces very less or no insulin, which means that you need daily insulin injections to keep blood glucose levels under control.
- **Type 2 diabetes** is more frequently observed in adults and accounts for approximately 90% of all diabetes cases. When you have type 2 diabetes, your body makes poor use of the insulin that it produces. The basis of type 2 diabetes treatment is healthy lifestyle, including increased physical activity and healthy diet. However, over time most people with type 2 diabetes will require oral drugs and/or insulin to keep their blood glucose levels under control.
- **Gestational diabetes (GDM)** is a type of diabetes that consists of high blood glucose during pregnancy and is linked with complications to both mother and child. GDM usually disappears after pregnancy but women affected and their children are at increased risk of developing type 2 diabetes later on in life.

Prevalence

Unfavorable modifications of lifestyle and dietary habits associated with urbanization are considered to be the most important factors for the steep rise in its prevalence. Asians have vulnerability to diabetes when subjected to unfavorable lifestyle. In the last one decade India has shown considerable increase in the rate of prevalence both in urban and rural population.

Causes of diabetes mellitus

- Unhealthy eating
- Increasing age
- Heredity
- Overweight and Obesity
- Sedentary lifestyle
- Stress
- Smoking

Consequences of diabetes mellitus

Diabetes makes your blood sugar higher than normal. After many years, too much sugar in the blood can cause problems in your body. It can harm eyes, kidneys, nerves, skin, heart, and blood vessels.

Diabetes Management

A diabetes diet simply means eating the healthiest foods in moderate amounts and sticking to regular mealtimes. A diabetes diet is a healthy-eating plan that's naturally rich in nutrients and low in fat and calories. Key elements are fruits, vegetables and whole grains.

Diabetes (only type 2, not type 1) can be managed with specific lifestyle changes

- The food you eat can affect your blood glucose level. Therefore, you need to take a healthy diet with a low to moderate amount of carbohydrate. Break up your 2 to 3 big meals into 4 to 5 smaller meals; can reduce blood-glucose spikes.
- Physical activity or regular exercise can help burn excess glucose in your bloodstream, as well as reduce your insulin resistance (if you have).
- Losing weight helps increase your insulin sensitivity, which has a direct relationship with your blood-glucose control.
- Enough sleep can repair your body and nourishes the entire system, additionally supports the management of your blood-sugar level.
- Stress is detrimental to your physical as well as mental health; proper stress management helps you to attain your target blood glucose level.

CARDIOVASCULAR DISEASES (CVD)

Cardiovascular diseases (CVDs) are a group of disorders of the heart and blood vessels and they include coronary heart disease, arterial disease, rheumatic heart disease, congenital heart disease etc.

Heart attacks and strokes are usually acute events and are mainly caused by a blockage that prevents blood from flowing to the heart or brain. The most common reason for this is a build-up of fatty deposits on the inner walls of the blood vessels that supply the heart or brain. Strokes can also be caused by bleeding from a blood vessel in the brain or from blood clots. The cause of heart attacks

and strokes are usually the presence of a combination of risk factors, such as tobacco use, unhealthy diet and obesity, physical inactivity and harmful use of alcohol, hypertension, diabetes and hyperlipidemia.

Risk factors A risk factor is something that increases your chance of getting a disease. The more risk factors for coronary heart disease that you have, the greater your chance of getting the disease.

Risk factors for coronary heart disease

Some risk factors are called modifiable, because you can do something about them. There are other risk factors, called non-modifiable, which you can't change. However, many non-modifiable risk factors can be controlled and their effect reduced by making changes to your lifestyle.

Modifiable and Non-modifiable risk factors

Modifiable risk factors include: smoking, high blood pressure ,diabetes, physical inactivity, being overweight, high blood cholesterol. The good news is that the effect of many risk factors can be changed (you cannot change the risk factor, only its effect). The effect of these modifiable risk factors can be reduced if you make lifestyle changes.

Non-modifiable risk factors are: age, gender, ethnic background and family history of heart disease.

The Figure given below describes modifiable and non-modifiable risk factors of cardiovascular diseases.

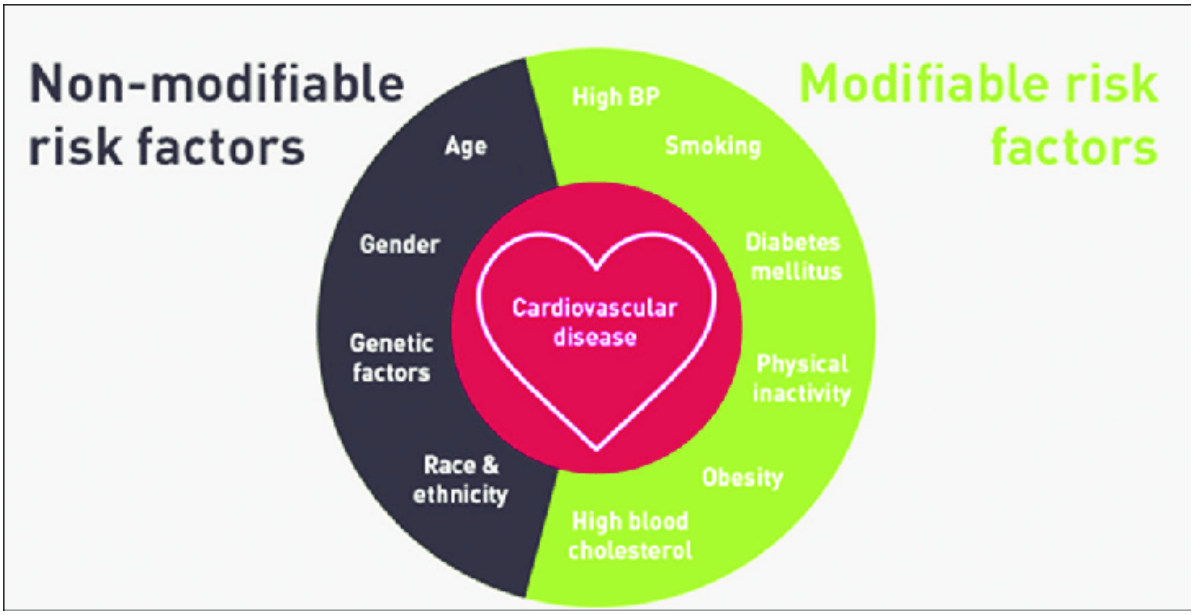


Fig: Risk factors of Cardiovascular diseases

Prevalence - Cardiovascular diseases (CVDs) have now become the leading cause of mortality in India.CVD death rates in India are estimated to have risen from 155.7 to 209.1 per 100,000 between 1990 and 2016. Cardiovascular diseases (CVDs) take the lives of 17.7 million people every year, 31% of all global deaths. Triggering these diseases – which manifest primarily as heart attacks and strokes – are tobacco use, unhealthy diet, physical inactivity and the harmful use of alcohol. These in turn show up in people as raised blood pressure, elevated blood glucose and overweight and obesity, risks detrimental to good heart health.

Consequences The consequences of heart disease and stroke can be fatal, but they can also lead to serious illness, disability, and lower quality of life. Suffering a stroke may

lead to significant disability, such as paralysis, speech difficulties, and emotional problems. Following a heart attack, individuals frequently suffer fatigue and depression, and they may find it more difficult to engage in physical activities.

CVD management

Diet is an important risk factor in coronary heart disease. Food-related risk factors include obesity, high blood pressure, uncontrolled diabetes and a diet high in saturated fats. A low-saturated fat, high-fibre, high plant food diet can substantially reduce the risk of developing heart disease. Heart healthy tips include limiting dietary intake of processed and prepackaged ready to eat foods, drinking water or unsweetened juices in place of sugary beverages and fruit juices. An alternative to sweets and desserts after the meals is fresh fruit. A variety of five handfuls of fruits and seasonal fruits and vegetables should be consumed every day. Avoid or limit the consumption of alcoholic beverages. Always pack and carry your own fresh and healthy school or office lunch.

Cardiovascular diseases (CVDs) take the lives of 17.7 million people every year, 31% of all global deaths. Triggering these diseases – which manifest primarily as heart attacks and strokes – are tobacco use, unhealthy diet, physical inactivity and the harmful use of alcohol. These in turn show up in people as raised blood pressure, elevated blood glucose and overweight and obesity, risks detrimental to good heart health.

Therefore to reduce risk of CVD avoid tobacco use, consume healthy diet, be regular in physical activity and avoid harmful use of alcohol as given in Fig below.

CANCER

Fig: Strategies to reduce cardiovascular disease risk

CANCER:

Cancer is a condition of abnormal growth of cells with invasion of adjacent tissues, structures and even distant sites. Eventually causing death of the affected person if untreated or has become untreatable. Cancer can occur at any site or tissue in the body. About two hundred types of cancers have been reported in human. The major categories of cancer, on the basis of cell types, are carcinoma, sarcoma, lymphoma, myeloma and leukemia. The term primary tumor denotes the cancer in the organ or site of origin, while secondary tumors are those which have spread to other organs or sites. When the growth of cancerous cells attain a critical size it is clinically evident as a lump with, the lump may ulcerate also. Moreover, the ulcer fails to heal. Known risk factors of cancer are tobacco use, alcohol, exposure to harmful radiations, reproductive factors, occupational exposure or hazards, unhealthy diet, certain harmful microbes, obesity and family history are given in Fig:

Fig : Risk factors of cancer

Prevalence Cancer mortality in India has doubled from 1990 to 2016. India's cancer incidence is estimated at 1.15 million new patients in 2018 and is predicted to almost double as a result of demographic changes alone by 2040.

Primary prevention

The primary prevention operates by controlling the factors related to some cancers, which are summarized as under

- Use of tobacco and alcohol consumption
- Maintaining personal hygiene
- Occupational exposures
- Toxic foods, drug, cosmetics
- Pollution etc.

Secondary prevention concerns with early detection and proper treatment with adequate follow up and cancer registry.

Diet and Cancer

A diet high in whole foods like fruits, vegetables, whole grains, healthy fats and lean protein may prevent cancer. Conversely, processed meats, refined carbohydrates, salt and alcohol may increase your risk.

Consequences of cancer

Cancer and its treatments can cause:

- Persistent hair loss
- Body image issues
- Depression, anxiety, loss of confidence
- Swallowing/speech problems
- Heart disease • Nausea, vomiting
- Urinary or bowel incontinence
- Lymphoedema and osteoporosis

Other typical long-term consequences include: fatigue & pain. Social and financial difficulties are also common. These are given in Figure below.

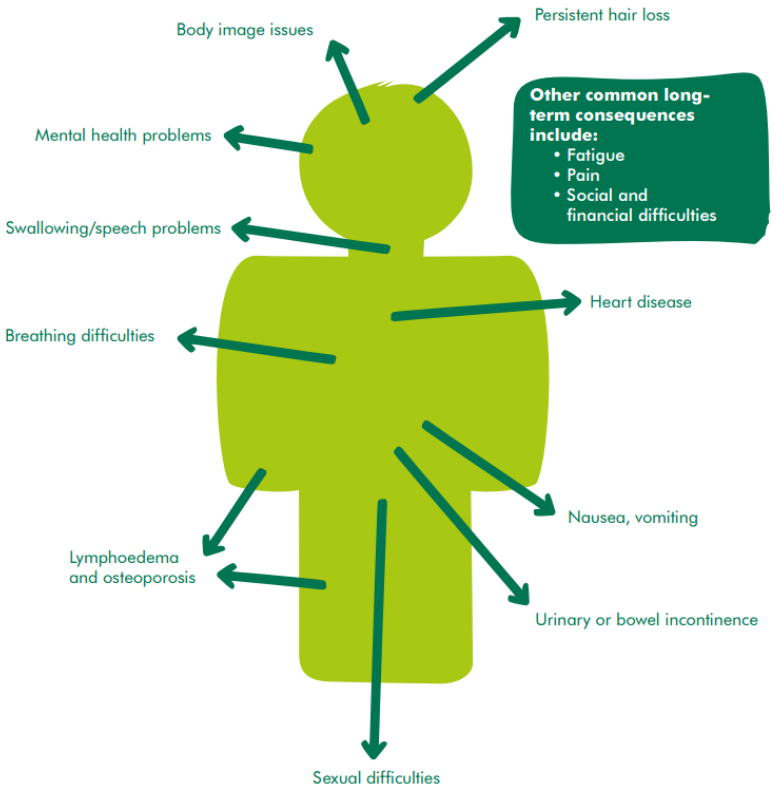


Fig: Consequences of cancer and its treatment

Cancer Education

It is very important part of primary prevention. It should be aiming at high risk groups to look for early diagnosis and early treatment keeping the fact, that this can save their live and mutilating physical social financial complications by following of early warning signs :

- A lump or hard area in the breast or elsewhere which does not get better
- A change in a wart or mole
- A persistent cough or hoarseness
- Excessive blood loss during or outside the usual dates
- Blood loss from any natural orifice
- A swelling or sore that does not heal
- Unexplained loss of weight

UNIT 5 : PUBLIC HEALTH AND NUTRITION : PROGRAMMES AND POLICIES

Chapter 1: NATIONAL PROGRAM FOR WELFARE OF WOMEN & CHILDREN

CHAPTER 2: PROGRAMMES FOR WELFARE OF ADOLESCENT GIRLS AND WOMEN

Chapter 1: NATIONAL PROGRAM FOR WELFARE OF WOMEN & CHILDREN

Learning objectives:

The students will be able to:

1. Understand the objective behind the introduction of programme's like ICDS & Mid-day meal.
2. Imbibe the function and components associated with these programmes.

Integrated Child Development Services (ICDS)

The Integrated Child Development Services (ICDS) Scheme is one of the flagship programmes of the Government of India launched on 2nd October, 1975, and represents one of the world's largest and unique programmes for early childhood care and development. It is the foremost symbol of country's commitment to its children and nursing mothers, as a response to the challenge of providing pre-school non-formal education on one hand and breaking the vicious cycle of malnutrition, morbidity, reduced learning capacity and mortality on the other.

Figure 1.1 Integrated Child Development Services (ICDS)

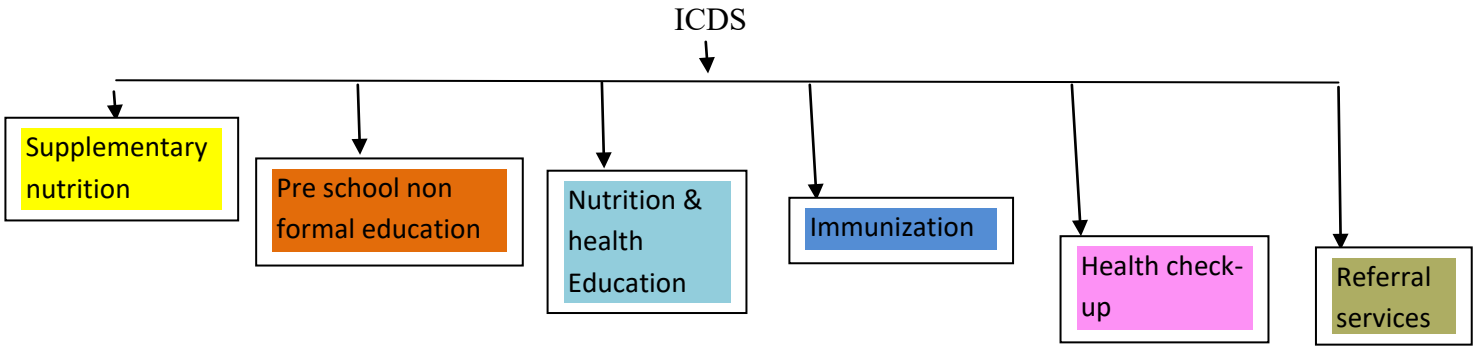
Beneficiaries : Children in the age group of 0-6 years, pregnant women and lactating mothers.

Objectives: The specific objectives are to:

- Improve the nutritional and health status of children in the age-group 0-6 years.
- Lay the foundation for proper psychological, physical and social development of the child.
- Reduce the incidence of mortality, morbidity, malnutrition and school dropout.
- Achieve effective co-ordination of policy and implementation amongst the various departments to promote child development.
- Enhance the capability of the mother to look after the normal health and nutritional needs of the child through proper nutrition and health education.

Components:

The term components refer to the kinds of services offered by the programme .ICDS Scheme is a package of six services :



Three of the six services namely Immunization, Health Check-up and Referral Services delivered through Public Health Infrastructure under the Ministry of Health & Family Welfare.

DETAILS OF THE SERVICES ARE GIVEN BELOW:

I. SUPPLEMENTARY NUTRITION PROGRAMME:

This includes supplementary feeding and growth monitoring and prophylaxis against vitamin A deficiency and control of nutritional anemia. All families in the community are surveyed, to identify children below the age of six and pregnant & nursing mothers. They avail of supplementary feeding support for 300 days in a year. By providing supplementary feeding, the Anganwadi attempts to bridge the caloric gap between the national recommended and average intake of children and women in low income. Growth Monitoring and nutrition surveillance are two important activities that are undertaken. Weight-for-age growth cards are maintained for all children below six years. This helps to detect growth faltering and helps in assessing nutritional status. Besides, severely malnourished children are given special supplementary feeding and referred to medical services.

2. **IMMUNIZATION:**

Immunization of pregnant women and infants protects children from six vaccine preventable diseases-poliomyelitis, diphtheria, pertussis, tetanus, tuberculosis and measles. These are major preventable causes of child mortality, disability, morbidity and related malnutrition. Immunization of pregnant women against tetanus also reduces maternal and neonatal mortality. All the children in the age group of 0 to 6 yrs, Pregnant Women and Adolescent girls within the jurisdiction of Anganwadi Centre.

3. **HEALTH CHECK-UPS:**

This includes health care of children less than six years of age, antenatal care of expectant mothers and postnatal care of nursing mothers. The various health services provided for children by anganwadi workers and Primary Health Centre (PHC) staff, include regular health check-ups, recording of weight, immunization, management of malnutrition, treatment of diarrhoea, de-worming and distribution of simple medicines etc.

4. **REFERRAL SERVICES**:

During health check-ups and growth monitoring, sick or malnourished children, in need of prompt medical attention, are referred to the hospital or its sub-centre. The anganwadi worker has also been oriented to detect disabilities in young children. She enlists all such cases in a special register and refers them to the medical officer of the dispensary/ Sub-centre.

The referral services are provided to the children in the age group of 0-6yrs, Pregnant, Nursing mothers who are at risk. The beneficiaries are referred to Dispensaries, PHC, General Hospital, Prayas.

5. **NON-FORMAL PRE-SCHOOL EDUCATION (PSE)**

The Non-formal Pre-school Education (PSE) component of the ICDS is considered the backbone of the ICDS programme, since all its services essentially converge at the anganwadi – a village/slum/colony/urban slum courtyard. Anganwadi Centre (AWC) is the main platform for delivering of these services. These AWCs have been set up in every village slum/colony/urban slum in the country. It is also the most joyful play-way daily activity, visibly sustained for three hours a day. It brings and keeps young children at the anganwadi centre - an activity that motivates parents and communities. PSE, as envisaged in the ICDS, focuses on total development of the child, in the age up to six years, mainly from the underprivileged groups. The early learning component of the ICDS is a significant input for providing a sound foundation for cumulative lifelong learning and development. It also contributes to the universalization of primary education, by providing to the child the necessary preparation for primary schooling and offering substitute care to younger siblings, thus freeing the older ones – especially girls – to attend school. The Non formal preschool education is provided to the children in the age group of 3 to 6 yrs on all working days of the anganwadi centres. The Preschool education is provided to the beneficiaries according to the Time Table prepared for them. Pre School Kits are available in each anganwadi centres.

6. **NUTRITION AND HEALTH EDUCATION**:

Nutrition, Health and Education (NHED) is a key element of the work of the anganwadi worker. This forms part of BCC (Behaviour Change Communication) strategy. This has the long term goal of capacity-building of women – especially in the age group of 15-45 years – so that they can look after their own health, nutrition and development needs as well as that of their children and families.

Ladies in the age group of 15 to 45 yrs are covered for providing Nutrition and Health Education. Mothers meetings are held on every Monday in each anganwadi centres. The Sectoral Level meeting are held in each Supervisor's area every month. The Anganwadi Workers are conducted 5 Home Visit per day for providing health and Nutrition Education. The official of Food and Nutrition Board visiting the centres regularly and providing nutrition and health education to the mothers of the beneficiaries. The demonstration on nutritious low cost recipes are also held at anganwadi level by the Food and Nutrition Board.

Another Schemes run by ICDS: **Scheme for Adolescent Girls**

The Govt of India had introduced new Scheme for the adolescent girls in the age group of 11-14 years namely "Scheme for Empowerment of Adolescent girls"-(SABLA) using the platform of ICDS through the Anganwadi Centre located in the Union Territory of Chandigarh. Under this scheme the following services are being provided to them :-

1. Nutrition Component for 11-14 years for out of school girls.
2. Iron and Folic Acid (IFA) supplementation
3. Health Check up and Referral Service
4. Nutrition and Health Education
5. Counseling/Guidance on Family Welfare, ARSH, Child Care Practices and Home Management
6. Life Skill Education and accessing public services

Mid Day Meal Programme

Mid day meal programme was started with a view to enhance enrolment, retention and attendance and simultaneously improving nutritional levels among children. Initially started as a 'central sponsored' scheme of India, the programme is now implemented by the state governments; however, central assistance is still provided. MDM is also known as ' Noon Meal Programme'.

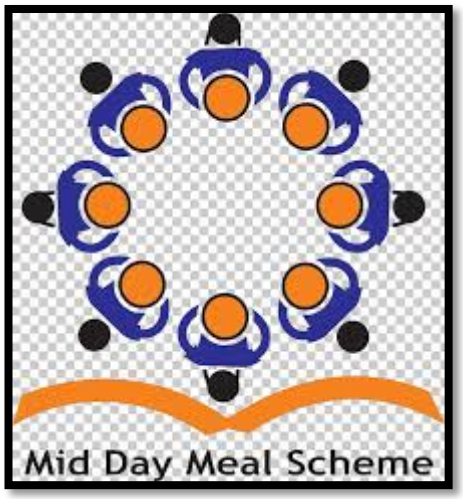


Figure 1.2 Mid-Day Meal Scheme

Objectives: The programme has both heath & educational objectives. These are:

- Improving the nutritional status of Primary school children particularly those belonging to low social- economic group.
- Encouraging poor children, belonging to disadvantaged sections, to attend school more regularly and help them concentrate on classroom activities.
- Providing nutritional support to children of primary stage in drought affected areas during summer vacation.

Beneficiaries:

Children attending the primary school (6-11 years of age), The children belonging to backward classes, Schedule caste and Schedule tribe families are given priority.

Programme Intervention and Coverage

To achieve the above objectives a cooked mid day meal with nutritional content the beneficiaries will be provided about 450 calories, 8-12 grams protein per day. The number of feeding days are 200 days per year.

Monitoring Mechanism

The Department of School Education and Literacy, Ministry of Human Resource Development has prescribed a comprehensive and elaborate mechanism for monitoring and supervision of the Mid Day Meal Scheme. The monitoring mechanism includes the following:

- **Arrangements for local level monitoring**

  Representatives of Gram Panchayats/Gram Sabhas, members of VECs, PTAs, SDMCs as well as Mothers' Committees are required to monitor the (i) regularity and wholesomeness of the mid day meal served to children, (ii) cleanliness in cooking and serving of the mid day meal, (iii) timeliness in procurement of good quality ingredients, fuel, etc. (iv) implementation of varied menu, (v) social and gender equity. This is required to be done on a daily basis.

- **Display of Information under Right to Information Act**

  In order to ensure that there is transparency and accountability, all schools and centres where the programme is being implemented are required to display information suo-moto. This includes information on:

  - Quality of food grains received, date of receipt.
  - Quantity of food grains utilized.
  - Other ingredients purchased, utilized
  - Number of children given mid day meal.
  - Daily Menu
  - Roster of Community Members involved in the programme.

- **Inspections by State Government Officers**

  Officers of the State Government/UTs belonging to the Departments of Revenue, Rural Development, Education and other related sectors, such as Women and Child Development, Food, Health are also required to inspect schools and centres where the programme is being implemented. It has been recommended that 25% of primary schools/EGS & AIE centres are visited every quarter.

- **Responsibility of Food Corporation of India (FCI)**

  The FCI is responsible for the continuous availability of adequate food grains in its Depots (and in Principal Distribution Centres in the case of North East Region). It allows lifting of food grains for any month/quarter upto one month in advance so that supply chain of food grains remains uninterrupted.

- **Periodic Returns**

  The State Government/UT is also required to submit periodic returns to the Department of School Education and Literacy, Government of India to provide information on: (i) coverage of children and institutions, (ii) Progress in utilisation of Central assistance, including cooking costs, transportation, construction of kitchen sheds and procurement of kitchen devices.

- **Monitoring by Institutions of Social Science Research**

Forty One Institutions of Social Science Research, identified for monitoring the Sarva Shiksha Abhiyan, are also entrusted with the task of monitoring the Mid Day Scheme.

- **Grievance Redressal**

  States and Union Territories are required to develop a dedicated mechanism for public grievance redressal, which should be widely publicized and made easily accessible.

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CHAPTER 2: PROGRAMMES FOR WELFARE OF ADOLESCENT GIRLS AND WOMEN

Learning objectives:

The students will be able to:

1. List the objectives of **Rashtriya Kishore Swasthya karyakram & Rajiv Gandhi Scheme.**
2. Explain the goals and components of **POSHAN Abhiyaan.**
3. Define and elaborate on the beneficiaries under the programme **Indira Gandhi Matritva Sehyog Yojana.**

Rashtriya Kishor Swasthya Karyakram (RKSK)

In order to ensure holistic development of adolescent population, the Ministry of Health and Family Welfare launched Rashtriya Kishor Swasthya Karyakram (RKSK) on 7th January 2014as a comprehensive programme focusing on Sexual Reproductive Health, Nutrition, Injuries and violence (including gender based violence), Non-Communicable Diseases, Mental Health and Substance Misuse with a promotive and preventive approach to reach out to 253 million adolescents - male and female, rural and urban, married and unmarried, in and out-of-school adolescents with special focus on marginalized and undeserved groups . The programme expands the scope of adolescent health programming in India - from being limited to sexual and reproductive health, it now includes in its ambit nutrition, injuries and violence, non-communicable diseases, mental health and substance misuse. The strength of the program is its health promotion approach. It is a paradigm shift from the existing clinic-based services to promotion and prevention and reaching adolescents in their own environment, such as in schools, families and communities. Key drivers of the program are community based interventions like, outreach by counselors; facility based counselling; Social and Behavior Change Communication; and strengthening of Adolescent Friendly Health Clinics across levels of care.

Figure 2.1 Rashtriya Kishor Swasthya Karyakram

Beneficiaries:

The adolescents in the age groups of 10-14 years and 15-19 years with universal coverage i.e. males and females; urban and rural, in school and out of school, married and unmarried and vulnerable and under-served.

Objectives: The objectives of this programme are:

Fig 2.1 Objectives of RKSK

Improve nutrition

- Reduce the prevalence of malnutrition among adolescent girls and boys (including overweight/obesity)
- Reduce the prevalence of iron-deficiency anaemia (IDA) among adolescent girls and boys

Enable sexual and reproductive health

- Improve knowledge, attitudes and behaviour, in relation to SRH
- Reduce teenage pregnancies
- Improve birth preparedness, complication readiness and provide early parenting support for adolescent parents

Enhance mental health

- Address mental health concerns of adolescents

Prevent injuries and violence

- Promote favourable attitudes for preventing injuries and violence (including GBV) among adolescents

Prevent substance misuse

- Increase adolescents' awareness of the adverse effects and consequences of substance misuse

Address conditions for Non-Communicable Diseases (NCDs)

- Promote behaviour change in adolescents to prevent NCDs such as cancer, diabetes, cardio-vascular diseases and strokes The strategy is operationalised through six key components i.e. Communication (including Social and Behaviour Change Communication for improved health seeking behaviour); provision of commodities; provision of services; capacity building; monitoring & evaluation and programme management including supportive supervision.

RAJIV GANDHI SCHEME FOR EMPOWERMENT OF ADOLESCENT GIRLS 'SABLA'

Adolescence is a significant period for mental, emotional and psychological development. Adolescence represents a window of opportunity to prepare for healthy adult life. During this period, nutritional problems originating earlier in life can be partially corrected, in addition to addressing the current ones. It is also the period to shape and consolidate healthy eating and life style behaviors, thereby preventing the onset of nutrition related chronic diseases in womanhood and prevalence of malnutrition in future generation. Iron deficiency anaemia is the most widespread micronutrient deficiency affecting the vulnerable groups including adolescent girls which reduces the capacity to learn and work, resulting in lower productivity and limiting economic and social development. Anaemia during pregnancy leads to high maternal and neonatal mortality and low birth weight etc. Addressing the health needs of Adolescent Girls will not only lead to a healthier and more productive women force but will also help to break the intergenerational cycle of malnutrition. Within the Human Rights framework established and accepted by the global community, the rights particularly relevant to adolescents include gender equality, right to education and health (including reproductive and sexual health) and information and services appropriate to their age, capacities and circumstances. Definite measures should to be taken to ensure these rights and also make the girls aware of their duties and responsibilities. The Adolescent Girls (AGs) need to be looked at not just in terms of their own needs as AGs but also as individuals who can be productive members of the society.

Figure 2.3 Rajiv Gandhi scheme for empowerment of adolescent girls

The Ministry of Women and Child Development, Government of India, in the year 2000 came up with scheme called "Kishori Shakti Yojna"(KSY) using the infrastructure of Integrated Child Development Services(ICDS). The objectives of the Scheme were to improve the nutritional and health status of girls in the age group of 11-18 years as well as to equip them to improve and upgrade their home-based and vocational skills; and to promote their overall development

including awareness about their health, personal hygiene, nutrition, family welfare and management. Thereafter, Nutrition Programme for Adolescent Girls (NPAG) was initiated as a pilot project in the year 2002-03 in 51 identified districts across the country to address the problem of under-nutrition among adolescent girls. Under the programme, 6 kg of free food grains per beneficiary per month are given to underweight adolescent girls. The above two schemes have influenced the lives of AGs to some extent, but have not shown the desired impact. Moreover, the above two schemes had limited financial assistance and coverage besides having similar interventions and catered to more or less the same target groups. A need has therefore, emerged to formulate a new comprehensive scheme with richer content, merging the erstwhile two schemes that would address the multi-dimensional problems of AGs. This Scheme shall be called Rajiv Gandhi Scheme for Empowerment of Adolescent Girls (RGSEAG) --"SABLA". It would replace KSY and NPAG in the 200 selected districts. KSY would be continued (where operational) in remaining districts.

Rajiv Gandhi Scheme for Empowerment of Adolescent Girls - SABLA - would be implemented using the platform of ICDS Scheme through Anganwadi Centers (AWCs).

Objectives

- To Enable the AGs for self-development and empowerment
- To Improve their nutrition and health status.
- Promote awareness about health, hygiene, nutrition, Adolescent Reproductive and Sexual Health (ARSH) and family and child care.
- Upgrade their home-based skills, life skills and tie up with National Skill Development Program (NSDP) for vocational skills
- Mainstream out of school AGs into formal/non formal education
- Provide information/guidance about existing public services such as PHC, CHC, Post Office, Bank, Police Station, etc.

Beneficiaries:

The Scheme would cover adolescent girls in the age group of 11-18 years under all ICDS projects in selected 200 districts in all the States/UTs in the country. In order to give appropriate attention, the target group would be subdivided into two categories, viz. 11-15 & 15-18 years and interventions planned accordingly. The Scheme focuses on all out-of-school adolescent girls who would assemble at the Anganwadi Centre as per the time table and frequency decided by the States/UTs. The others, i.e., the school going girls would meet at the AWC at least twice a month and more frequently during vacations/holidays, where they will receive life skill education, nutrition & health education, awareness about other socio-legal issues etc. This will give an opportunity for mixed group interaction between in-school and out-of-school girls, motivating the latter to join school.

Services

An integrated package of services is to be provided to AGs that would be as follows

i. Nutrition provision
ii. Iron and Folic Acid (IFA) supplementation
iii. Health check-up and Referral services
iv. Nutrition & Health Education (NHE)
v. Counseling/Guidance on family welfare, ARSH, child care practices and home management

vi. Life Skill Education and accessing public services
vii. Vocational training for girls aged 16 and above under National Skill Development Program (NSDP)

Brief Description Of Services

i) Nutrition: Each AG will be given Supplementary nutrition (SN) containing 600 calories, 18-20 grams of protein and micronutrients1, per day for 300 days in a year. The out of school AGs in the age group of 11-15 years attending AWCs and all girls in the age group of 15-18 years will be provided SN in the form of Take Home Ration (THR).

ii) IFA Supplementation: Under Reproductive & Child Health (RCH-2) of National Rural Health Mission (NRHM), school children (6-10 years) and adolescents (11-18 years) have been included in the National Nutrition Anaemia Control Programme (NNAPP). States will establish convergence with the programme being implemented by Ministry of Health & Family Welfare to provide 100 adult tablets of IFA to each beneficiary through supervised consumption. IFA tablets will be distributed to AGs on Kishori Diwas. The States/UTs can procure these supplements under SABLA if Health Department is unable to do so under their scheme, AGs will be given information by ANM/AWW on food fortification, dietary diversification and advantages of supplementation by these tablets, for combating IFA deficiency.

iii) Health check-up and Referral Services: There will be general health check up of all AGs, at least once in three months on a special day called the Kishori Diwas. The Medical Officer/Auxiliary Nurse Midwife (ANM) will provide the deworming tablets to the girls requiring this (as per State specific guidelines). Height, weight measurement of the AGs will be done on this day. Kishori cards for every girl will be prepared and maintained by marking major milestones. The weighing scales provided under ICDS will be used for weighing AG.

iv) Nutrition and Health Education (NHE): Sustained information on nutrition & health issues will result in a better health status of the girls, leading to an overall improvement in the family health and also help in breaking the vicious intergenerational cycle of malnutrition. NHE will be given to all AGs in the AWC jointly by the ICDS and health functionaries and resource persons/ field trainers from NGOs/Community Based Organisations(CBOs). This will include encouraging healthy traditional practices and dispelling harmful myths, healthy cooking and eating habits, use of safe drinking water and sanitation, personal hygiene, including management of menarche, etc. The adolescent girls will be informed about balanced diet and recommended dietary intake, nutrient deficiency disorders and their prevention, identification of locally available nutritious food, nutrition during pregnancy and for infants. This would also include imparting information about common ailments, personal hygiene, exercise/ yoga and holistic health practices. NGOs/CBOs and other Institutions would be identified for imparting NHE.

v) Guidance on Family Welfare, ARSH, Child Care Practices and Home Management: Age appropriate knowledge for the two age groups of 11-15 and 15- 18 years with respect to reproductive cycle, HIV/AIDS, contraception, menstrual hygiene, marriage and pregnancy at right age,child care and child feeding practices, exclusive breast feeding, etc. will also be imparted . NGOs/CBOs and other Institutions would be identified for imparting modules on these issues.

vi) Life Skills Education and Accessing Public Services: Life skills refer to the personal competence that enables a person to deal effectively with the demands and challenges of everyday life. The AGs will acquire knowledge and develop attitudes and skills which support and promote the adoption of healthy and positive behavior in them. Its ultimate aim is to enable AGs in self development. Broad topics to be covered in the training for development of life skills may include

confidence building, self awareness and self esteem, decision making, critical thinking, communication skills, rights & entitlement, coping with stress and responding to peer pressure, functional literacy (wherever required) etc.

vii) Vocational Training: Vocational training is a major contributor to the socioeconomic enhancement of any individual. Tie up shall be established with National Skill Development Programme (NSDP) of M/Labour & Employment for imparting vocational training to out of school girls above 16 years of age for orientation towards self employment after 18 years of age. It will focus on non-hazardous income generating skills, which may be area specific. Vocational Training is provided under various modules of NSDP by various Vocational Training Providers (VTPs).

Indira Gandhi Matritva Sehyog Yojana (IGMSY)

Matritvaí means motherhood and Sahyogí means support. The name of the Scheme itself tellsus that the Scheme aims to support women in their motherhood. *Indira Gandhi Matritva Sahyog Yojana* (IGMSY) is a Conditional Maternity Benefit (CMB) Scheme of the Government of India launched in 2010 implemented by the Ministry of Women and Child Development. Pradhan Mantri Matru Vandana Yojana, previously Indira Gandhi Matritva Sahyog Yojana, is a maternity benefit program run by the government of India
In India, every third woman is undernourished. An undernourished mother almost inevitablygives birth to a low birth weight baby. When poor nutrition starts in the womb, it extends throughoutthe life cycle, particularly in women. We all know that due to poverty many women continue towork outside home during pregnancy and resume working soon after delivery. Due to the timeand economic constraints they cannot take good care of themselves and their newly born baby.IGMSY is a Conditional Cash Transfer Scheme. This means that a woman enrolled under the scheme will get cash assistance upon completion of specific conditions. The total cash benefitamount is ` 4000/- which will be provided to beneficiaries who enroll under the Scheme in threeinstallments subject to fulfillment of specific conditions. Cash incentive is envisaged to support health and nutritional needs of pregnant and lactating women and partly compensate the woman for the wage loss that she might incur while caring forherself and the child. It would also increase the demand for mother and child health services byproviding incentives based on fulfillment of specific conditions relating to health and nutrition ofthe mother and child.

Objective of the Scheme

To improve the health and nutrition status of Pregnant and Lactating (P & L) women and their young
infants by:

i. Promoting appropriate practices, care and service utilisation during pregnancy, safe delivery
and lactation.
ii. Encouraging women to follow (optimal) Infant and Young Child Feeding (IYCF) practices includingearly and exclusive breastfeeding for the first six months.
iii. Contributing to better enabling environment by providing cash incentives for improved health
and nutrition to pregnant and lactating women.

Beneficiaries:

Woman is entitled to receive the benefit of the Scheme if she fulfills 4 criteria:
1. Pregnant women
2. Not less than 19 years old
3. This is her first or second live birth
4. She or her husband does not work in Government / Public Sector Undertaking (Central and State)

The rationale and benefits of the conditions can be explained as under:

A. Care during pregnancy and delivery: The focus of IGMSY is to improve nutritional and health status of pregnant and lactating women across the country by partly compensating for their wage loss and encouraging increased access to supplementary nutrition under ICDS Scheme.

a) Early Identification and Registration of pregnancy: Early registration of pregnancy is essential for availing facilities offered by the health care services to assess the health and nutritional status of the pregnant woman. It also helps to screen for complications early in the pregnancy. Early identification and registration of pregnancy is being promoted by the Government of India primarily through National Rural Health Mission(NRHM) and Janani Suraksha Yojana (JSY).

b) Antenatal Care (ANC): During the ANC at the health centre, vital milestones of pregnancy are noted. Ideally, apart from the ANC at registration, three ANCs are necessary and are mandated under NRHM.Periodic antenatal check-ups help in early detection, management of complications, timely advice and appropriate referral. This can help improve maternal and neonatal survival. ANC is a key entry point for a pregnant woman to receive a broad range of health promotion and preventive health services, including nutritional support and prevention and treatment anaemia and other infectious diseases associated with reproductive health

c) Institutional Delivery: One of the accepted strategies for reducing maternal mortality is to promote deliveries at health institutions by skilled personnel like doctors and nurses. The Janani Suraksha Yojana (JSY) provides cash assistance for Institutional Delivery. The benefits under JSY are linked to pregnant women getting the delivery conducted in health centres/ hospitals. [Early initiation of breast feeding and colostrum feeding may also be ensured]. No cash transfer has been envisaged under IGMSY at the time of delivery since it is covered under JSY.

B. Infant Care

a) Immunization: Immunization of pregnant women and infants protects children from six vaccine preventable diseases - poliomyelitis, diphtheria, pertussis, tetanus, tuberculosis and measles. These are major preventable causes of child mortality, disability, morbidity and related malnutrition. Immunization of pregnant women against tetanus also reduces maternal and neonatal mortality. This service is delivered by the Ministry of Health and Family Welfare under its Reproductive Child Health (RCH) programme

b**) Growth Monitoring:** Growth monitoring consists of routine weighing &watching developmental milestone to observe pattern of growth, combined with preventive action when deviations are detected. Under the ICDS Scheme, growth monitoring of children is one of the important activities. Children under three are weighed once a month and children 3-6 years of age are weighed quarterly. Mother and Child Protection Cards are provided to mothers to track the nutritional status, immunization schedule and developmental milestones for both the child and the pregnant and lactating mothers. Through discussion and counselling, growth monitoring also increases the participation and capabilities of families to understand and improve childcare and feeding practices.

POSHAN Abhiyaan

India is home to one of the largest populations of malnourished children in the world. One cannot build a strong building on a weak foundation. Similarly, if the children of the country are weak, the progress of the country will also slowdown. Today's children are the future of tomorrow, and so it's important they have access to nutritious food right from birth through adolescence.

POSHAN Abhiyaan was launched by Honourable Prime Minister on 8th March 2018. in Jhunjhunu, Rajasthan The focus of Abhiyaan is to lay emphasis on nutritional status of adolescent girls, pregnant women, lactating mothers and children from 0 to 6 years of age.The first 1000 days of a child are the most critical, which includes the nine months of pregnancy, six months of exclusive breastfeeding and the period from 6 months to 2 years to ensure focused interventions on addressing under-nutrition. Besides increasing the birth weight, timely intervention will help reduce both Infant Mortality Rate (IMR) and Maternal Mortality Rate (MMR). It is to ensure that malnutrition doesn't affect children's cognitive development or physical growth. The initiative seeks to reduce the level of stunting, undernutrition and low birth weight by 2% each, and anaemia by 3%. It aims to reduce stunting from 38.4% (NFHS-4) to 25% by 2022. A key idea of the initiative is to incentivise Anganwadi Workers (AWs) for using ICT-based tools, making it easier to implement and monitor the programme.

Figure 2.4 POSHAN Abhiyaan logo

The objective of POSHAN Abhiyaan to reduce stunting in identified Districts of India with the highest malnutrition burden by improving utilization of key Anganwadi Services and improving the quality of Anganwadi Services delivery. Its aim to ensure holistic development and adequate nutrition for pregnant women, mothers and children. The Ministry of Women and Child Development (MWCD) is implementing POSHAN Abhiyaan in 315 Districts in first year, 235 Districts in second year and remaining districts will be covered in the third year.

Goals and Objectives

- Reduce stunting in children (0-6 years) @2% per annum
- Reduce under-nutrition (underweight prevalence) inchildren (0-6 years) @2% per annum
- Reduce low birth weight (LBW) @2% per annum
- Reduce the prevalence of anemia amongst young children(6-59 months) @3% per annum
- Reduce the prevalence of anemia amongst women andadolescent girls @3% per annum

Components of POSHAN Abhiyaan

1. Convergence: POSHAN Abhiyaan ensures convergence with various programmes i.e. Anganwadi Services, Pradhan Mantri Matru Vandana Yojana (PMMVY), Scheme for Adolescent
Girls of this Ministry; Janani Suraksha Yojana (JSY), National Health Mission (NHM) of MoH&FW; Swachh - Bharat Mission of Ministry of Drinking Water & Sanitation (DW&S); Public Distribution System (PDS) of Ministry of Consumer Affairs, Food & Public Distribution (CAF&PD); Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS) of Ministry of Rural
Development (MoRD); Drinking Water & Toilets with Ministry of Panchayati Raj and Urban Local

2. Technology: The ICDS-Common Application Software (CAS) is one of the main components of POSHAN Abhiyaan. The mobile application facilitates the capture of data by frontline functionaries and a six-tier dashboard ensures the monitoring and intervention mechanism. CAS replaces ~8.2 kg of paper registers with 173 gms of smartphone. It enables growth monitoring of children with the help of auto plotting of growth chart on the mobile application; Auto-generates task list and home visit scheduler for enabling AWW to focus on the beneficiaries based on priority. System generated SMS alerts are sent to beneficiaries and government officials.

3. Capacity Building: Capacity enhancement of ICDS functionaries is part of POSHANAbhiyaan i.e. 'incremental learning by doing approach' (ILA). There are twenty-one thematic modules developed under ILA for training of State Resource Groups (SRG), District Resource Groups (DRG), Block Resource Groups (BRG) and AWWs.e-ILA (Learning and Management Solution): An e-ILA software has been developed as a comprehensive training and evaluation web-based learning portal for the staff based infield; this will be in addition to ongoing face-to-face ILA sessions. This will contribute to the sustainability of the ILA and establish systems that allow for easy measurement of learning outcomes through e-learning platforms. For Capacity Building of front-line workers and all service providers the training has been envisaged in 21 modules through Incremental lLearning Approach (ILA)

4. Community Mobilization and Behavioural Change: is another important component of the Mission. The problem of malnutrition is inter-generational and is dependent on multiple factors which, inter-alia, include optimal Infant & Young Child Feeding (IYCF) practices, Immunization, Institutional Delivery, Early Childhood Development, Food Fortification, Deworming, access to safe drinking water & proper sanitation (WASH), Dietary diversification, and other related factors. Therefore, to address the problem of stunting, under-weight and wasting, especially in children, there is a need to take-up sustained efforts requiring multipronged approach and bring grass-root synergy and convergence. The Mission focuses on converting the agenda of improving nutrition into a Jan Andolan through involvement of Panchayati Raj Institutions/Villages Organizations/SHGs/volunteers etc. and ensuring wide
Public participation.

Unit 6 : Nutrition Education, Communication and Behaviour Change

Chapter 1: Information, Education and Communication (IEC)\

Learning Objectives:

After reading this unit, the students will be able to:

- define the terminologies IEC, Behaviour Change Communication (BCC) and nutrition education (NE),
- explain the concept of BCC and its relation to IEC and nutrition education,
- discuss the need, scope and importance of behaviour change communication, and
- identify basic methods of communicating BCC centered messages to the target population

You may have seen health workers display posters, distribute pamphlets, screen films or make announcements or hold camps, specific to certain event, day or a cause. For example

TERMINOLIGIES USED IN THE CONTEXT OF NUTRITION EDUCATION

COMMUNICATION

each year, June 21, is celebrated as World Yoga Day. Government and non government organizations pool their resources and organize yoga camps, and use the occasion to create awareness about yoga and its benefit for both physical and mental health. The purpose is to inform, educate and communicate (IEC) regarding the importance of the activity (i.e. promotion of good health, prevention of life style diseases like obesity, diabetes, heart diseases etc) but also as part of the effort to bring about a behaviour change i.e. promotion of positive behaviour in terms of including physical exercise as part of their daily routine. Similarly, you have also seen information. education and communication (IEC) being extensively used to improve immunization coverage in our country. The sustained IEC campaign on polio over several years has had a great unprecedented success as no case of polio has been reported since January 2011 thus paving the way for polio free India. World Health Organization (WHO) recognizes the important role of BCC in the achievement of health, nutrition and population goals. In this Unit we will focus on what is BCC, the process and the approaches to nutrition education communication. We begin with first defining the various terminologies used in the context of nutrition education communication.

Education in nutrition is a necessary part of practical programmes to improve human nutrition. As a student of public nutrition you will come across terms like Behavior Change Communication (BCC), Information, Education and Communication (IEC) and very commonly nutrition education (NE) used

as an approach to create awareness and facilitate change in nutrition, health behaviour of individuals. What are these terms? Let's define them.

Nutrition Education (NE): Nutrition education is a process of persuading people to act in their own best interest for attaining nutritional well-being. It is a process by which beliefs, attitudes, environmental influences and understanding about food leads to practices that are sound, practical and consistent with individual needs that will make a maximum contribution to health and social well being.

Information, Education and Communication (IEC): IEC is described as a strategy to inform the public about nutrition/health concerns and attempts to change or reinforce a set of behaviour in a target population regarding the specific problem in a predefined period of time.

Behaviour Change Communication (BCC): BCC is a process of working with individuals, families, communities through different communication methods to promote positive health behaviour and support an environment that enables the community to maintain and sustain positive health behaviour.

Now that you have gone through the three definitions what do you notice? Yes, BCC, IEC and nutrition education terminologies, all three, are in fact, interchangeable. They all aim at creating awareness, motivating people to change behaviors and result in necessary action i.e. persuades people to adopt and sustain desirable nutrition and health practices. Disseminating knowledge provides important information; however, provision of information on its own has little effect. Action directed at strengthening the skills and capabilities of individuals to make healthy behaviour choices and change nutrition/health behaviour should be the objective of any nutrition education communication exercise. The biggest challenge in nutrition education communication is behaviour change. Behaviour change communication, therefore, is a process of promoting and sustaining healthy changes in behaviour in individuals and communities.

With this understanding let us learn about the need, scope of BCC.

NEED, SCOPE AND IMPORTANCE OF BEHAVIOUR CHANGE COMMUNICATION (BCC)

BCC can play a vital role in improving the nutritional status of individuals, families and community members if they adopt positive nutrition behavior. BCC also has a vital role to play for policy makers as it helps mainstream nutrition into various projects and programmes. The following points highlight the importance of BCC and inform why it is essential:

- BCC helps individuals to make judicious food choices and select the best diet possible from the food available, whether it is home produced or must be purchased, often within limited funds. Further it suggests ways of improving the nutritive value of diet,
- It equips individuals to turn into better informed consumers by providing insight into the nutritional components of the food,
- It informs people about health, illness and therapeutic value of food and its role in the maintenance of health,
- It enables people to define their own problems and needs, understand what they can do about these problems and decide the most appropriate action and advocate for resources to promote health,
- It motivates people to develop favourable attitudes and change, adopt and maintain more healthful practices,
- It allows the individual to evaluate the nutrition information he/she has received and remove myths, misconceptions and taboos,
- It promotes and highlights the importance of sanitary food handling practices at home, the market, industry and institutions responsible for serving food to large number of people such as hostels, hospitals, schools, canteens and restaurants,
- It is an essential catalyst for nutrition impact in food security, community nutrition and health interventions,
- It promotes healthy lifelong eating and nutrition learning in schools, home and community,
- It equips policy makers and programme planners in formulating policies, developing supplementary feeding programmes for vulnerable sections of population, and
- It helps policy makers and planners to formulate policies for other sectors like agriculture, rural development, manufacturing industry etc. which are linked to food supplies thus directly effecting consumers.

With our study so far you have a good understanding of behavior change communication concept and the need and importance of BCC. You must have realized that BCC involves working with individuals, families, communities to develop communication strategies/ activities. The next

BEHAVIOUR CHANGE COMMUNICATION PROCESS

section focuses on the process of behavior change communication.

Before we discuss the process of BCC let us first understand what is meant by the term 'communication'.

Communication simply defined, is the act of transmitting information, ideas and attitudes from one person to another such that intended goals are met. Communication is a two way

process wherein the message in the form of an idea, thought, feeling, opinion is transmitted between two or more persons with the intent of creating a shared understanding.

Figure 1 illustrates the communication process. If you look at the figure carefully you would identify four components in communication process. These include - SENDER, RECEIVER, MESSAGE and the FEEDBACK.

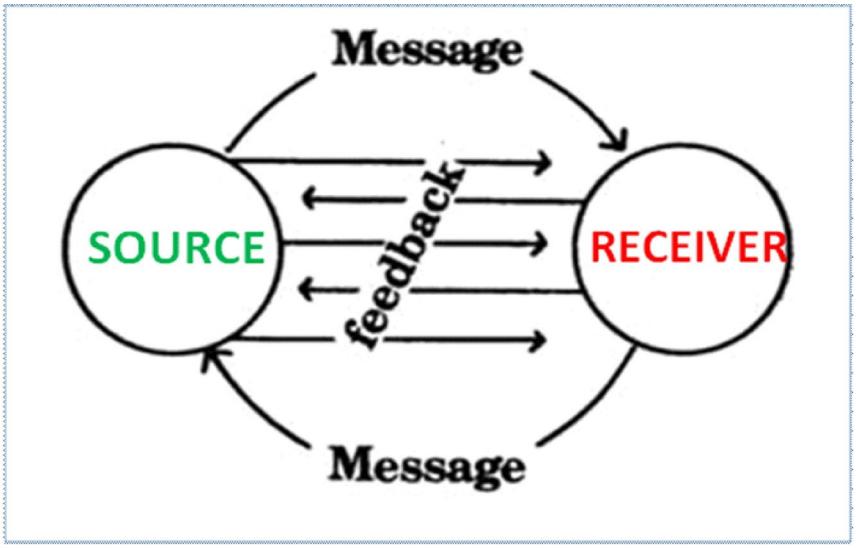
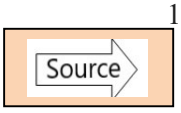
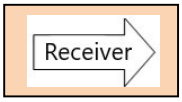


Figure 1: The communication process

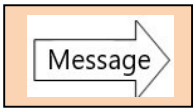
Let us review these four components in the context of behaviour change communication:



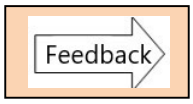
1. The BCC process begins with the conceptualization of an idea by the SOURCE. In this process the sender or communicator communicates the message. The communicator can be any source, you or any other nutrition/health expert or health worker or it can be any medium/channel such as audio visual aid like the television, radio etc.



2. The second component is the Message. Message consists of what is actually communicated. Message can be oral, written, non verbal such as body gesture, sound etc. or picture or any other signal that we use to get our idea across for motivation or behavior change. An example of a written message in nutrition education communication could be: "Breast milk is the best food for the Infant". Remember, the message should be brief, logical, persuasive, coherent i.e. clearly address the problem/issue to be dealt with.



3. The third component is the RECEIVER. Receiver is the person/population (audience) for whom the message is intended or targeted. It can be an individual or a vulnerable group or a community as a whole with whom we communicate for change in behavior. For example in an infant and child feeding nutrition communication programme the primary audience could be the mothers, grandmothers or older siblings whoever is the caretakers of children, who need to be informed.



4. The last component is FEEDBACK. Feedback is defined as the response or information provided as a result of an event, the event in this case being the transmission of information. Feedback occurs when the receiver receives the message from a source. The receiver listens, reads or observes non verbal signals or visual information and send non verbal or verbal feedback to the source who can than modify the message in response to the feedback to make it more persuasive to the receiver. So you may have noticed that feedback is a two way process.

It would be worth remembering here that behavior change communication process will be effective only and only if all the four components highlighted above are present.

In order to facilitate the process of communication we need communication skills. These skills are gained through knowledge and practice of the methods of communication. The messages can be conveyed through a variety of communication methods. These are described in the next

BEHAVIOUR CHANGE COMMUNICATION METHODS

section.

Information, education and communication (IEC) approaches are used to reach the target audience. There are a wide variety of methods/media that can be used to disseminate messages, information to the people. The correct choice of method is an essential aspect of communication in nutrition and health education. Off course which method to use will depend on who the target audience is i.e. are we reaching out to rural population or urban population or to school children or to general public? Each audience has their own characteristics (i.e. age, experiences, education level, exposure to media, reading, writing, listening skills, ownership of radio/TV etc.). Also the cost factor will influence the use of method/media.

Primarily the behaviour change communication methods can be categorized as:

- Interpersonal Communication methods: include all those forms of communication involving direct interaction between the source and the receiver. Examples of interpersonal communication methods include: interviews, individual discussions, face to face counseling or group discussions, community meetings, events etc.
- Mass communication media: Mass communication comprises techniques by which specialized groups employ technological devices such as press, radio, television audio visuals aids like films, documentaries etc. to disseminate content, information to large

heterogeneous and widely dispersed audience, and

- Traditional Communication methods: the non electronic form of communication employing vocal, verbal, musical and visual folk art form, transmitted from an individual or a group of individual from one generation to another. Examples include folk music and dance, puppetry, storytelling etc. These are indigenous modes and have served the society as a medium of communication since ages. They were used for moral, religious, socio-political communication earlier but in the recent past, they are being used for educational purposes particularly in nutrition and health education.

Refer to Figure 2 which illustrates thee different methods of communication.

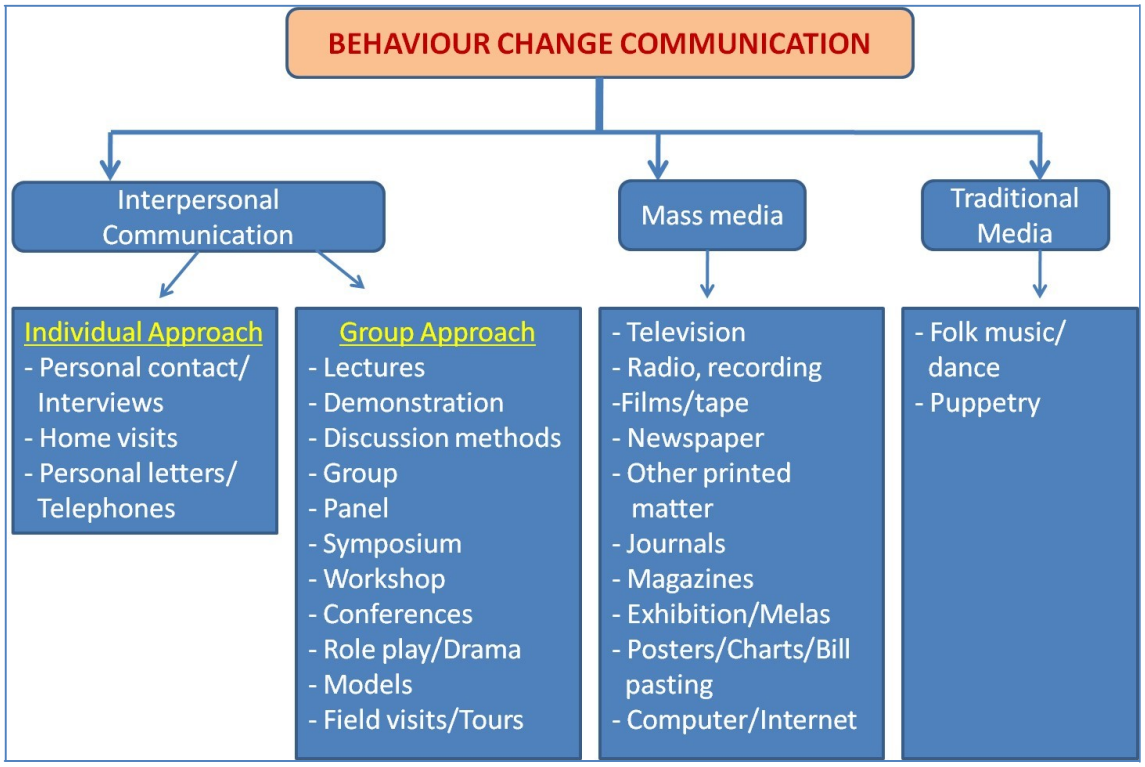


Figure 2: Behaviour change communication methods

The most successful attempt to change nutrition/health habits have been based mainly on interpersonal communication used in conjunction with other methods. Interpersonal communication can take place as an individual approach or group approach. Under individual approach one-to-one counseling or home visit or one-to-one interview, telephone contact can take place. For example when a caregiver say a mother visits the hospital or a health facility, the nutrition health educator listens to the caregiver's problems and help her find solutions to her problems. Similarly, group discussion method

involves face-to-face interaction with a group ofpeople.

Lecture cum Discussion

Demonstration

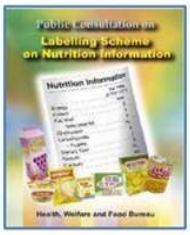
Lectures, demonstrations, meetings, community events are all group discussion methods. Theories about behavior change emphasize that people develop confidence and are willing to perform a new behaviour when they can observe others in their community doing the same. Therefore, role play, drama can build people's confidence in performing a new practice.

The main advantage of using interpersonal communication method is that it is possible to contact specific individuals or groups of individuals and make the advice relevant to their social, health needs and develop problem solving skills and encourage community participation. But the method has few limitations as the approach can be slow for spreading information in a population as it would require travelling to different communities and need to mobilize large number of health/nutrition workers. Further in large groups it may be difficult to have feedback and discussions.

Mass media implies that we can reach large number of people at a time through the means of communications employed through this approach. In this method the Source and the Receiver are never in direct contact. The interaction between source and receiver is mediated through the visual image (poster, flip chart, video, TV etc.), print (news paper, magazines), verbal (radio, etc.) or by a combination of these elements. Mass media can be very effective in creating awareness and interest in new ideas among general population. It provides a rapid way to reach a large audience without using a lot of manpower. It makes good use of scarce recourses. It not only informs but it also appropriate to create or reinforce change and motivates people. But the use of mass media can be limiting for large n diverse audience. The problems, needs may differ from one region to region or from people to people. Hence, it may be difficult to make the message appropriate to the special situation or need of the people. Mass media alone cannot persuade people to change deep-rooted attitudes or learn complex skills. We need to combine it with interpersonal communication also individual feedback is difficult to obtain.

Poster

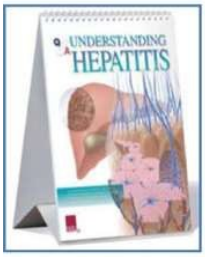
Leaflet



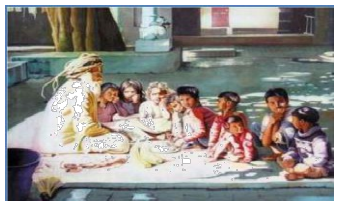
Banner

TV Broadcast

Flip Chart



Newspape

Puppe  Folk Songs  Folktales 	Traditional methods can be folk music, ballad forms of folk and puppetry. Some common forms of ballad style include Barrakatha (from Andhra Pradesh, Jugani and Vaar (Punjab). Adopting and composing folk songs, folktales and stories in local languages related to a particular problem can help people understand the issue. For example folktale relating to anaemia, can be designed on how misunderstanding the cause of anaemia led to the death of an anemic mother during child birth or the death of an anaemic child. Further, Puppetry too fascinates people of all ages, but children in particular. It can be effectively used to communicate Traditional media appeals at personal and intimate level. It can be available at very low cost. It is flexible in adopting themes specific to nutrition/health education. But traditional media is cultural specific and only people from a particular culture; region can identify the context and understand the

From our discussion above we have a good idea about the different communication methods and their uses and limitations. So you can appreciate how methods can help change behavior. Remember, posters, charts, leaflets and other visual aids can provide information. Stories, dramas, plays can present role models for behavior change; discussions provide opportunities to provide for solving problems by two way interaction and feedbacks. Radio, TV and other audio video aids can remind people about action. So use the communication methods judiciously.

Also remember that the effectiveness of each method is specific to the audience or target group. For example, using mass media as a means to reach out to urban population is most effective. Similarly, while using interpersonal communication with rural women, demonstrations, charts, models may be more effective. It is always better to use a multi-media combination i.e. use several methods of communication in such a way that each one of them reinforces the other and their collective impact is greater than using particular method alone.