

LECTURE 18: Food and nutrition, Balanced/modified diets, Menu planning, Malnutrition(over and under nutrition) and Nutritional disorders

Food may be defined as anything solid or liquid which when consumed meets the requirements of energy, body building, repair, regulation and protection due to the nutrients present in it. Food, as we all know is a basic necessity and is vital to nourish the body. It is essential right from the womb until the tomb. Intake of the right kinds and amounts of food can ensure good nutrition and health, which may be evident in our appearance, efficiency and emotional well-being. Different nutrients present in the food are carbohydrates, proteins, fats, vitamins and minerals. Nutrient requirements are the quantities of nutrients that healthy individuals must obtain from food to meet their physiological needs.

The recommended dietary allowances (RDAs) are estimates of nutrients to be consumed daily to ensure the requirements of all individuals in a given population. The Indian Council of Medical Research (ICMR) provides RDA for Indians. Nutrition in simple words has been defined as food at work in the body. Nutritional science includes the study of nutrients and other substances in the food, their absorption, assimilation, biosynthesis, catabolism and excretion. **Diet** on the other hand, refers to whatever we eat and drink each day. It includes use of specific intake of nutrients at right amounts to meet the nutritional needs of normal individuals or modification with specific restriction of nutrients during a diseased state which is also called as *therapeutic diets*.

A diet balanced in the required amounts of nutrients play a vital role in meeting the nutritional needs during special conditions such as pregnancy and lactation. It is also important for patients with a disease or to those who are recovering from an illness. When the diet is deficient in certain nutrients they reflect as acute deficiency disorders such as *goitre, protein energy malnutrition, night blindness, anaemia* etc or as chronic diseases such as cardiovascular diseases and cancer. Lifestyle and diet play a major role in preventing and managing diseases.

A. FUNCTIONS OF FOOD

Food has various functions in our lives. Functions of food may be classified according to *their role in the body as physiological, social and psychological functions*. Let us have a look into the physiological function of food.

1. Physiological functions of food

- ✓ Energy yielding foods: Carbohydrates and fats
- ✓ Body building foods: Proteins
- ✓ Protective and regulatory foods: Vitamins and minerals
- ✓ Foods that help in maintenance of health

Energy yielding foods: Foods rich in carbohydrates and fats are called energy yielding foods. They provide energy to sustain the involuntary processes essential for continuance of life, to carry out various voluntary activities and to convert food ingested into usable nutrients in the body. The energy needed to carry out these work is obtained from oxidation of food. *Cereals, roots, tubers, dry fruits, oils, butter and ghee* are all good sources of energy. Carbohydrates and protein provide 4 Kcal of energy per gram whereas fats and oils provide 9 Kcal of energy per gram.

Body building foods: Foods rich in protein are called body building foods. These foods help to *maintain life, to repair or replace worn out tissues and to promote growth*. They also supply energy. *Milk, meat, egg and fish* are rich in proteins of high biological value. *Pulses and nuts* are good sources of protein but the proteins are of relatively lower biological value than animal protein.

Protective and Regulatory foods: Foods rich in *protein, minerals and vitamins* are known as protective and regulatory foods. They are essential for health and regulate activities such as *maintenance of body temperature, muscle contraction, control of water balance, clotting of blood, removal of waste products from the body, maintaining heartbeat and to improve immunity*. *Milk, egg, liver, fruits and vegetables* are sources of protective foods.

Foods that help in maintenance of health: Food is a source of *phytochemicals and antioxidants* which help in *neutralizing deleterious free-radicals which damage the biological tissues* thus, preventing a wide array of degenerative diseases. Food plays an important role in preventing chronic diseases like *cancer, degenerative diseases and cardiovascular diseases*; and in the management of diseases such as *hypertension and diabetes*. Such foods can be termed as *functional foods*. Few examples of foods that are rich in phytochemicals and antioxidants are *green leafy vegetables, fruits, vegetables and spices*.

2. Social functions of food

Food has always been the central part of our social existence. Humans are social beings and food has been a part of our community, culture and religion. Special foods are distributed as benediction in religious places. Cultural changes are observed in the preparation of food and pattern of diet in different regions of the country. Whether fasting or feasting, food has acquired religious importance. It is a token of *expressing gratitude, love, friendship and happiness*. Food is the central part of various occasions such as *birth, naming ceremony, birthdays, festivals, marriages* etc. It connects our social life and symbolizes social acceptance. Hence, food is an integral part of our social well-being.

3. Psychological functions of food

In addition to satisfying physiological and social needs, foods also satisfy certain emotional needs of human beings. These include a *sense of security, love and acceptance*. For example, preparation of delicious foods for family members is a token of love and affection. Food influences greatly on our psychological well-being. Certain amino acids such as *tryptophan, phenylalanine, tyrosine and methionine* are

precursors of neurotransmitters that influence our psychological well-being such as serotonin, dopamine, nor-adrenaline and γ -aminobutyric acid. Dietary deficiencies of amino acids, carbohydrates and essential fatty acids have been linked to psychological disorder such as depression.

B. FOOD GROUPS

Foods have been classified into different groups depending on their nutritive value and for the ease to plan a diet. They are grouped as basic four, basic five and basic seven foodgroups.

Objective of the food group system are

- ✓ Planning wholesome balanced menus to achieve nutritional adequacy.
- ✓ Assessing nutritional status-a brief diet history of an individual can disclose inadequacies of food and nutrients from any of the five groups.

Groups	Food	Nutrients
Basic Four	a) Cereals, millets and pulses	Carbohydrates, proteins, B-vitamins
	b) Vegetables and fruits	Vitamins, minerals and fiber
	c) Milk, milk products and animal foods	Protein, calcium, B-vitamins, phosphorus
	d) Oils, fats, nuts and oilseeds	Fat and protein
Basic Five	a) Cereals, grains and products	Carbohydrates, protein, invisible fat, thiamine, riboflavin, folic acid and fiber
	b) Pulses and legumes	Carbohydrates, protein, invisible fat, thiamine, riboflavin, folic acid, iron, calcium, and fiber
	c) Milk and meat products	Protein, calcium, fat, riboflavin and phosphorus
	d) Fruits and vegetables	Carotenoids, Vitamin C, riboflavin, folic acid, iron, calcium and fiber
	e) Fats and sugars	Essential fatty acids, iron, vitamin A, D, E and K
Basic Seven	a) Green and yellow vegetables	Carotenoids, ascorbic acid and iron
	b) Oranges, grapes, tomatoes, raw cabbage	Ascorbic acid
	c) Potatoes, other vegetables and fruits	Vitamins, minerals, fiber
	d) Milk and milk products	Calcium, phosphorus, protein, vitamins,
	e) Meat, poultry, fish and eggs	Protein, phosphorus, iron, B-vitamins
	f) Bread, flour and cereals	Thiamine, niacin, riboflavin, carbohydrates, fiber
	g) Butter or fortified margarine	Vitamin A and fat

The most commonly used food group system is the **five basic food groups** as recommended by the ICMR. Foods that fall under each group have been discussed below.

I. Cereals, Grains and Products:

- ✓ Cereals:- Rice, Wheat, Barley, Oats, Rye
- ✓ Millets:- Ragi, Bajra, Maize, Jowar, Little millet (Samai), Kodo millet (varagu)
- ✓ Products:- Flakes, Flour, Puffed products

II. Pulses:

- ✓ Pulses:- Bengal gram, Black gram, Green gram, Red gram, lentils, Cow pea, Horse gram
- ✓ Beans:- Broad bean, Field bean, Haricot bean, Shell bean, Lima bean, Moth bean
- ✓ Peas:- Green peas

III. Milk and Meat Products:

- ✓ Milk:- Curd, Skimmed Milk, Cheese, Khoa, Cream
- ✓ Meat:- Chicken, Liver, Fish, Egg, Beef, Mutton, Pork

IV. Fruits and Vegetables:

- ✓ Fruits:- Mango, Guava, Tomato, Papaya, Orange, Sweet

Watermelon Vegetables:-

- ✓ Green Leafy:- Amaranth, Spinach, Drumstick leaves, Coriander leaves, Mustard leaves, Fenugreek leaves, Cabbage.
- ✓ Roots and tubers:- Beetroot, Carrot, Onion, Potato, Radish, Tapioca, Sweet potato, Yam
- ✓ Other Vegetables:- Brinjal, Ladies fingers, Capsicum, Beans, Drumstick, Cauliflower, Bottle gourd, Snake gourd.

V. Fats and Sugars:

- ✓ Fats:- Butter, Ghee, Hydrogenated fats, Cooking oils like Groundnut, Mustard, Coconut.
- ✓ Sugars:- Sugar, Jaggery

Balanced diet: A balanced diet is a diet which gives your body the nutrients needed by it to function efficiently. In order to obtain the proper nutrition from your diet, you need to obtain the majority of your daily calories from *fresh fruits, vegetables, whole grains, legumes, nuts, lean proteins*. A balanced diet comprises of *macronutrients like proteins, carbohydrates and fats along with micronutrients which include vitamins and minerals*. Each of them has a vital role in maintaining the body functions. These nutrients are derived through a combination of the five major food groups. Each person's body is different and often individuals require a different amount and type

of nutrition. This depends on the age, gender, illness and the rate at which one's body works.

Basics of maintaining a balanced diet and choosing the healthier option:

- ✓ Eat at least five portions of fruit and vegetables a day.
- ✓ Cut down the sugar and saturated fat intake.
- ✓ Drink plenty of water, six to eight glasses is the recommended amount. Add a fresh squeeze of lemon if needed to get a bit of flavor.
- ✓ Aim for at least two portions of fish every week.
- ✓ Reduce the salt intake. It is advised to eat not more than 6 grams of salt in a day.
- ✓ Always eat breakfast, as it provides you with energy for the day.
- ✓ Use starchy foods as the base of your meals. These act as fuel for the day.
- ✓ Get active. Teenagers and adults are required to exercise moderately for 150 minutes a week. A brisk walk of 30 minutes daily is recommended.

Recommended dietary allowance (RDA)

RDA is estimates of nutrients to be consumed daily to ensure the requirements of all individuals in a given population.

Fats: Fats provide energy. They store vitamins and synthesize hormones. According to NIN, about $\frac{1}{5}^{\text{th}}$ of our diet or 20% should be devoted to fats of all 3 kinds - *polyunsaturated, monounsaturated and omega-3 fatty acids*. Vegetable oil used in day to day cooking is a major source of visible fat in our diet. To ensure optimal fat quality the use of a combination of vegetable oils is important. It is suggested to include a blend of various types of oils in the diet. You could juggle between *butter, ghee, olive oil, mustard oil, soybean, sesame* and even *groundnut oil* for different meals. Depend more on unrefined or cold pressed oils versus refined oils. In foods, there are 2 types of fat: saturated and unsaturated. Unsaturated fat is the 'good fat' this can help lower cholesterol and provide a source of omega-3, a fatty acid that is said to be essential. Fat also helps the body absorb some vital vitamins such as vitamin A, D and E. Nutritional experts generally recommend that unsaturated fats make up a maximum of **35%** of a person's daily energy intake. The 'bad' saturated fats should **not reach more than 11%** of the daily allowance. Unsaturated fats can be found in *oily fish (tuna and salmon), seeds and nuts, avocados, olive oil and sunflower seed oil*. Saturated fat can be found in *lard and butter, pastries, biscuits and cakes, cream, sour cream and ice cream, hard cheese, pies and sausages*. The disadvantages of eating fat is that it *raises cholesterol levels, increases risk of heart attack, puts pressure on our internal organs, can lead to depression, low self-esteem and stress*.

Carbohydrates: Carbohydrates are the body's main source of energy. In India, **70-80%** of total dietary calories are derived from carbohydrates present in plant foods such as cereals, millets and pulses. It is suggested that half of the total calories of the day should come from carbohydrates. Carbohydrates from healthy sources such as *whole grains (brown rice, millets and oats)* which have a high nutritive value should be incorporated in the diet.

Proteins: About **30-35%** of the diet should consist of protein. This could be in the form

of milk, pulses, leafy greens, eggs, white meat or sprouts. This is because protein is the main component of all our body cells, as well as hair, skin and soft tissues. Moreover, we burn more calories in digesting proteins than carbohydrates. Since men tend to be muscular and usually weigh more than women, they require more protein. The recommended dietary allowance of protein is *60 grams/day for men and 55 grams/day for women*. Meat, fish, beans and eggs all provide our bodies with a good source of protein. Protein is essential for the body to develop and repair itself. While pulses (beans, nuts and seeds) are a good source of protein, they do contain high levels of fat. Nuts are high in fiber and are a good alternative to saturated fats. But they have to be eaten in moderation as too much fat can be damaging.

Vitamins and Minerals: These micronutrients support metabolism, nerve and muscle function, bone maintenance and cell production. Minerals are inorganic and so minerals from plants, meat and fish easily find their way into the body. Vitamins are fragile compounds and it is difficult to shuttle them as they may be destroyed during cooking or storage. They can be derived from nuts, oilseeds, fruits and green leafy vegetables. Vitamin A, E, B₁₂ and D are vital and so is calcium and iron. Calcium is needed to keep our bones and teeth strong. Calcium is also needed to regulate muscle contraction including heart beat. It ensures that blood clots normally.

Fiber: Fiber aids in digestion. A meal is incomplete without fiber both *soluble and insoluble*. Vegetables and fruits should be eaten instead of being consumed as juice. Most fruits and vegetables (besides potato and corn) and whole grains are also foods with a low glycemic index which means that they do not cause sudden spikes in blood sugar levels and help maintain them.

C. DIETARY GUIDELINES OF ICMR TO ENSURE A BALANCED DIET

The ICMR has provided guidelines for Indians to ensure balanced diet. The guidelines are as follows:

- ✓ Choosing variety in the daily diet is not only appealing but also provides nutrients and promotes good health because, a single food cannot provide all the nutrients.
- ✓ A diet consisting of foods from several food groups provides all the required nutrients in proper amounts.
- ✓ Cereals, millets and pulses are major sources of most nutrients.
- ✓ Milk which provides good quality proteins and calcium must be an essential item of the diet, particularly for infants, children and women.
- ✓ Oils and nuts are calorie-rich foods, and are useful for increasing the energy density and quality of food.
- ✓ Inclusion of eggs, flesh foods and fish enhances the quality of diet. However, vegetarians can derive almost all the nutrients from diets consisting of cereals, pulses, vegetables, fruits and milk-based diets.
- ✓ Vegetables and fruits provide protective substances such as vitamins/minerals/phytonutrients.
- ✓ Diversified diets with a judicious choice from a variety food groups provide the necessary nutrients.

Portions of food groups to be included by adults with sedentary activity for a balanced diet

Food groups	Portion size (g)	Man (No. of portions)	Woman (No. of portions)	Pregnant Woman (No. of portions)
Cereals and millets	30	12	9	9
Pulses (Vegetarians)	30	2	2	2
Pulses (Non-vegetarians)	30	1	1	1
Milk and milk products	100	3	3	5
Vegetables	100	3	3	3.5
Fruits	100	1	1	2
Fats and oils	5	5	4	6
Sugars	5	5	4	4

D. BALANCED DIET AT DIFFERENT STAGES OF LIFE

a. **Nutritional requirements during infancy:** During early infancy, much of the nutrient requirements are met by *breast milk* whereas *after 6 months 70% of the needs can be achieved by breast feeding and 30% by supplementary foods*. The energy requirements for infants are higher than adults per unit body weight i.e., *infants require 108 Kcal/kg body weight whereas adults require 40Kcal/kg body weight*. The protein, calcium and phosphorus needs are also higher than adults per unit body weight since the demand for skeletal and muscle growth is higher in infants. The protein requirements *are 2 g/kg body weight*. Diluted and strained vegetable and fruit juices, milk (120-180 ml/day), sprouted and dried cereals gruels, sprouted and dried pulse porridge can be supplemented during late infancy. Germinated cereal and pulses are rich in enzyme amylase which aids in digestion.

b. **Nutritional requirements for school children (1-12 Yrs):** During schooling, the nutritional requirements for *protein, iron and pyridoxine increases*. There is an increase in total body size along with muscle mass and bone growth. *Energy, protein, calcium and iron deficiencies* are the most common nutrient deficiencies observed during schooling. Hence milk, egg, greens, pulses and cereals should be provided sufficiently in the diet. The protein requirement is *1.5-2g/kg body weight*. Energy dense, body building and protective foods are important for children of 1-12 years of age. Protective foods such as fruits help in fighting infections which is common among school going children.

c. **Nutritional requirements during adolescence (13-18 Yrs):** Adolescence is the time period between childhood and adulthood. The major change in the physiology includes influence of hormones which result in physical, biochemical and emotional development. During this period the final accelerated growth spurt occurs with respect to height and weight and the maximum height is attained. These changes demand for nutrients such as energy, protein, minerals and vitamins. The energy

requirements for *adolescents range between 2000-2500 Kcal*, protein requirements are *1.5g/kg body weight* and *calcium of 600-800mg/day*. Adolescent girls are at greater physiological stress than boys because of menstruation. Therefore for growth, maturation and bone development; body building, protective foods and foods rich in calcium and iron are essential during adolescence.

d. Nutritional requirements for adults: The energy and protein requirements per unit body weight are lesser for adults than infants and children aged 1-12 years. The protein requirement for an adult is *1g/kg body weight* and requires around *60g of protein per day*. The RDA for *fat is 20-25g/day*. The portion sizes of different food groups to be included in the diet to meet the nutritional requirements of adults per day are given in detail in table.

e. Nutritional requirements during pregnancy: Nutritional requirements during pregnancy are of utmost importance to the mother and growing fetus. Good nutritional status before and during conception will ensure lesser complications. *Folic acid 500µg/day* supplementation has proven to be beneficial before planning pregnancy and during pregnancy to prevent *neural tube defects*. Pregnant women need an additional *300 Kcal of energy, 15 g of protein, 10 g of fat, 600 mg of calcium and 8-10 mg of iron than normal adult women*. The body demands requirement of all the nutrients in right amounts during pregnancy. Therefore diet comprising of energy dense, body building, and protective foods especially *egg, fish, fruits, vegetables, nuts and green leafy vegetables* are essential during pregnancy. As discussed in table regarding the portion size and numbers of different food groups for normal adult, pregnant women require an *additional 2 portions of fats and oils, 2 portions of milk, 1 portion of fruits and half portion of green leafy vegetables*.

f. Nutritional requirements during lactation: The nutritional requirements of lactating mothers should meet the needs for *post pregnancy tissue repair, daily nutritional needs, nutritional needs of the infant and for production of milk*. Nutritional needs are greater during lactation than during pregnancy. The body demands requirement of all the nutrients in right amounts during lactation. Fluid intake of *2-3 liters per day* is essential to prevent dehydration during lactation. An additional *550 Kcal of energy, 25 g of protein, 25 g of fat and 600 mg of calcium* is required for lactating mothers than normal adult women. An additional *1 portion of cereals, 2 portions of pulses, 2 portions of fat/oil, 2 portions of milk, 1 portion of fruits and half portion of green leafy vegetables* are required during lactation. Between 6-12 months of lactation, diet intake should be gradually brought back to normal.

g. Nutritional requirements during old age: the energy requirement during old age is lesser than adults due to decreased activity. The requirement of *protective foods is essential during old age* to prevent damage from free radicals and oxidative stress related degenerative diseases. *10- 12% of total calories should be from protein and 50% from carbohydrates*. The requirement for *calcium is higher and is 1000 mg/day* for postmenopausal women. Saturated fats should be limited in the diet. *20g of fiber everyday* is essential to prevent bowel discomfort however *rough bran, fiber and mature vegetables are not recommended*. Fiber from tender vegetables and fruits are advisable therefore number of portion of *cereals and millets is reduced by 3 for*

elderly men and 2 portions for elderly women and an extra portion of fruits is added.

E. FOOD PYRAMID AND FOOD PLATE

A diet is optimum or balanced when it consists of foods from several food groups, provides all the required nutrients in proper amounts and provides *phytochemicals, antioxidants and nutraceuticals to promote health*. A balanced diet should provide 50-60% of the calories from complex carbohydrates, 10-15% from protein and 20-30% from visible and invisible fat. A balanced diet helps in meeting the nutrient requirements, improves immunity and cognition, prevents diseases, reduces stress and helps in improving the overall quality of life.

The food guide pyramid was introduced in 1992 by United States Department of Agriculture (USDA) as a general plan of what to eat each day. The food guide pyramid is a valuable tool for planning a health promoting diet. By incorporating the principle of balance, variety and moderation, an individual can still eat their favorite foods while following the food guide pyramid. A balanced diet should provide 50-60% of the calories from complex carbohydrates which is the major part of the diet thus making it the base of the food pyramid. Therefore 6-11 servings of cereals are recommended. Protective foods are essential in providing vitamins, minerals and fiber. Therefore 3-5 servings of vegetables and 2-4 servings of fruits form the next level of food pyramid, 2-3 servings of pulses, milk and milk products, egg, meat and fish form the next level of food pyramid to meet 10-15% of protein of the total calories. The tip of the food pyramid has sugars, fats and oils which are to be used sparingly since they are energy dense foods.

My plate

My Plate is the current and latest nutrition guide published by the USDA, a food circle (i.e. a pie chart) depicting a place setting with a plate and glass divided into five food groups. It replaced the USDA's my pyramid guide on June 2, 2011, ending 19 years of USDA food pyramid diagrams. My Plate is divided into sections of approximately 30% cereals, 40% vegetables, 10% fruits and 20% protein, accompanied by a smaller circle representing dairy, such as a glass of milk or a yogurt cup.

Deficiency of proteins in the diet results in the development of diseases related to PEM. Kwashiorkor and Marasmus are two types of diseases related with protein and energy malnutrition (PEM).

a. **Kwashiorkor** is one type of a deficiency disease related to protein energy malnutrition. It affects mainly children under 5 years of age who do not get protein in their regular diet. Symptoms: Child exhibits stunted growth, anaemia, swollen legs, discolouration of hair etc. Children affected by this disease are treated by giving milk, eggs and other protein rich foods.

b. **Marasmus** is also a disease related to protein-energy malnutrition. It affects mostly

infants who feed on mother's milk who receive less amount of protein in their diet. Symptoms: Lean muscles, weak bones, rough skin, weak legs, mental retardation etc. Treatment: Protein rich diet should be consumed by mothers who feed their children with breast milk.

Prevention and management of malnutrition

Effective promotion of infant and early child feeding practices is the first step in eradication of malnutrition, it includes:

- ✓ Breastfeeding within the first hour of new-borns.
- ✓ Complementary feeding with or without provision of food supplements.
- ✓ Micronutrient interventions with Vitamin A, D and Zinc fortification and supplementation for children.
- ✓ For maternal health, sufficient and healthy dietary intake during pregnancy with iron, folic acid and calcium supplements.
- ✓ General supportive strategies for improving family and community nutrition and reducing the incidences of diseases.

OBESITY

Obesity is defined as a *disorder characterized by excessive body fat accumulation* with multiple organ-specific consequences. *Over weights the direct cause of obesity.* Worldwide, in year 2015, 42 million children under age 5 were overweight, up from 31 million that was recorded in the year 2000. Trends suggest that this number will continue to rise. While the number of children affected has been steady in Latin America and the Caribbean, they have been increasing since the year 2000 in all other regions. East Asia and the Pacific had the highest number of overweight children in 2015.

People who are overweight or obese are at a risk of *heart diseases, hypertension, stroke, diabetes, certain types of cancers and gallbladder diseases.* It is most dangerous if a person has a high hip-waist ratio i.e. the waist circumference is large compared to the hips. People put on weight when they eat more food than the energy spent. This is the usual case when people's normal lives and work do not involve much physical activity and their meals contain large amounts of energy-rich foods, such as fats and oils. Although sugar is not a particularly energy-rich food, people who are, or at risk of becoming obese should limit the amount they eat. Sugary foods are often rich in fats and they encourage overeating because they are sweet and therefore attractive to many people. While overweight and obesity is normally seen as a problem of excessive food intake, some health workers do not know that even the overweight people often suffer from micronutrient deficiencies (in particular, vitamins A, E, C, and B-group vitamins) because they often eat poor, unbalanced diets. This is an important point to be noted and should be properly conveyed to overweight and obese people. Not only do they need to reduce their energy intake and increase their physical activity level, but they must also have healthy, balanced diets. Obesity is a complicated, difficult-to-treat condition in which social norms, values and psychological factors also play an important role. This makes it more difficult to persuade people to change what they eat and to change their activity level.

Two major strategies to prevent and manage obesity are

- ✓ Physical activity
- ✓ Food limitation