

LESSON 1

CONCEPT OF HEALTH AND NUTRITION IN COMMUNITY

Nutrition is the science of food values. It is relatively a new science, which was evolved from chemistry and physiology. The effect of food in our body is explained in nutrition. In other words, nutrition is defined as food at work in the body. In a broader sense nutrition is defined as “the science of foods, the nutrients and other substances their action, interaction, and balance in relationship to health and diseases, the process by which the organism ingests, digests, absorbs, transport and utilizes nutrients and dispose off their end products, in addition nutrition must be concerned with the social, economic, cultural and psychological implication of food and eating.”

Nutrients are defined as the constituents of food, which perform important functions in our body. If these nutrients are not present in our food in sufficient amount, the result is ill health. Important nutrients include carbohydrates, proteins lipids, vitamins, minerals, and water. Food also contains many substances, which are non-nutrients e.g. coloring and flavoring substances in food.

When all essential nutrients are present in correct amount and proportion as required by our body it is called *optimum nutrition* or *adequate nutrition*. Optimum nutrition is required to maintain good health.

Malnutrition is an impairment of health either from a deficiency or 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. For example, vitamin A deficiency and PEM (Protein Energy Malnutrition) are common problems in India. Over nutrition means excess of one or more nutrients. For example overweight or obesity occurs when an individual takes more energy than he is able to agenda on his daily activities which results in accumulation of fat and hence weight increase (overweight).

Relationships of food to health have been made from the research conducted by chemists, microbiologists, pathologists, and nutritionist for the past two centuries. Human nutrition is governed by many factors like food habits and behaviour, food beliefs, ethnic influences, geographic influences, religious and sociological factors, psychological factors, food and production, income, national and international food policies, food technology, processing, fisheries, transportation, marketing, educational status and other mass media facilities.

Health is a common theme in most cultures. In fact, all communities have their concepts of health. Traditionally health is conceived as “absence of disease”. At the individual level, it cannot be said that health occupies an important place. It is usually subjugated to other needs defined as more important e.g. wealth, power, prestige, knowledge, security etc. Health is often taken for granted and its value is not fully understood unless it is lost.

Health is one of those terms which most people find it difficult to define, although they are confident of its meaning. Therefore many definitions of health have been offered with the terms. Some of them are:

- a. “The condition of being sound in body, in mind and spirit, especially freedom from physical disease or pain” (Webster).
- b. “ Soundness of body or mind, that conditions in which its functions are duly and efficiently discharged”(Oxford English Dictionary).
- c. “A condition or quality of human organism expressing the adequate functioning of the organism in given condition, genetic and environmental”.

WHO Definition

The widely accepted definition of health is that given by the world Health Organisation (1948). It defines it as “*a state of complete physical, mental and social well being and not merely an absence of disease or infirmity*”.

In recent years, this statement has been amplified to include the ability to lead a “*socially and economically productive life*”.

The WHO definition envisages three specific dimensions—the physical, mental, and social aspect of health and many more may be cited viz. spiritual, emotional, vocational, and political dimensions.

(i) **Physical dimensions:** It is the easiest to understand. The state of physical health implies the notion of “Perfect functioning” of the body. The signs of physical health in an individual are “ a good complexion, a clear skin, bright eyes, lustrous hair with a body well clothed with firm flesh not too fat, a sweet breadth, a good appetite, sound sleep, regular activity of bowels and bladder and smooth, easy coordinated bodily movement. All the organs of the body are of unexceptional size and function normally; all the senses are in tact; the resulting pulse rate, blood pressure and exercise tolerance are all within the range of “normality” for the individual’s age and sex. This state of normality has fairly wide limits, which are set by observing a large number of ‘normal’ people, who are free from evident disease.

(ii) **Mental Dimensions:** Mental and physical dimension of health are inter-related. It is not the mere absence of mental illness. Good mental health is the ability to respond to the many varied experiences of life. Poor mental health affects physical well being also and vice-versa. Psychological factors are considered to play a major role in disorders such as hypertension, peptic ulcer and asthma.

(iii) **Social Dimension:** Social well being implies harmony and integration within the individual, between each individual and other members of the society and between individuals and the world in which they live, social health of a community depends upon its progress,

broadmindedness, consideration, through fullness and sympathy towards other. It also depends upon the education, productivity, health and social security of its members.

(iv) **Spiritual Dimension:** Due to stresses and strains of modern life, it is very important for us to consider this dimension of health as well. An individual has to be at peace with himself, before he can be at peace with the world. Attention to moral values, ethics, exercise, and meditation are some of the ways of attaining spiritual health.

(v) **Vocational Dimensional:** The vocational aspect of life is a new dimension. The importance of this dimension is exposed when individuals suddenly lose their jobs or faced with mandatory retirement. For many individuals, the vocational dimension may be nearly a source of income. To others, this dimension represents the culmination of the efforts of other dimensions as they function together to provide what the individual consider in life “*Success*”

DETERMINANTS OF HEALTH

Health does not exist in isolation. The factors, which influences health lie both within the individual and externally in the society in which he or she lives. These factors interact and the result of these interactions may be health promoting or deleterious. Thus, the health of individuals and whole communities may be the result of much such interaction. Some of the important determinants of health are discussed below.

- i) Heredity
- ii) Environment
- iii) Life style.
- iv) Socio-economic conditions
- v) Health and family welfare services
- vi) Others.

i) **Heredity:** The physical and mental traits of every human being are to some extent determined by the nature of his genes at the moment of conception. This genetic make up is unique, that it cannot be altered after conception. A number of diseases are known to be of genetic disorder, e.g. chromosomal anomalies, sickle cell anemia, hemophilia, errors of metabolism, mental retardation, some types of diabetes, etc. The state of health, therefore depends on the genetic constitution of man.

ii) **Environment:** It was hippocrates who first related disease to environmental e.g. climate, water, food, air, etc. Century’s later Pettenkofer in Germany revived the concepts of disease environment association.

The external environment consists of those things to which the man is exposed after conception. It is defined as “all that which is external to the individual human host”. It can be divided into physical, biological, and psychosocial components, any or all of which can effect the health of man and his susceptibility to illness. It has a direct impact on the physical, mental and social well being of those living in it. If the environment is favourable to the individual he can make full use of his physical and mental capabilities.

iii) **Lifestyle:** The term life style implies “the way people live”. Reflecting a whole range of social values, attitudes and activities. It is composed of cultural and behavioural patterns and life long personal habits. (e.g. smoking, alcoholism) that have developed through process of socialization. Lifestyle is learnt through social interactions with parents, peer groups, friends and siblings and through school and mass media.

Health requires the promotion of healthy lifestyles, examples include adequate nutrition, enough sleep, sufficient physical activity etc. Health is both a consequence of an individual's life style and a factor determining it. Many current day health problems especially in the developed countries (e.g. coronary heart disease, obesity, lung cancer, drug addiction) are associated with lifestyles changes. In developing countries such as India where traditional lifestyle will persists, risks of illness and death are connected with lack of sanitation, poor nutrition, personal hygiene, elementary human habits, customs and cultural patterns. In short the achievement of optimum health demands adoption of healthy lifestyles.

iv) **Socio-economic conditions:** It has long been known that socio-economic conditions influence human health, some of the important factors which determine the socio-economic conditions are:

a) **Economic Status:** The per capita GNP is the most widely accepted measure of general economic performance. The economic status determines the purchasing power, standard of living, quality of life, size of the family and the pattern of disease and deviant behaviour in the community. It is also an important factor in seeking health care; ironically, affluence may also be a contributory sense of illness as exemplified by the high rates of coronary heart disease, diabetes and obesity in the upper socio-economic groups.

b) **Education:** A second major factor influencing health status is education (especially female education). The world map of illiteracy closely coincides with the maps of poverty, mal-nutrition, ill health, high infant and child mortality rates. Studies indicate that education to some extent compensates the effect of poverty on health irrespective of the availability of health facilities. In India Kerala is an example, Kerala has an estimated infant mortality rate of 29 compared to 104 for all India in 1984, and major factors is the highest female literacy rate of 65.7% compared to 24.8% of all-India.

c) **Occupation:** Unemployment shows a higher incidence of ill-health and death. Form many loss of work does not only mean loss of income and status, but psychological and social damages also.

d) **Political system:** Health is also related to country's political system. Often the main obstacles to the implementation of health technologies are not technical, but rather political. Recessions concerning resource allocation, manpower policy, choice of technology and the degree to which the health services are made available and accessible to different segments of the society are examples of the manner in which the political system can shape community health services.

e) **Health Services:** The purpose of health services is to improve the health status of population. The term health and family welfare services cover a wide spectrum of personal and community services for treatment of disease, prevention of illness and promotional of health. Immunization of children can influence the incidence/prevalence of a particular disease. Provision of safe water can prevent mortality and morbidity from water-borne diseases. The care of pregnant women and children would contribute to the reduction of maternal and child morbidity and mortality. All these are ingredients of what is now termed as “primary health care”, which is seen as the way to better health.

f) **Other factors:** Other factors which influence the health of populations are beside the formal health care system. This would include opportunities, increase wages, prepared medical programmes and family support system. In short medicine is not the sole contributor to the health and well being of populations. The contributions of inter-sectoral programmes to the health of communities is increasingly recognized.

LESSON 2

ELEMENTARY KNOWLEDGE OF NUTRIENTS –I

Good Nutrition is a basic component of health. It is of prime importance in the attainment of normal growth and development and in the maintenance of health throughout life. The discovery of vitamins at the turn of the past century has “rediscovered”, the science of nutrition. Since then, great advances have been made in the field of nutrition. Between the two world wars, research was mainly centered around vitamins. After the Second World War, research on protein gained momentum. During the seventies a great deal of interest had been focused on the role of dietary fats in the pathogenesis of atherosclerosis and its complications, particularly coronary artery disease. In the last decades the role of trace elements and dietary fiber in human health and disease have attracted considerable attention. Since all foods are not of the same quality from the nutritional point of view, man’s ability to meet his nutritional needs and maintain good health depends upon the type and quantity of foodstuffs he is able to include in his diet.

Definitions

Nutrition: It is the science of foods, the nutrients, and other substances therein, their action, interaction, and balance in relationship to health and disease.

Food: The edible stuff that provides us with nutrients is termed as food. Food is broadly classified as cereals, pulses, vegetable, fruits, milk, eggs, flesh foods, fats and sugars.

Nutrients: are the constituents in food that must be supplied to the body in suitable amounts. These include proteins, fats, carbohydrates, minerals, water and vitamins.

Nutrition status: It is defined as the extent to which a customary diet meets the body’s requirement. In other words, it signifies the condition of body after the consumption of food. The Condition of health of individuals as influenced by the utilization of nutrients. It can be assessed by dietary survey, anthropometry, clinical and laboratory investigations. A brief outline of the dietary information on the importance of various nutritional constituents that are present in foodstuffs is given in the following pages.

ENERGY

Energy is defined as the capacity for doing work. It is the heat produced in the body which is utilized for performing the involuntary and voluntary activities, to maintain body temperature to synthesize new body constituents.

Basal Metabolic Rate: A number of processes go on in the body without any conscious effort, even when subject is at complete rest and no physical work is done. These include involuntary processes such as the beating of heart, the circulation of blood etc. These activities are called basal metabolic processes. The energy used for carrying out these activities, is known as the basal metabolic rate, abbreviated BMR. The basal energy need constitute more than half of the total energy need, for most of the people.

Unit of Energy: The energy value of food is expressed in terms of Kilocalories (K cal or C). A Kilocalorie is defined as the amount of heat required to raise the temperature of one kg of water by 1⁰C.

In the metric system, the international unit, which is Kilojoules, is used instead of Kilocalories. A Kilojoule is energy expended when one kg. of mass is moved by one meter using a force of a newton.

1 Calorie	= 4.184 Joule
1 K cal or C	= 4.184 K Joule
1000 K Cal or C	= 4.184 M Joule
1 K Joule	= 0.239 K Cal.
1 M Joule	= 239 K Cal.

Factors influencing the total Energy Requirement: Among factors which influences energy needs are age, sex, body size, climate, secretion of endocrine glands, status of health, altered physiological activity.

1) **Age:** During the growth period, the BMR is high, therefore during infancy the energy need per Kg of body weight are highest than during adulthood. Energy requirement also decline progressively after early adulthood due to steady decline in BMR thereafter. The basal metabolism during rapid growth is at a high level. The younger the individuals the higher, the basal metabolism since much energy is stored for growth. The period at which the basal metabolism reaches its highest level is between the ages of 1-2 years. A gradual decline occurs between the age of 2-5 years, with a more rapid decline until adult age is reached.

2) **Sex:** The BMR is higher in adolescent boys and adult males as compared to adolescent girls and adult females though it is not due to direct influence of sex differences, but is due to the differences in body composition. Males have a greater amount of muscles and glandular tissues which is metabolically more active whereas, females have greater adipose tissues which is metabolically less active, Hence energy requirement of males is higher then of females.

3) **Body Size:** It will have an important effect on energy needs because a larger body has a greater amount of muscles and glandular tissue to maintain, thus requiring higher energy allowances. Heat is continuously lost through the skin by radiation. Since the heat loss is proportional to the skin surface, the basal heat production is directly proportional to the surface area. A tall thin individual has a greater surface area than an individual of the same weight who is short and fat and the former will therefore, have a higher basal metabolic rate.

4) **Climate:** It is known that the BMR is lower in tropics then in temperate zones. Hence the energy cost of work is slightly higher when the temperature falls below 14⁰C. However, it is felt that there is no need to make any adjustment for temperature in India.

5) **Secretion of Endocrine Glands:** The thyroid gland in particular exerts a marked influence on the energy requirement. If it is overactive (hyper-thyroidism), the BMR will

increase; if the activity of the gland decreases (hypo-thyroidism), the BMR will be reduced. Thereby, increasing or decreasing energy requirement accordingly.

6) **Status of health:** During the periods of fever as well as malnutrition, the BMR of an individual is affected. Illness involving an elevation of body temperature markedly increases the basal heat production thus increasing the BMR, hence increased energy requirement.

7) **Altered Physiological States:** During pregnancy and lactation, the energy needs are increased because of an elevated BMR. In pregnancy; this additional energy is needed to support the growth of foetus and maternal tissues. During lactation energy is required for synthesis of milk.

8) **Effect of food:** A certain amount of work is expended in the digestion of food, its absorption transfer to the tissues and utilization. The increased heat production as a result of the ingestion of food is known as the specific dynamic action of the food. Protein when eaten alone has been shown to increase the metabolic rate by 30%. On the basis of the mixed diets, which are usually consumed, the specific dynamic action of food is approximately 10% of the energy requirement.

9) **Extent of Physical activity:** Any kind of physical activity increases the energy expenditure above the basal energy need. Energy for the performance of all types of physical activities ranks next to basal metabolism in amount of energy expended. Sleep causes a reduction of about 10% in the BMR depending on the number of hours spent in sleeping and its manner i.e. restless/ peaceful.

The energy need is determined by the nature and duration of physical activity. Sedentary work, which includes office work, bookkeeping, typing, teaching, etc., calls for lesser energy than moderate work (more active and strenuous occupations) such as nursing, homemaking, or gardening. A still greater amount of energy is required by those individuals who are involved in heavy work (hard manual labourer) such as ditch digging, shifting freight etc. Energy needs vary with age, occupation and physiological state. (Fig:1)

Fig:1 Energy needs vary with age, occupation and physiological state.

Recommended Daily allowances: The Indian Council of Medical research 1990 recommended the following standards in respect of energy requirements in India (Table 1)

TABLE 1
Recommended Energy Requirement/Day

Group	Particulars	Net Calories (Kcal) day
Man	Sedentary work	2425
	Moderate work	2875
	Heavy work	3800
Women	Sedentary work	1875
	Moderate work	2225
	Heavy work	2925
	Pregnancy (Second half of pregnancy)	+300
	Lactation	
	O-6 months	+550
	6-12 months	+400
Infants	O-6 months	108 Kg. Body wt.
	6-12 months	98 Kg. Body wt.
Children	1-3 years	1240
	4-6 years	1690
	7-9 years	1950
	10-12 years	2190
Boys	10-12 years	1970
Girls	10-12 years	1970
Boys	13-15 years	2450
Girls	13-15 years	2060
Boys	16-18 years	2640
Girls	16-18 years	2060

Source: Nutrient Requirements and Recommended Dietary Allowances, 1990

PROTEINS

The word protein mean to “take the first place”. In 1938 a Dutch Chemist Mulder, described that all living plants and animal contain certain substance without which life was not possible and this was identified as proteins. In constitution of body they stand next to the water. Indeed proteins are of the greatest importance in human nutrition.

They are complex organic compounds containing the carbon, hydrogen, oxygen, nitrogen, and usually sulphur. Some proteins also contain phosphorus, iron, iodine, copper and other inorganic elements. The proteins differ from carbohydrates and fat as they contain nitrogen, Proteins are made up of much smaller units known as *amino acids*.

Function

Proteins are very essential for life processes, as there is hardly any important physiological function in which proteins do not participate. The important functions of proteins are:

- (1) **Body building:** It is the most important function of protein. These are the major structural components of body tissues. Infact every living cell contains protein. The first need for proteins therefore is to supply the materials for the growth and development and the continuous replacement of the cell protein.
- (2) **Body Regulatory:** Many proteins have highly specialized functions in the regulation of body processes. All chemical reaction in the body are carried out by enzymes, which are protein in nature. Proteins are also a constituent of hemoglobin, which is necessary to carry oxygen from lungs to tissues and bring back CO₂.Governing the body reaction are hormones, which are also proteins. Plasma protein has a fundamental role in the maintenance of water balance. Blood proteins also help in maintaining acid base balance of the body.
- (3) **Body protection:** There is a protein called gamma globulin, which has a capacity to fight against invading organism. The body’s resistance to disease is maintained in part by antibodies, which are protein in nature.
- (4) **Energy Yielding:** The energy needs of the body take priority over other needs, and if the diet does not furnish sufficient energy from carbohydrates and fats. The proteins of the diet as well as tissue protein will be used up for giving energy. One gram of protein gives 4 calories.
- (5) **Maintenance of body temperature:** During the metabolism of proteins extra heat is liberated, which is used for maintaining the body temperature.

Food Sources

There are two main dietary sources of proteins (1) *Animal source:* Milk and milk products excluding butter and ghee, eggs, meat, fish and poultry. (2) *Plant sources:* Pulses e.g. Soyabean, Bengal gram, redgram dal, green gram, black gram dal; Cereals e.g. wheat maize, rice, barley, jowar bajra; and nuts e.g. peanuts, almond, cashewnuts. Fruits and vegetables are poor sources.

Protein Quality

It is not only the quantity of protein, which is important but also the quality. This depends mainly on the type of amount of particular amino acids present in the particular protein.

There are twenty-two amino acids, which are needed by the human body out of which eight are called “*essential*”. It is because the body cannot synthesize them, therefore, they must be obtained from the diet. Rest of the amino acids are termed as “non-essential” as they can be synthesized in our body.

Essential amino acids are isoleucine leucine, lysine, methionine, phenylalanine threonine, tryptophan and valine. In addition to these infants require histidine for growth.

Based on the quality of proteins, they can be classified into three classes.

- (1) Complete protein (First Class)
- (2) Partially complete proteins (Second Class)
- (3) Incomplete proteins (Third Class)

- (1) ***Complete Proteins:*** These contain all the essential amino acids in sufficient quantities so that a normal rate of growth can be maintained by the body. Mainly proteins from animal source belong to this class i.e. milk, meat, eggs, fish, and poultry. Wheat germ and dried yeast have a biologic value approaching that of animal sources.
- (2) ***Partially complete proteins:*** They can maintain life, but they lack sufficient amount of some of the amino acids necessary for growth. Proteins from plant source like pulses, wheat and nuts belong to this class.
- (3) ***Incomplete proteins:*** They can neither promote growth nor maintain life because they lack many of the amino acids or even if they contain, it is in very small amounts, Gelatin and zein which is found in corn are the examples which belongs to this class.

Supplementary Value of Proteins is the capacity of one protein to make good the deficiency of another protein. This is also known as the “mutual supplementation effect”.

The Chief source of protein in diets for most of the world’s people is from plants. Just because plant foods, when fed alone do not provide necessary quota of essential amino acids is no reason to condemn them as protein sources. However four possibilities exist for improving the quality of protein.

First, is to feed some amount of animal or complete protein with second and third class protein e.g. to include little amount of animal protein at each meal.

Second, to use a combination of various vegetable proteins so that they would make up the deficiency of each other e.g. mixture of cereals and pulses.

Third, to add the lacking essential amino acids synthetically.

Fourth, by germination and fermentation e.g. sprouting of pulses, cereals etc.

Recommended Daily Dietary Allowances

The protein requirements vary from individual to individual. Apart from age and physiological conditions, factors like emotional disturbances infection and stress can affect a person's protein requirement. For proper utilization of protein, energy intakes should be adequate. Maximum amount of protein per Kg. of body weight is required during infancy i.e. till one year of age. The requirement per Kg. of body weight slowly decreases as one reaches the adulthood and then it is stable i.e. 1 gm. Per Kg. of desirable body weight.

During pregnancy and lactation the protein allowances for woman are increased over the basic level. The Indian Council of Medical Research (1990) has recommended the following standards in respect of protein requirement in India (Table II)

TABLE II
Recommended Protein Requirement /day

Group	Particulars	Proteins (gm.) Day
Man	Sedentary work: Moderate work: Heavy work:	60
Women	Sedentary work: Moderate work: Heavy work:	50
	Pregnancy (Second half of pregnancy)	+15
	Lactation 0-6 months	+25
	6-12 months	+18
Infant	0-6 months	2.05/Kg body wt.
	6-12 months	1.65 /Kg body wt.
Children	1-3 years	22
	4-6 years	30
	7-9 years	41
Boys	10-12 years	54
Girls	10-12 years	57
Boys	13-15 years	70
Girls	13-15 years	65
Boys	16-18 years	78
Girls	16-18 years	63

Source: Nutrient Requirements and Recommended Dietary Allowances for Indian, ICMR 1990.
Deficiency

A reduced protein intake or constant consumption of poor quality proteins over an extended period of time leads to depletion of the tissue reserves and lowering of blood protein levels. The protein deficiency occurs mostly during infancy, early childhood, pregnancy and lactation.

(Fig 2 & 3)

Fig: 2 Clinical photograph of a child suffering from marasmus

Fig: 3 Clinical Photograph of a child suffering from Kwashiorkor

In children protein deficiency leads to occurrence of marasmus and kwashiorkor. They show retarded growth, oedema and diarrhea. In adults usually proteins deficiency causes loss of weight, weakness and lowered resistance to diseases.

CARBOHYDRATES

They are simple sugars or substances, which can be reduced to simple sugars by hydrolysis. They are composed of carbon, hydrogen, and oxygen, the last two being in the proportion to form water hence termed as “Carbohydrate”. The general formula is $C_n H_{2n} O_n$. Carbohydrates are widely distributed in nature in the form of sugars, starches, celluloses and other substances.

Carbohydrates are classified as monosaccharides, disaccharides and polysaccharides. The term “*Saccharide*” meaning sugar or sweetness is related to the characteristics taste of many of the simple carbohydrates. Monosaccharides are simple sugars, which serve as the building blocks of complex sugars and polysaccharides. Carbohydrates were first named according to the sources from which they were obtained e.g. grape, sugar, cane sugar, malt sugar, milk sugar, etc. Then they were named from a prefix related to the sources followed by the suffix “ose”. eg. Fructose (fruit sugar), Lactose (milk sugar) these trivial names are still used.

Function

The functions of carbohydrates are

- (1) **Energy Yielding:** Carbohydrates are the cheapest source of energy. One gram of carbohydrate gives 4 calories. Glucose is the main source of energy. So all types of carbohydrates are converted to glucose in body and then used for immediate tissue energy need. A small amount is stored as glycogen in the liver and muscles, and some is stored as fat in the adipose tissues.
- (2) **Protein Sparing Action:** The body uses carbohydrates preferentially as a source of energy when it is adequately supplied in the diet, thus sparing protein for tissue building.
- (3) **Provide taste to the food:** As most of the carbohydrates are sweet in nature, they improve the palatability of the diets.
- (4) **For Complete Oxidation of Fats:** A certain amount of carbohydrates is necessary in the diet so the oxidation of fats can proceed normally. If carbohydrates are severely restricted fats are metabolized resulting in ketosis.
- (5) **Lactose:** Being less soluble than other sugars remain in the intestine long enough to encourage the growth of desirable bacteria, which help in synthesis of B-Complex vitamins. It also helps in better absorption and utilization of calcium.
- (6) **Provide bulk to the diets:** Cellulose, hemicelluloses and pectin's gives no nutrients to the body, but these fibres are very useful in providing bulk to the diets. These indigestible substances facilitate the elimination of intestinal wastes by stimulating the peristaltic movements of gastrointestinal tract and they also have the property of absorbing water thus giving bulk to the intestinal contents. Lack of adequate dietary fibre in diets containing refined foods, leads to constipation and colon cancer, also some of the dietary

fibres like gum and mucilage's in our diets have been shown to lower blood cholesterol in hypercholesterolemie subjects and blood sugar in diabetes. Vegetables especially the leafy ones, fruits and unrefined cereals are rich in fibre and a generous inclusion of these provides a diet rich in fibre.

Source

There are three main sources of carbohydrates (1) Starches (2) Sugars and (3) Cellulose.

- (1) Starches are present in cereals (eg. Rice, wheat, maize, sago, and all bakery products) pulses, potatoes, sweet potatoes, yam and dry fruits.
- (2) Sugars are present in cane sugar, jiggery, honey, jam, jellies, dry fruits, sweets and fresh fruits, eg. Banana, sapoto, grapes, mango.
- (3) Cellulose is the fibrous substance. eg. whole grains, whole pulses.

Recommended Daily Dietary Intakes

There is no fixed amount recommended for carbohydrates, but even then it should provide about 60-70% of the total energy. The daily diet of an adult should contain at least 40 gms of dietary fibre.

Deficiency

The energy needs are not met if the diets are deficient in carbohydrates. The work efficiency is lowered. Also person becomes underweight. Growth will be slow in the case of children. Symptoms of ketosis may also develop. Lack of dietary fibre in the diet leads to constipation and colon cancer.

If carbohydrates are consumed in excess they get accumulated as fat in the body leading to obesity and predisposes to diabetes and heart ailments.

LIPIDS OR FATS

Fat is an important component of our diets and serve a number of functions. These are also organic compound of carbon, hydrogen and oxygen. These differ from carbohydrates is that they have much smaller proportion of oxygen and much greater proportions of carbon and oxygen. Lipids are broadly classified into two groups. Simple lipids and Compound lipids. Simple lipids include fatty acids and waxes. All other lipids are included under compound lipids eg, carotenoids and phosphoglycerides .

The term fat is generally applied to all triglycerides regardless of whether they are solid or liquid at room temperature. Triglycerides from animal sources contain a higher percentage of saturated fatty acids and are normally solids at room temperature and known as fats. The plant triglycerides are rich in unsaturated fatty acids and are generally liquids at room temperature and called oils.

Fats in the diets can be of two kinds, the visible and invisible fat. The visible fats are those which are derived from animal fats like butter, ghee and those derived from vegetables sources like mustard oil, groundnut oil, sunflower oil etc. Apart from the added /visible fat, some amount of fat is present in other foods like cereals, pulses, oilseeds, milks, eggs & meats. The invisible fat is believed to contribute significantly to the total fat and essential fatty acid content of the diet depending upon the foodstuffs present in the diet.

Essential Fatty Acids

Certain fatty acids should be provided essentially in the diets, as they are not synthesized in the body. These are polyunsaturated fatty acids, namely linoleic, linolenic and arachidonic acids and are grouped as “essential” fatty acids. They are required for metabolism and for maintenance of normal health of the skin.

Therefore, proper type of fats which are rich in essential fatty acids, eg. Peanut, cottonseed, corn, and sunflower oils, must be present in the diets. Animal fats are poor sources of essential fatty acids. However, it is only the linoleic acids which we really need as the other two can be synthesized in the body from the same i.e. linoleic acid.

Functions

The functions of fats are:

- (1) ***Energy fielding:*** Fats are concentrated source of energy. One gram of fat gives 9 calories. Compared to carbohydrate it not only gives more amounts of energy but at a faster rate too.
- (2) ***Fats also perform the protein sparing action*** in the same way as carbohydrate does.
- (3) ***Storehouse of energy for the body's needs:*** In fact not only amount of fats as such are stored in adipose tissue, but any amount of glucose, amino acids, not promptly utilized are also synthesized and stored in the body, thereby energy is continuously available from the stores in adipose tissues.

- (4) ***Insulation and padding:*** The subcutaneous layer of fat is an effective insulator and reduces losses of body heat in cold weather, thus regulating the body temperature. The vital organs such as the kidneys are protected against physical injury by a padding of fat around the organs.
- (5) ***Fats help in absorption and transportation*** of fat-soluble vitamins in the body.
- (6) ***Provides essential fatty acids:*** Fat is also the source of certain fatty acids which are essential for metabolism and for maintaining a normal skin.
- (7) ***Fats acts as a lubricant*** for various body organs especially the organs of the gastrointestinal tract.
- (8) ***Gives satiety value:*** Fat depresses the secretion of hydrochloric acid in the stomach, Thus the food stays in the gastrointestinal tract for a longer time and feeling of hunger is delayed.
- (9) ***Fat also increases the palatability*** of the diet by adding flavour to many cooked preparations.

Food Sources

Dietary fats are derived from two main sources (1) *Animal sources:* It includes butter, ghee, curd, whole milk, and its products meat, fish, poultry, and eggs. (2) *Plant sources:* They include all vegetables oils e.g. groundnut, *gingelly*, mustard, cottonseed, sunflower, and coconut oil. Also it will include hydrogenated fats, margarine, nuts and oil seeds like cashewnut, peanuts, almonds, and mustard seeds.

Recommended Daily Dietary Intakes

The fat requirement mainly depends upon the energy needs of the individual. From physiological point of view there can be wide variation in fat intake and still good health can be maintained. On an average about 15-20% of the total energy should be supplied from fats. The dietary fats should be a good source of essential fatty acids and hence at least 50% of the dietary fat should be from vegetables oils rich in essential fatty acids.

Deficiency

Just like carbohydrates deficiency, the energy needs will not be met if the diet is deficient in fat content. Hence leading to underweight, weakness and lowered work efficiency. In addition to this the deficiency of the essential fatty acids play a role in several metabolic reactions, a deficiency of these fatty acids is believed to lead to a skin condition known as 'phyrnoderma' (toad skin) in which the skin becomes rough and thick horny papules of the size of a pinhead irrupt in certain areas of the body, notably the thighs, buttocks and trunk. In addition

to this, the deficiency of fat-soluble vitamins and essential fatty acids will also result. This will cause the ailments related to skin, eyes, bones, etc.

Excess

If excessive fat is consumed it will result in obesity gastrointestinal disturbances, and predisposal to many other diseases like diabetes and cardiovascular ailments. In recent years there has been a revival of interest in the nutritional aspect of excessive intake of the fat in the diet in increasing the level of cholesterol in the blood, Excessive cholesterol in blood gradually causes it to deposit under the lining of blood vessels, resulting in “atherosclerosis” wherein the blood vessels are narrowed and hardened leading to heart diseases.

VITAMINS

The term 'vitamine' derives from the word 'vital amine' which means essential nitrogenous compounds. The term was coined by Polish Scientist, Funk, who gave the name 'vitamine' to anti-beriberi substance. Later on 'e' was dropped and thus the term 'vitamin' was coined. However with the discovery of more vitamins, it was soon realized that all the vitamins are not nitrogenous compounds; but all vitamins are essential for health. Vitamins are complex chemical substances, required by the body in very small amounts. They do not yield energy, but act as catalyst in various body process. Since vitamins cannot be manufactured in the body (at least in sufficient amounts) they have to be supplied through the diet. Vitamins are broadly divided into two grounds.

- (1) *Fat soluble vitamins* e.g. Vitamins A, D, E and K
- (2) *Water soluble vitamins* e.g. Vitamins of B Group and Vitamins C.

VITAMIN A

Vitamin A was discovered in the early nineteenth century by Dr. McCollum and Davis. Dr. McCollum carried out experiments on rats and found that when butter and egg yolk were added to the diet of group of rats, they were healthier, stronger as compared to the other group which were fed on lard and vegetables only. He came to the conclusion that butter and egg yolk contain some vital elements that were absent in lard and vegetables. In 1913, he isolated vitamin A from butter and egg yolk.

Chemistry

Vitamin A occurs in several forms: as retinal, as retinal, as an aldehyde and as retinoic acid. These several forms may be referred to as vitamin A. In its pure form, vitamin A is a pale yellow crystalline compound and occurs naturally in animals. It is soluble in fat solvents but insoluble in water, and is relatively stable to heat, acids and alkalies. It is easily oxidized and rapidly destroyed by ultra-violet radiation.

The ultimate source of all vitamin A is in the carotenes which are synthesized by plants. Animals, as well as man in turn convert a considerable portion of carotene of the foods they eat into vitamin A. Carotenes are dark-red crystalline compounds also known as "Pro-vitamin A" or "precursors of vitamin A". Alfa, Beta, Gama, molecules of carotene are of significance in nutrition. Each molecule of beta-carotene yields two molecules of vitamin A.

Functions

1. Vitamin A is required for normal vision in dim light. The retina has two kinds of cells-rods and cones. Rods are sensitive to dim light, the cones respond to bright light. The rods contain a pigment called rhodopsin. Rhodospin is formed by the combination of a specific form of vitamin A with a protein. Rhodospin in the presence of bright light, breaks down into its components. In the dark these components, Vitamin A and protein again combine to regenerate rhodospin. This rhodospin helps us to see in dim light. This is called a visual cycle.
2. Vitamin A is required to maintain the integrity of epithelium, especially the membranes that line eyes, the mouth and the gastrointestinal, respiratory and genitourinary tracts. These membranes offer resistance to bacterial invasion.
3. Vitamin A is essential for normal skeletal and tooth development.
4. It has a probable role in the immunological defence mechanism of the body.

Food Sources

Only animal foods contain vitamin A as such; fish-liver oil being the outstanding. Milk, butter, wholemilk cheese, liver and egg-yolk contain good quantities of vitamin A.

Vitamin A is not present in plant foods, but its precursor, carotene is present which is converted into vitamin A in the body. Carotene is present in plants with green and yellow colorings. There is a direct correlation between the greenness of a leaf and its carotene content.

Green leafy vegetable: spinach, turnip tops, beet greens, coriander leaves, curry leaves.

Yellow vegetables : Carrot, sweet potatoes, pumpkin

Yellow fruit : Papaya, mango, apricots, peaches.

Recommended Daily Allowances

The recommended allowances for the Indians are given in the table I. One IU of Vitamin A is equal to 0.3 mcg of retinol or 0.6 mcg of Beta – carotene.

TABLE I
Recommended Daily Allowances of Retinal for Indians (1989)

Group	Vitamin A mcg/day	
	Retinol	Carotene
Adult		
Man	600	2400
Woman	600	2400
Pregnancy	600	2400
Lactation	950	3800
Infant		
0-6 months	-	-
0-12 months	350	1400
Children		
1-3 yrs.	400	1600
4-6 yrs.	400	1600
7-9 yrs	600	2400
10-12 yrs	600	2400
Adolescents:		
13-15 Yrs. Boys	600	2400
Girls		
16-18 Yrs. Boys	600	2400
Girls		

Deficiency

Xerophthalmia is an eye manifestation arising due to vitamin A deficiency. Blindness, as a result of xerophthalmia, is an important public health problem in India.

(i) One of the earliest manifestations of xerophthalmia is *night blindness*. Individual suffering from night blindness cannot see in dim light or around dusk. This is followed by *conjunctival xerosis* which means, dryness of the conjunctiva (this transparent membrane that covers the cornea and lines the inside of the eyelid) (Figure 1). In addition to *xerosis*, dry foamy, triangular spots may appear on the conjunctiva. These are called *Bitot's spot*. (Figure 2). As in the case of conjunctiva, the normal cornea (the anterior, transparent portion of the outermost layer of the eye is moist and shining, when vitamin A deficiency become severe, the cornea becomes dry and dull and appear like ground glass. This condition is called *corneal xerosis* which means dryness of the cornea (Figure 3) the most dangerous form of *xerophthalmia* is known as *keratomalacia*. In this condition, the cornea become very soft and raw and easily infected. It leads to destruction of they eye. The eyes gets completely melted and destroyed (Figure 4). This condition leads to *irreversible blindness*.

(ii) The deficiency of vitamin A leads to the *degeneration and keratinization of the epithelium*. This increase the susceptibility to infection of the eye, nasal passages, middle ear, pharynx, mouth, respiratory tract, lungs and genitourinary tract.

(iii) Dry and scaly skin is an important symptom of a deficiency of this vitamin. This patched skin is an important symptom of a deficiency of this vitamin. This patched skin is termed as *toad's skin*.

Major Changes in the eyes due to Vitamin A deficiency

Fig: 1 Conjunctival Rerosis

Fig: 2 Bitot's spot

Fig: 3 Corneal Xerosis

Fig: 4 Keratomalacia

VITAMIN D

Pure Vitamin D was isolated in crystalline form in 1930 and was called *calciferol*. It was also known as antirachitic vitamin.

Chemistry and Characteristic

Vitamin D is a group of sterol compounds possessing anti-rachitic properties, but only two are of nutritional interest. (i) *Vitamin D₂* or Ergocalciferol found in a plants and (ii) *Vitamin D₃* or cholecalciferol which occurs in animal cells and activates in the skin on exposure to ultra-violet light. Pure Vitamin D are white, crystalline compounds which are soluble in fats and fat solvents, but insoluble in water. They are stable to heat, alkalies and oxidation.

Function

1. Vitamin D regulates the absorption of calcium and phosphorus from the intestinal tract and also calcification of bones and teeth. It is believed that vitamin D renders the intestinal mucosa more permeable to calcium and phosphorus. Thus vitamin D is required for normal bone and teeth development.
2. Vitamin D regulates the enzyme 'alkaline phosphates' which regulates the release of phosphate organic compounds.

Food Sources

Vitamin D occurs only in foods of animal origin. Fish liver oils are the richest natural source. Liver, eggs and butter contain useful amount. Small amounts are present in fresh milk and milk products.

Another cheap source of vitamin D is sunlight. Exposure to ultraviolet rays of the sunlight converts the precursor of vitamin D (7-dehydrocholesterol) present in the skin, to its active form.

Recommended Daily Allowances

The recommended daily allowances of Vitamin D is not fully known for the present. 200 IU of Vitamin D can be taken as tentative value. If exposure to sunlight is sufficient, deficiency symptom are not seen.

Deficiency: Deficiency of vitamin D leads to *Rickets* in Children, a condition in which the level of calcium and phosphorus is always low. Bone growth cease and in more severe cases the bone which has already formed may be demineralised. This results in clinical changes which are observed by the swelling or bending of ribs. This condition is known as '*rachitic rosary*' (Figure 5) . The long bones increase in at the ends and they may become curved instead of remaining straight. This leads to '*knock-kees*', bowed legs, (Figure 6) curvature of vertebral column and deformities of the pelvic bones. Softening of the skull, particularly in infants and the delayed closing of fontanelle is another feature of the deficiency of this vitamin. Deficiency in adults leads to *Obsteomalacia*, a condition in which bones become fragile so that they are susceptible to fracture.

In old age a deficiency of both vitamin D and calcium leads to *Osteoporosis*, a condition in which bones become porous and break easily.

Fig: 5 Rickety Rosary

Fig: 6 Bowed Legs

VITAMIN E

Evans and Bishop established the fact that a fat soluble factor was necessary for reproduction in rats. They showed that the absence of this factor, or vitamin E, as it was designated, leads to infertility in rats.

Chemistry and characteristic

Vitamin E consists of a group of chemical substances called 'tocopherols'. Alphatocopherol is the compound possessing the greatest vitamin E activity. High temperature and acids do not affect the stability of this vitamin, but oxidation takes place in the presence of rancid fats or lead and iron salts. Decomposition occurs in ultraviolet light, alkalies and oxygen.

Functions

1. The primary role of vitamin E is to act as an anti-oxidant. By accepting the oxygen, it helps to prevent the oxidation of vitamin A in the intestine, thereby sparing vitamin A.
2. Vitamin E reduces the oxidation of the polyunsaturated fatty acids, thereby helping to maintain the integrity of the cell membranes.
3. Vitamin E plays a part in the formation of RBC's in the bone marrow.
4. It helps in releasing the energy from carbohydrates and fats, through the synthesis of a coenzyme Q .
5. In some animals vitamin E is required to prevent the sterility.

Food Sources

Many vegetable oils such as wheat germ oil and cotton seed oil are good sources of vitamin E. Good concentration of vitamin E is present in dark-green leafy vegetables, nuts, legumes, as well as whole-grain cereals. Although foods of animal origin are low in vitamin E, liver, heart, kidney, milk and eggs are the animal sources of this vitamin. Human milk provides an adequate amount of vitamin E to infants, cow's milk is low in this vitamin.

Recommended Daily allowances

The vitamin E requirement is linked to that of essential fatty acids. The requirement of vitamin E suggested is 0.8 mg/g of essential fatty acids.

Deficiency

Vitamin E deficiency results in increased haemolysis (break down) of the red blood cells leading to anaemia. Premature infants also show a low level of tocopherol. In some species of animals, vitamin E deficiency is known to cause reproductive failure. In human beings vitamin E deficiency is not frequently reported.

VITAMIN K

Dr. Dam (1935) found that a 'Koagulation Vitamin' was necessary to prevent fatal haemorrhages in chicks by promoting normal blood clotting.

Chemistry and Characteristics

Vitamin K is found in nature in two forms: K₁ occurs in alfa-alfa and K₂ is produced by bacterial synthesis. These are soluble in fat. They are not destroyed by heat, but are unstable to alkalies, strong acids, oxidation and light.

Function

1. Vitamin K is essential for the formation of prothrombin and other clotting proteins by the liver.
2. Vitamin K probably also participates in oxidative phosphorylation in the tissues.

Food sources

The variation K mainly occurs in plants. Green leaves of plants such as spinach, cabbage, cauliflower are excellent sources. Cereals, fruits and other vegetables are poor sources. Among animal foods, pork liver is a good source.

Recommended Daily Allowances

The variations in intestinal synthesis and in the diet have made it impossible to establish a daily allowance. Dietary deficiency is not believed to be a problem.

Deficiency

Deficiency usually occurs due to faulty absorption or due to liver disorders that affect the synthesis of prothrombin. Dietary deficiency is rather unusual.

A low level of prothrombin and other clotting factors leads to increased tendency to hemorrhages. Premature infants, anoxic infants and those whose mother have been taking anticoagulants are most susceptible to deficiency.

VITAMIN B COMPLEX

In 1911, Funk coined the term 'vitamin' for the substance which he found effective in preventing beriberi. McCullum and Davis applied the term water soluble B to the concentrates which cured beri-beri.

It was soon discovered that vitamin B was not a single substance, but a group of compounds, to which we now designate as the vitamin B complex. Some of these are discussed.

THIAMINE OR VITAMIN B₁

Chemistry and Characteristics

Thiamine hydrochloride is a white crystalline substance. It has a faint yeast-like odor and a salty, nut like taste. It is readily soluble in water but not in fat solvents or fats. It is readily destroyed by heat in neutral or alkaline solution; in acidic medium it is resistant to heat up to 120°C.

Functions

Thiamine teams up with an enzyme to form a coenzyme. The latter acts as a catalyst in the oxidation processes

1. It is essential for the utilization of carbohydrates in the body; in deficiency there is accumulation of pyruvic acid and lactic acid in the tissues and body fluids.
2. Thiamine is also essential for the maintenance of good appetite and normal digestion.
3. It has a role in brain metabolism as the deficiency causes neurological and nervous disorders.

Food Sources

All the natural foods contain thiamine, even if in very small amounts. Important sources are dried yeast, wholegrain cereals and pulses, oilseeds and nuts especially groundnuts, Meat, fish eggs, vegetables and fruits are relatively poor sources.

Recommended Daily Allowances

The recommended daily allowance is 0.5 mg/1000K. cal.

Deficiency

The clinical manifestations of thiamine deficiency are *beri-beri* and Wernicke's *encephalopathy*. Beri-beri exists in three forms-dry, wet and infantile beri-beri. Manifestations of minor thiamine deficiency are loss of appetite, absence of ankle jerks, knee jerks and presence of calf tenderness.

RIBOFLAVIN OR VITAMIN B₂

Chemistry and Characteristics

In its pure form this vitamin is bitter tasting, orange yellow, odourless compound in which crystals are needle-shaped. It dissolves sparingly in water to give a typical greenish yellow fluorescence. It is stable to boiling in acids, but in alkaline solutions it is readily decomposed by heat. It is also destroyed by exposure to light.

Function

Roboflavin, like thiamine unites with the enzymes and helps in the tissue oxidation with the release of the energy, thus helping in protein, fat and carbohydrate metabolism.

Food Sources

The richest source is dried yeast. Among the good sources are milk, liver, meat eggs, kidney and growing leafy vegetables. Cereals and fruits are not rich sources, but due to the large quantity consumed, they supply much of vitamin in the Indian diets.

Recommended Daily Allowances

The recommended daily allowances is 0.6 mg/1000 K. cal.

Deficiency

Ariboflavinosis is one of the most common of the deficiency diseases. Signs suggestive but not specific include: -

- i) *Angular stomatitis*: the patients develop cracks on both the sides (angles of upper and lower lips) of the mouth (Figure – 7)

Figure: 7 Angular Stomatitis

- ii) *Cheilosis*: The lips develop cracks and become red (Figure-9)
- iii) Sourness of tongue.
- iv) Redness and burning sensation in the eyes and visualization of the cornea.
- v) Scrotal or vulva dermatitis.

Figure: 8 Cheilosis

NIACIN OR NICOTINIC ACID

Chemistry and Characteristics

It occurs in white needle-like bitter tasting crystals. It is moderately soluble in hot water, but only slightly soluble in cold water. It is stable to heat, alkalis, acids light and oxidation and unstable to reduction. In fact, it is one of the most stable of the vitamins. Niacin occurs in two forms: *Niacin* and *proniacin* form i.e. tryptophan. Human body can make 1 mg of vitamin from 50 to 60 mg of tryptophan. Thus if a diet contains large amount of tryptophan, it will provide enough niacin, even though the diet might be low in its niacin content.

Functions

- 1) Niacin is rapidly converted in the body to nicotinamide, which is a component of coenzymes which are essential for the metabolism of carbohydrates, fats and proteins.
- 2) It is also essential for the normal functioning of skin, intestinal tract and the nervous system.

Food Sources

Poultry, meat and fish are the good sources, peanuts is also among good sources. Whole grains are fair sources of niacin. Potatoes, legumes and some green leafy vegetable contain fair amount of niacin but most fruits and vegetables are poor sources. Germination and fermentation enhances the value of niacin in the food.

Recommended Daily Allowances

The recommended daily allowances is 6.6 mg/1,000 K. cal.

Deficiency

Niacin deficiency results in pellagra. *Pellagra* involves the gastrointestinal tract, the skin and nervous system. Early signs include fatigue, headache, backache, loss of weight and loss of appetite. Nausea and vomiting are followed by diarrhoea (i.e. loose motion is present). A characteristic symmetrical dermatitis especially on the exposed surfaces of the body – hands, forearms, elbows, legs, knees and neck appear.

Neurological symptoms include dizziness, confusion, poor memory and irritability of disease. The classic 'D' are the final stages i.e. dermatitis, diarrhoea, dementia and death.

PYRIDOXINE OR VITAMINE B₆

Chemistry and Characteristics

Vitamin B₆ consists of a group of related pyridines: Pyridoxine, pyridoxal and pyridoxamine. Vitamin B₆ is soluble in water and relatively stable to heat and to acids. It is destroyed in alkaline solutions and is also sensitive to light.

Functions

Vitamin B₆ is the coenzymes for a large number of enzyme systems, most of which are involved in amino acid metabolism. It plays a role in the conversion of (a) tryptophan to niacin (b) linoleic to arachidonic acid and in the (c) interconversion of amino acids.

Food Sources

Foods rich in pyridoxine are meat, poultry and fish, Potatoes, sweet potatoes are fair sources. Whole grain cereals are also good sources.

Recommended Daily Allowances

There recommended allowance is for adult is 1.5 mg/day.

Deficiency

The deficiency of this vitamin causes convulsions, dizziness and vomiting. Other symptoms are cheilosis, glossitis and abdominal pain.

FOLIC ACID GROUP

Characteristics

Folain is a generic term for folic acid, pteroylglutamic acid and other compounds having the activity of folic acid. It consists of three linked components: a *pteridine grouping*, *para-amino-benzoic acid*, and *glutamic acid*, an *amino acid*. Pure folic acid occurs as a bright yellow crystalline compound, only slightly soluble in water. It is easily oxidized in an acid medium and is sensitive to light.

Functions

1. It is required for the synthesis of DNA.
2. It is also required for the normal production of red blood cells in the bone marrow.
3. It is also required for the oxidation of amino acid phenylalanine to tyrosine.

Food Sources

It is present in the free form and in the conjugated form. Liver kidney, deep green leafy vegetables are good sources of this vitamin. Wheat, cereals provide a fair amount. Vegetables, dairy-foods, pork and light green vegetables are poor sources.

Recommended Daily Allowances

The ICMR expert committee, 1989 recommended the allowances of 'free' folic acid per day as shown in Table 2:

TABLE 2
Recommended Allowance of Free Folic Acid

Group	Folic Acid mcg/day
Adults	100
Pregnancy	400
Lactation	150
Infants	25
Children	30 to 100

Deficiency

Folic acid deficiency results in megaloblastic anemia, glossitis and gastrointestinal disturbances. Services deficiency results in infertility or even complete sterility. The anaemia is the second most common cause of nutritional anaemia in India.

CYANOCOBALAMIN OR VITAMIN B₁₂

Characteristics

This vitamin is the only cobalt containing substance essential for health. It occurs as deep red needle like crystals which are slightly soluble in water. This vitamin is absorbed from the ileum only. Its absorption depends on the presence of a muco-protein enzyme produced by the gastric mucosa. The enzyme is called as intrinsic factor.

Functions

1. It helps in the synthesis of nucleic acid and nucleoproteins.
2. It is essential for the maturation of red blood cells in bone marrow.
3. It is also required for the metabolism of nervous tissues.

Food Sources

It is present only in the foods of animal origin. Liver, meat, eggs and milk are good sources. It is not found in the food of vegetable origin.

Recommended Daily Allowance

The ICMR expert committee (1989) recommended the intakes of vitamin B₁₂ as shown in table III

TABLE III
Recommended Daily Allowance of Vitamin B₁₂

Group	Folic Acid mcg/day
Adults	1.0
Pregnancy	1.0
Lactation	1.5
Infants	0.2.
Children	0.2-1.0

Deficiency

Deficiency of this vitamin leads to pernicious anaemia. This occurs only when there is a genetic deficiency which affects the formation of castle's intrinsic factors. Macrocytic anaemia and degenerative changes of the nervous system may result after gastroectomy. It is seen that vegetarian diet, deficient in vitamin B₁₂ lead to retarded growth but do not produce anaemia.

ASCORBIC ACID OR VITAMIN C

Chemistry and Characteristics

Vitamin C is a white crystalline compound of relatively simple structure and closely related to monosaccharide sugars. It can be prepared synthetically at low cost from glucose. Of all the vitamins, Vitamin C is the most easily destroyed. It highly soluble in water heat, light, alkalis, oxidative, enzymes and trace.

Functions

1. It is required for the formation and maintenance of collagen, a protein widely distributed in the body. Collagen is the cementing material that holds the cells of the body together.
2. Vitamin C is necessary for the production of tissues for quick post operative healing and for the maintenance of previously formed scar.
3. It plays an important role in the normal metabolism of the amino acids.
4. It helps in easy absorption of iron from gastro-intestinal tract by the reduction of ferric iron to ferrous ion.

Food Sources

Fruits and vegetables are the main sources of this vitamin. Citrus fruits (oranges, grapes, fruits, lemons and limes) berries, melons, pine-apples, guavas, pears, banana, apple, leafy vegetables, green pepper, amla, tomatoes are good source of ascorbic acid. Dry legumes contain negligible amount which increase approximately seven times, during germination. Milk, eggs, meat and poultry do not have any Vitamin C. Human milk contains four to six times as much ascorbic acid as cow's milk to protect the infant from scurvy.

Recommended Daily Allowances

The values recommended by ICMR Expert Committee (1989) is shown in Table -4.

TABLE 4
Recommended Daily Allowance of Ascorbic Acid

Group	Folic Acid mg/day
Adults	40
Pregnancy	40
Lactation	80
Infants	25
Children	40

Deficiency

Deficiency of ascorbic acid results in defective formation of the intercellular cementing substance collagen, Fleeting joint pains, irritability, retardation of growth in infants and children, anaemia, shortness of breath, poor healing of wounds and increased susceptibility to infections are some of the signs of deficiency.

Gross deficiency of ascorbic acid result in *Scurvy*, a disease characterized by swelling, and bleeding of a gums, multiple hemorrhages, anaemia and weakness. Today frank Scurvy is uncommon but partial deficiency of ascorbic acid may be frequent.

LESSON 4

ELEMENTARY KNOWLEDGE OF NUTRIENTS – III

In the previous chapters, nutritional needs of the family for Energy, Protein, Carbohydrates, fats and vitamins were discussed. Let us now study the nutritional needs of other important constituents required by human body viz. Minerals and Water.

MINERAL ELEMENTS

Minerals may be defined as those elements which remain largely as ash when plant and animal tissues are burnt. The human body contains more than 19 minerals, all of which must be derived from foods. A total of 4% of the body weight is made up of minerals. Some of the important minerals found in our body include calcium, phosphorus, iron, iodine, sodium, potassium, zinc and chloride. All these minerals are derived from the food we eat. Of these, calcium, phosphorus, sodium, potassium, chloride and magnesium are the minerals required in larger amounts by the body. Calcium and phosphorus account for three-fourth of the minerals present in the body, and five other elements account for most of the rest. Many of these elements are present in such minute amounts that they are referred to as a trace elements or micronutrients.

TABLE 1
MINERALS

Required in large amount	Required in smaller amount
Calcium Phosphorus Potassium Chloride Magnesium	Iron Iodine Zinc Copper

Minerals are important for the body in various ways. They are required to form such organic compounds like phosphoproteins, hemoglobin and thyroxin. Hard skeletal structures are formed with the help of elements like calcium, phosphorus and magnesium, whereas soft tissues contain a relatively high proportion of potassium. Mineral elements are also required in the constitution of enzymes; for maintaining osmotic pressure and water balance between intra-cellular and extra-cellular compartments; for proper functioning of the nervous system; for muscular contraction and so on.

CALCIUM

On the approximately 1200g of calcium present in the adult body, 99 per cent is in the bones and teeth and remaining 1 per cent is widely distributed in body fluids where it fulfills many functions.

Functions

- 1) Calcium together with phosphorus and other elements gives rigidity to bones and teeth. This characteristic makes it possible for the bone to support the body. Bone forms protective cavities for vital organs – the heart and lungs in the chest cavity, the brain in cranial cavity.
- 2) Calcium acts as a catalyst for the conversion of prothrombin to thrombin, this being one of the several steps in the clotting of blood.
- 3) It activates the permeability of the cell membrane (regulating the passage of substances into and out of cells).
- 4) It activates number of enzymes including lipase, adenosine; triphosphatase, and some proteolytic enzymes.
- 5) It has a role in the transmission of nerve impulses (conveying message from one nerve cell to another).
- 6) It is directly related to muscle contraction. In the absence of calcium, muscles lose their ability to contract.
- 7) It aids in the absorption of vitamin B₁₂ from the ileum.

Food Sources

Milk and milk products are excellent sources of calcium. Certain green leafy vegetables such as mustard green, turnip greens, mint, spinach, carrot leaves rank next to dairy products in their calcium content. Citrus fruits, legumes, meats grains and nuts provide the least calcium.

Recommended Daily Dietary Allowances

The ICMR Expert Committee (1989) has recommended the dietary allowances as shown in Table - 2

TABLE 2
Recommended Dietary Allowances of Calcium/Phosphorus

Age Group	Calcium/day(mg)	Phosphorus/day(mg)
Adults	400	400
Pregnancy	1000	1000
Lactation	1000	1000
Infants	500	750
Children (1 to 9 yrs)	400	400
Adolescents (10-15 yrs)	600	600
Adolescents (16-19)	500	500

Deficiency

A deficiency of calcium in the diet results in retarded calcification of bones and teeth in the young. Due to the deficiency of calcium bones start bending and there is enlargement of ankle and wrists. In children, the deficiency disease is known as *Rickets* and in adults, as *osteomalacia*. Repeated pregnancies coupled with inadequate dietary intake can also give rise to the deficiency of calcium.

PHOSPHORUS

Phosphorus accounts for about 1 per cent of body weight, or one-fourth of the total mineral elements in the body. About 85 percent of phosphorus is in combination with calcium in bones and teeth. Soft tissues contain much higher amounts of phosphorus than of calcium and most of it is in organic form.

Functions

Phosphorus is one mineral which performs widely differing functions. These are: -

1. It combines with calcium to form insoluble compound, calcium phosphate, which gives strength and rigidity to bones.
2. The Phosphorus containing Lipo-proteins facilitate the transport of fats in the circulation.
3. Phosphorus is a constituent of Nucleoproteins, the basic genetic material.
4. Phospholipids are constituents of cell-membranes, thus regulating the transport of solutes into and out of the cell.
5. Phosphorylation is the key reaction in many metabolic processes.
6. Phosphorus captures and store vital energy in the cells of many tissues by forming a high energy compound. Muscle tissue is a prominent example where phosphorus helps in energy store and thus fuel muscle contraction.
7. Inorganic phosphorus in the body fluids constitutes an important buffer system in the regulation of body neutrality.

Food Sources

Phosphorus is widely distributed in foods; the milk and meat groups being important contributors. Whole grain cereals and flours contain much more phosphorus than refined cereals and flours. Vegetables and fruits contain only small amount of phosphorus.

Recommended Daily Allowances

The ICMR Expert committee has recommended the intake as shown in Table 2.

Deficiency

A deficiency of phosphorus is generally not seen in human beings because diets having cereals as major food are seldom inadequate in phosphorus.

MAGNESIUM

The amount of magnesium in the body is much smaller than that of calcium and phosphorus i.e. about 20 to 35 g in the adult body. Of this about 60 percent are carbonates and phosphates at the surfaces of the bones. Most of the remaining magnesium is within the cells.

Functions

1. It is required for numerous biological reactions involving the release of energy.
2. It is a constituent of bone. It is involved in bone mineralization.
3. It is also essential for normal metabolism of calcium and phosphorus.
4. Its presence in the extra-cellular fluids regulates the transmission of nerve impulses.
5. It activates the enzyme responsible for breakdown of glycogen.

Food Sources

Dairy products excluding butter provide enough magnesium. Flour and cereals products, dry beans soybeans, peas and nuts are good sources of magnesium. Green leafy vegetables are excellent sources because, magnesium is a part of chlorophyll.

Effect of Imbalances

Under normal conditions of health and food intake magnesium deficiency is not likely to occur. A deficiency of it may result from malabsorption syndrome, chronic alcoholism, toxemia of pregnancy or after intake of diuretics. Deficiency of magnesium results in neuromuscular irritability, tetanic convulsions, twitching, tremors, convulsions. In excess, it results in extreme thirst, excessive heat in the body, decrease in neuromuscular movements.

POTASSIUM

An adult body contains about 250 g of potassium of which about ninety seven per cent of the potassium in the body is in intra-cellular fluid (intra-cellular fluid refer to fluid inside the cells) while the remainder being in the extra-cellular fluid compartments (extra-cellular fluid refers to fluid outside the cells).

Functions

1. Within the cell it maintains the osmotic pressure and fluids balance.
2. It is required for the synthesis of proteins.
3. It is required for enzymatic reactions taking place within the cell. Some potassium is bound to phosphate and is required for the conversion of glucose to glycogen.
4. It is required for the transmission nerve impulse and for contraction of muscle fibres.

Food Sources

It is widely distributed in foods. Meat, poultry and fish are good sources. Fruits, vegetables and whole grain cereals are especially high in potassium. Banana, potatoes, tomatoes, carrots orange juice, grapefruit juice are rich sources.

Recommended Daily Allowance

The exact amount of potassium required is not known. A normal diet provides this mineral in sufficient amount.

Deficiency

Primarily the deficiency of potassium is not seen. Impaired appetite, severe malnutrition, chronic alcoholism and burn injuries can disturb the acid base balance and lower osmotic pressure.

SODIUM

An adult body contains approximately 120g of sodium of which about 50 percent of the body's sodium is present in the extra-cellular fluid, 40 percent in bones and 10 per cent or less in intra-cellular fluid. (Intra-cellular fluid refer to fluid inside the cell).

Functions

1. It is required for maintenance of normal osmotic pressure and water balance.
2. It is also required for maintaining the permeability of cell membrane.
3. Sodium “pump” helps to maintain the electrolyte difference between intra-cellular and extra-cellular fluid compartments.

Food Sources

Common salt or sodium chloride is the chief source of sodium in the diet. One tea spoon of salt provides almost 2000mg sodium. It universally used to flavor the food we eat and is also used for preserving food for long periods. Numerous sodium compounds are used in food processing and preparation; baking soda, baking powder, sodium alginate, sodium propionate, sodium citrate.

Sodium is a naturally occurring constituent of animals foods, including milk, egg, meat poultry and fish and in certain vegetables as spinach, celery, beet greens and fenugreek. Most vegetables, fruit, cereals, legumes are naturally low in sodium.

Recommended Daily Allowances

5-10 gm of salt (sodium chloride) is sufficient for an average adult. An individual doing hard labour may need more.

Sodium Imbalance

Osmotic pressure and the pH are seriously affected when there is a disturbance in the concentrations of sodium in the extra-cellular fluid of the body tissues. When there is a retention of sodium in the tissue, oedema occurs. In cardiac and renal failure sodium excretion gets reduced. Excess sodium losses occur during the hot weather causing muscular weakness, cramps, fatigue, vomiting and loss of appetite. In this case a small amount of salt may be added to liquid intake.

CHLORINE

Chlorine exists in the body almost entirely as chloride ion. Most of the 100 gm or so of chloride ion is present in the extra-cellular fluid, but it also occurs to some extent in the red blood cells and to a lesser degree in other cells.

Functions

1. It is important in regulation of osmotic pressure, water balance and acid base balance.
2. It activates the gastric enzymes and the digestion in the stomach.
3. It is one of the several activators of salivary amylase.

Recommended Daily Allowances

The requirements for chlorine has not been ascertained, but, if sodium chloride is taken liberally, it ensures the adequate intake of chloride as well.

Chloride Imbalance

Severe vomiting, drainage or diarrhoea leads to large loses of chloride and an alkalosis, because the replacement of chloride with bicarbonate.

IRON

Iron is chief among the trace elements required for the body. In an adult male it is approximately 3 to 5 g and in woman about 2 to 3 g. A major portion of the iron is in the red blood cells as haemoglobin. Muscle tissues contain about 3 per cent of iron as myoglobin and the rest is stored as ferritin, haemosiderin, and siderophillin in liver, spleen, kidney and bone marrow.

Functions

1. Iron is a major constituent of a red-coloured compound called haemoglobin presents in the blood. Iron is present in the haemoglobin. Haemoglobin (Hb) is necessary for transport of oxygen to various parts of the body. Hb carries oxygen from the lungs to the tissues and in turn helps in carrying carbon dioxide from the tissue to the lungs. From the lungs carbon-dioxide is then exhaled out.
2. Iron is also present in the muscle in the form of myoglobin. Myoglobin has the capacity to store oxygen. This oxygen is used for muscle contraction and for other immediate needs of the muscle cells.
3. Iron facilitates the complete oxidation of carbohydrate fats and proteins within the cell.

4. Iron plays an important role in maintenance of specific brain.
5. Iron forms a vital component of certain enzymes and substances that aid in metabolism.
6. Iron has protective function. It helps in preventing infections.

Food Sources

Lean meats, deep green leafy vegetables and whole-grain cereals are good sources. Egg, yolk and organ meats are also among good sources. Liver is an excellent source of iron. Other vegetable and fruits are fair source. Milk, cheese and ice-cream are poor sources. Jaggery contain a good amount of iron.

Recommended Daily Allowances

The requirement of iron for the body is small, but due to poor absorption, much more is needed. From a vegetarian diet only 10% of the dietary iron is absorbed. For a mixed diet 15-20% absorption takes place. Keeping this in mind ICMR Expert Committee (1981) has recommended the daily allowances for various age group as shown in Table 3

TABLE 3
Recommended Daily Dietary Allowance of iron

Group	Iron (mg)/day
Adults male	28
Adult female	30
Pregnancy	38
Lactation	30
Infants	1.0 mg/kg body wt
Children (1 to 9 yrs.)	12-16
Adolescent boys (10-18 yrs.)	34-50
Adolescent girls (10-19 yrs.)	19-30

Deficiency

Anaemia results due to deficiency of iron. Usual symptoms are fatigue, giddiness, breathlessness on exertion, sleeplessness and loss of appetite. Paleness of the tongue, conjunctiva (white of eye) and nail bed is observed in anaemic person.

In severe anaemia, the nails of the fingers and toes becomes brittle and spoon shaped. Severe anaemia can even lead to death.

IODINE

About one third of iodine present in an adult body variously estimated from 25 to 50 mg is found in the thyroid gland. The concentration in thyroid tissue is 2500 times as great as is any other tissue, all of which contain traces.

Functions

The only known function of iodine is as a constituent of thyroglobulin, a protein complex of several iodine-containing compounds. The thyroid hormone regulates the rate of oxidation within the cells and in doing so, regulates the physical and mental growth; the functioning of nervous and muscle tissues, circulating activity and the metabolism of all nutrients.

Food Sources

Iodine is supplied by food and water; the variations are wide depending upon the iodine content of the soils from which they come. People living in coastal areas and eating locally grown foods ingests enough iodine for their use. In hilly areas where there is a deficiency of iodine in food and drinking water – Iodinization of the salt is the only technique available to make good this deficiency in order to prevent goiter.

Recommended Daily Allowances

The daily requirement of iodine is 0.14 mg for an adult man and 0.10 mg for an adult woman. Growing children, pregnant and lactating women may need more.

Deficiency

Endemic goiter results in the parts of the world, where soil has a low iodine content. Endemic goiter is a public health problem in sub-Himalayan region, Maharashtra and sub-Vindhya region, where 50% have goiter.

Goiter is characterized by the swelling of the thyroid gland (Figure 1)

Figure: 1 Goitre

FLUORINE

Fluorine occurs normally in the body primarily as a calcium salt in the bones and teeth. It is not essential for life but small amounts of fluoride bring about striking reductions in tooth decay.

Functions

A proper intake of fluorine is essential to prevent dental caries. It is required for normal mineralization of bones.

Food Sources

The main source is drinking water. It occurs in traces in many foods and in good amounts in shell fish, cheese etc.

Deficiency and Excess of Fluorine

On one hand fluorine is required for deposition of fluorides on teeth and discourages the solubility of minerals and growth of acid forming bacteria. If there is a deficiency of fluorine during the growing period, it will result in dental caries and tooth decay.

On the other hand when taken in excess it could damage teeth and bones. The enamel on the teeth loses its luster, becomes patchy, chalky white and pits appear on its surface. This condition is known as dental fluorosis.

ZINC

It is found in traces in all body tissues and the body's content of zinc is 2 to 3 gm. It is a constituent of insulin and of many enzymes in the body. Zinc deficiency has been reported to result in growth failure and sexual infantilism in adolescents and in loss of taste and delayed wound healing. Zinc is widely distributed in food stuffs both animal and vegetable – but the bioavailability of zinc vegetable foods is low. Animal foods such as meat, milk and fish are dependable sources. Suggested daily intake for adults ranges from 5 to 10 mg. Growing children and pregnant and lactating woman need more. Most human diets provide these amounts.

WATER

The body's need for water is only second to that of oxygen. One can live for weeks without food, but death is likely to follow a deprivation of water for more than a few days. A 10 per cent loss of body water is a serious hazard and death usually follows at a 20 per cent loss.

The water contents of an infant's body is as much as 70 percent, about 65 percent of body weight of lean adults is accounted for by water and 55 percent or less of weight in obese adults in water. All body tissues contain water but variations in tissue contents are wide. In our body water is present in two forms. *Intra-cellular fluids* which are present within the cells accounts for about 45% of our body weight and *Extra-cellular fluids*, which are present outside the cells. Examples of extra-cellular fluids are plasma, interstitial fluids, lymph's and the secretions of pancreas, the liver and gastro-intestinal mucosa.

Functions

1. Water is a structural component and a cushion of all the cells.
2. Water is the medium of all body fluids including the digestive juice, the lymph, the blood, the urine and the perspiration.
3. Water enters into many essential reactions such as hydrolysis that occur in digestion.
4. Water is a solvent for the products of digestion, holding them in solution and permitting to pass through the walls for absorption.
5. It is a carrier of nutrients as well as of waste.
6. Water helps in maintaining the temperature of the body by distributing the heat in the body.
7. Water is essential as a body lubricant the saliva that makes swallowing possible, the mucous secretions of gastrointestinal, respiratory and genitourinary tracts, the fluids that bathe the joints; and so on.

Food Sources

To meet the body's needs water is supplied by the ingestion of water and beverages, the preformed water in foods and the water resulting from the oxidation of foods.

Water Balance

Our body loses water due to excretion in feces and perspiration. Some of the water is also lost with the air that we exhale. To make up these losses through perspiration, Table 5 illustrates the balance between the water intake and water losses.

TABLE 5
Normal Water Balance

Available water	(gm)	Excreted water	(gm)
Water intake	1100	In urine	1000
Water in diet	900	In stool	200
Water of oxidation	200	In vapor (skin and lungs)	1000
	<u>Total 2200</u>	-	<u>2200</u>

LESSON 5

FUNCTIONS OF FOOD, FOOD GROUPS AND THE CONCEPT OF BALANCED DIET

Food has been a basic part of our existence. Life cannot exist without food. After air and water, food is the utmost important thing for survival. There is no other habit, practice or factor that influence the health of an individual, as much as the kind and amount of food consumed. Through, the centuries, food has also been used, as an expression of love, friendship and social acceptance.

Food refers to anything, which nourishes the body. It would include solids, semi-solids, and liquids which can be consumed and which help to sustain body and keep it healthy.

Food is a substance which after ingestion, digestion and absorption is capable being utilized by the body for its various functions

Ingestion means intake of food. It is intake of a substance which should be chewable, palatable and should enter the gastrointestinal tract.

After ingestion, food undergoes a process of digestion. *Digestion* is a process by which complex substance in food is broken down into simpler substance, which the body can take in and use. Some of this complex substance such as carbohydrates, protein and fats undergo some change during digestion.

The end products of digestion or the nutrients present in the small intestine can be used by the body only when they enter these blood stream. This process of movement of digested food or nutrients from the small intestinal wall to the blood stream is termed as *absorption* of food.

Food supplies nutrients to the body, which help us to maintain our nutritional status and health. For example, apple can be classified, as food, as it is capable, of being ingested, digested and finally supplies nutrients to the body after being absorbed. These materials help the body in carrying out the day today activities and thus maintain health.

The nutrients provided by food are carbohydrates, protein, fats, minerals, vitamins, and water and these performs various functions in the body for maintaining our health. Apart from performing this major function, food has another function also. Now let's talk about those functions:

FUNCTIONS OF FOOD

The functions of food can be broadly classified into three main categories.

- 1) Physiological functions of food.
- 2) Psychological functions of food.

3) Social function of food.

1) **Physiological functions of food**

The physiological functions of food can be further sub-divided as follow:

- a. Energy giving.
- b. Body building.
- c. Regulatory and protecting functions of food.

a) **Energy giving:** The body needs a constant supply of energy to carryout the involuntary processes of which we are not even aware, like, respiration, circulation of blood etc. which are essential for continuance of life. Energy is also required to carry out voluntary activities like professional, household and recreational activities, which every human being indulges in like, either jumping, walking, playing etc. Besides this some amount of energy is also required to convert the ingested food into usable nutrients in the body and the heat released during this process helps to keep the body warm.

Energy is mainly provided to our body through carbohydrates and fats in the food. Rich sources of carbohydrates are cereals, sugar, jiggery, potatoes, honey etc. Good Sources of fats include ghee, oil, nuts etc. A major part of our daily diet is constituted by these energy-rich food materials.

b) **Body Building:** The foods we eat become a part of us. Thus one of the most important functions of food is that of building the body. A newborn body weighting 2.7-3.2 Kg. Can grow to its potential adult size of 55-70 Kg., if right kinds and amounts are eaten from birth to adulthood, In adult life, the food eaten each day helps to maintain the structure of the adult body, and to replace worn out cells of the body.

Building of new tissues is very important particularly for the growing children and pregnant women. There is also a continuous breakdown of old tissues and building up of new tissues going on in our body at all ages irrespective of the apparent growth, thus maintaining a need for body building nutrients.

For the body building purposes, the major nutrients utilized are proteins and minerals. Proteins are mainly provided through milk and milk products, meat, fish, poultry, nuts, soybean, and pulses etc.

c) **Regulatory and Protective function:** The third physiological function of food is to regulate the activities of the body. It includes regulation of such varied activities as beating of the heart, maintenance of body temperature, muscle contraction, control of water balance, clotting of blood, removal of waste products from the body etc. For any of these processes, one or the other nutrients is responsible. For example Vitamins of the B groups are an integral part of the enzymes and are responsible for metabolizing food and thus release energy. Vitamin K is an essential factor in clotting of blood.

Apart from regulating our body processes, food also protects us from various infections, diseases, and injuries. For example, Consumption of Vitamin A and Vitamin C rich food help in building resistance in the body to fight against invading organism.

The main nutrients which perform these functions include proteins, vitamins, minerals, water and roughage. Although these nutrients are required by the body in very small amounts, yet it is very important for them to be present in our daily diets. The major sources of these protective and regulatory nutrients are green leafy vegetable, milk, fresh fruits and vegetable, fish etc.

2) The Psychological Functions of food

The second major function of food is the psychological function. Food must also satisfy certain emotional needs. These include sense of security, love and attention. Everyone grows in a particular culture with its own unique food habits of that culture and caste.

The person begins to associate the food habits and foods commonly consumed by him, as it gives him a sense of security and satiety. The foods daily eaten by us, give us more mental satisfaction, even a nutritional balanced meal may not be satisfying to the individual, if food include is unfamiliar or distasteful to him/her.

In a friendly gathering, one may try unfamiliar foods and thus enlarge our food experiences. During the course of time and repeated experience, strange foods become familiar and new tastes are formed. These new taste are developed should again be satisfying to the mind. For example, a person accustomed to traditional Indian cuisine, takes time to adjust to Chinese or western dishes, but feels mentally satisfied at the site of familiar foods.

3) Social function of Food

Food and eating has significant social meaning. Share 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. Earlier only persons enjoying equal status in society eat together. A person would never share a meal with someone inferior to him in social terms. Food is also a symbol of our social life. Food is a medium through which we express our happiness. For example, feasts are given at specific states of life, such as birth, mundane ceremony, birthday, marriage etc. Sweets are also distributed and exchanged to mark certain auspicious occasion like festivals. Food is the common link in a meeting, party or get-together that attracts people to come to such social gatherings. Refreshment served even at officials meeting creates a relaxed atmosphere, where people can exchange their views. The menu for such get-to-gather should bring the people together, rather than divide them. Foods help to strengthen mutual friendship.

For example, inviting friends and relatives over meals signify acquaintance and hospitality. Food also has a specific significance and meaning in the religious context. Certain

food items such as fruits, sweets, and coconut are offered to the deity in temples. Often sweets are prepared at temples and gurudwaras and distributed to devotees as a benediction or prasad.

Further, people of a given religious community share a common eating pattern. This is because religious texts and practices strongly recommend some foods while rejecting others. Food thus becomes an integral part of the social and religious life of people.

Thus it can be concluded that food performs various important functions from satisfying hunger to building mutual understanding and above all helps to maintain our health and adequate nutritional status.

FOOD GROUPS

To get maximum benefit from food, so that it performs all its functions it is important that we take a diet containing all the nutrients in adequate amounts. It is often seen that most foodstuffs contain some nutrients in either more or lesser amounts than required. Thus, to be able to obtain all the nutrients and in adequate amounts, it is important to include different types of foodstuffs in our diet. On the other hand, it is also not possible to include, all the foodstuffs in our diet at one time. Therefore, to overcome this problem, food items providing same types of nutrients have been grouped together, termed as a 'Food Group'.

Food groups have been formed according to various methods from time to time. ICMR (1989) has classified the different food items into five food groups, as follows:

1. Cereal, roots and tubers
2. Pulses, nuts, and oil seeds
3. Milk, meat and their products
4. Fruits and vegetables
5. Fat and oils, sugar and jaggery

In this classification, the foodstuffs providing similar nutrients have been grouped together. The five food groups together with their nutrient contribution is given in Table I.

1) Cereals, Roots, and Tubers

This group has been further subdivided into two:

- i) ***Cereals and Cereals products:*** The foodstuffs included in this group are rice, jawar, bajara, maize, bread, maida, etc. These food items are rich sources of energy and, thus provide energy to the body.

Five Food Groups and their major nutrients. Table I

	Food Group	Main Nutrients
	<p>I. <i>Cereal grains and products:</i></p> <p>Rice, wheat, Ragi, bajra, maize, jowar, barley, rice flakes, wheat flour.</p>	<p>Energy, protein, invisible fat, Vitamin B₁, Vitamin B₂, folic acid, iron, fibre.</p>
	<p>II. <i>Pulses and legumes:</i></p> <p>Bengal gram, black gram green gram, red gram, lentil, peas, rajmah, soyabeans, and beans.</p>	<p>Energy, protein, invisible fats, Vitamin B₁, Vitamin B₂ folic acid, calcium, iron, fibre.</p>
	<p>III <i>Milk and meat products:</i></p> <p>Milk, curd, cheese, chicken, egg, meat, liver, fish.</p>	<p>Protein, fat, Vitamin B₂, calcium.</p>
	<p>IV <i>Fruits and vegetables:</i></p> <p><i>Fruits:</i> Mango, guava, tomato, papaya, orange, sweet, lime, watermelon etc.</p> <p><i>Vegetables: (green leafy):</i></p> <p>Amaranth, spinach, coreander, leanco, and fenugreek leaves etc.</p> <p><i>Other vegetables:</i></p> <p>Carrots, brinjal, lady finger, capsicum, beans, onions etc.</p>	<p>Carotenoids, Vitamin C, Vitamin B₂ Iron, fibre.</p> <p>Vitamin B₂, folic acid, calcium, fibre iron, carotenoids.</p> <p>Carotenoids folic acid, calcium, fibre.</p>
	<p>V. <i>Fats and Sugar:</i></p> <p><i>Fats:</i> Butter, ghee, Cooking oil etc. <i>Sugar:</i> Honey and jaggery and sugar.</p>	<p>Energy, fat, essential fatty acids Energy.</p>

Cereals are an integral part of our diet on some form or other. Cereals are the cheapest source of energy. In addition to carbohydrates, they also contain some amounts of proteins and as cereals constitute a major part of our daily diet, ample amounts of proteins are derived from them. However, cereals are poor in lysine and rich in methionine, pulses are poor in methionine and rich in lysine, when cereals are mixed with pulses in the same meal then the quality of protein improves through mutual supplementation.

Cereals are also a good source of B-group vitamins, provided one consumes whole grain cereals, as most of B-group vitamins are present in the outer layer of the cereals. These vitamins are thus absent in refined cereals such as maida etc. Whole grain cereal is also a good source of mineral iron, bajra, being the richest among all. Ragi is the only cereal, which contains appreciate amounts of calcium. Cereals are lacking in Vitamin A and C. Both germination and fermentation of cereals significantly increase the B-group vitamins and vitamins C contents.

- (ii) **Starchy roots and tubers:** Like potatoes, sweet potatoes, jam, colocasia, tapioca etc. mainly provide carbohydrates and are thus grouped along with cereals under energy giving foods. These food items do not provide protein, as do cereals. Therefore it is not advisable to use them in place of cereals to provide energy for a very long time. These roots and tubers, can however, be used along with cereals in providing energy.

2) **Pulses, Nuts and Oil seeds**

This food groups include various pulses and legumes, like green gram, black gram beans, etc. Nuts and oil seeds like groundnuts, sesame are included in this group. The foodstuffs from this food group provide major portion of protein for vegetarians as pulses are very good source of proteins. The proteins from these sources are also second-class proteins.

Pulse lack in essential amino acid, methionine and rich in lysine. On the other hand, cereals are lacking in essential amino and lysine and rich in methionine. Therefore when cereals and pulses are combined together, the quality of protein improves through mutual supplementation. Hence, cereal–pulse combination as in dosa, dal-roti, rice dal are good practice in Indian homes. Pulses are also good sources of vitamins and minerals. They contain appreciable amounts of B groups of vitamins, especially thiamine.

Pulses do not contain vitamin C, however, on sprouting they became a very good source of this vitamin also. In general pulses are good sources of iron and on sprouting the availing of iron increased further. Apart from proteins, nuts also contain a high amount of fat; therefore they are good sources of energy also. Oil seeds like groundnuts, till, mustard, and sunflower seeds etc. also have good amounts of proteins. The oil cake or meal left after the extraction of oils is rather a very good source of proteins. This oil cake should be incorporated in the diets in combination with other protein food to improve protein utilization.

3) **Milk, Meat and their products**

The foodstuffs included in this food groups are:

- i) Milk and milk products.
- ii) Eggs, meat fish, poultry etc.

All these foodstuffs provide us with first class proteins i.e. their protein contain all the essential amino acids, in adequate amounts. The food items from this group thus help in body building and maintenance processes.

- i) ***Milk and its products:*** Milk and its products like cheese, curds, are very good source of good quality proteins. Along with proteins milk also provide us with calcium and phosphorous, vitamin A and riboflavin. Milk is a very important food for growing children, as it provides them with good quality proteins and they are also able to digest it. For small infants this is the only food, which is easily digested and assimilated in the body.
- ii) ***Eggs, meat, fish and chicken:*** These are also excellent sources of first class protein, which can be totally utilized in our body for building the body. They also contain B-group vitamins in good amounts. Among, this liver is very good source of vitamin A and vitamin B₁₂. Eggs contain nearly all the nutrients, but are particularly good source of protein, fats, vitamin A, iron., calcium and phosphorus.

4) **Fruits and Vegetables**

This food includes fresh vegetables and fruits which provide protective nutrients to our body i.e. vitamins and minerals. The foodstuffs included in this group are spinach, methi, cabbage, cauliflower, carrot, papaya, mango, apple, tomato, lemon, orange, guava, amla etc.

Green leafy vegetables and orange and yellow coloured fruits and vegetables provide us mainly with carotenes.(precursor of vitamin A) vitamin C is found in citrus fresh fruits. Vitamin B group is also present in green leafy vegetables. Some fruits like peaches, pineapple and vegetables like fenugreek, mustard leaves, horse gram leaves are exceptionally good sources of iron. Calcium is basically furnished by green leafy vegetables.

Fruits and vegetables also provide dietary fibre to our meals. The fibrous tissues, which are not digested, help to move the food through the digestive tract and regulate excretion of body wastes.

5) **Fats and Oils, Sugar and Jaggery**

Fats and oils like vegetable oils; hydrogenated fats and pure ghee are very concentrated sources of energy providing 9 Kcal./g. They are mainly used as the cooking medium and hence do form a necessary part of the diet. Fats and oils help to increase the palatability of our food.

Sugar, jaggery and honey supplies energy in the form of carbohydrates. These food items provide about 4 Kcal/g. Sugar is the main source of energy in the form of carbohydrate. Apart from providing carbohydrates, jaggery is also a good source of iron.

Although, most of the food items are covered under these five food groups, but still some widely used food items are uncovered. Condiments and spices are also used in our diet which are mainly added to make the food tasty and appealing. Though they contain significant amounts of certain nutrients, but since these are used in very small quantities, they do not contribute much to the nutritive value of the diet.

The ICMR classification is based on grouping foodstuffs according to the similarity in nutrients found in them. To incorporate the goodness of all the food groups in one's diet, one must choose some foodstuffs out of the two energy giving food groups i.e. cereals, roots, and tubers, and fat, oil and sugar and some food items out of either pulses or meats for body building purpose. The fruits and vegetables however are a must in every meal. Thus, some items from the energy giving food groups, bodybuilding food groups and protective food group must be incorporated in every meal.

For ease in planning diets and for the sake of simplicity and remembrance, the food groups have also been divided according to their functions. Thus on the basis of three physiological functions of food, food items have been grouped into three food groups as follows:-

- 1) Energy giving food groups
- 2) Body building food groups
- 3) Protective and regulatory food groups.

- 1) ***Energy giving food groups:*** The food stuffs included in this food groups are cereals, like wheat, rice, bajra, jawar, etc. roots and tubers like potato, colocasia, and sugar, jaggery, ghee oil, butter etc.

All these foodstuffs are either rich sources of carbohydrates of fats and provide us with energy. These foodstuffs give the strength to carry on the various days to-day activities.

Fig 1: Energy Giving Foods

- 2) ***Body building foodstuffs:*** The food items included in this food groups are milk and its products, meat, fish, pulses, nuts, soyabeans, etc.

The food from this group mainly provide us with proteins and some vitamins and minerals to aid in the growth of the body and for the maintenance of the body by repair of worn out tissues.

Fig 2: Body Building Foods

- 3) ***Body protective and regulatory foodstuffs:*** The food items included in this group are fruits, green vegetables and other vegetables.

Fig 3: Protective Foods

The nutrients derived from these foodstuffs are vitamins and minerals. These nutrients help us to fight against disease and infections. Vitamins and minerals also aid in the regulation of various body processes.

If some food items from the three functional food groups are included in each meal, then our meal becomes a complete meal. To make our meals complete, it is not necessary to go in for elaborate menus, but by simple and judicious selection of menus, we can achieve a complete and balanced meal, e.g. incorporation of any vegetable in paranathas and having them with curds. A more time saving option would be roti i.e. cereal pulse combination, along with some green leafy vegetables or any other vegetables.

Other example of complete meals include roti, dal and subji, Sambar–idly as sambar usually contains some vegetables, vegetables palao with curd, cheese and vegetables sandwiches etc.

BALANCED DIET

Balanced diet can be defined as “ the one which contains different types of foods in such quantities and proportions that the need for all the nutrients are adequately met and a small extra provision is made for nutrients as a margin of safety”.

Thus, our meals will only be said to be adequate and balanced when the quantity of food consumed is sufficient to meet our daily requirements, plus there is an allowance to be stored in the body to be used in conditions of stress. When a person due to some reasons, is not able to consume the required amount of nutrients, like in fevers or fasting , then the body stores of these nutrients are utilized.

The quantity of our meals can be improved or is said to be optimum when our diets are complete. Every meal should have foodstuffs providing energy, protein, and vitamins, and minerals.

The component of a balanced diet will , however differ according to age, sex, physical activity, economic status and physical state of human being, which shall be discussed in detail in the next chapter. However, as an example a day’s diet for an adult man belonging to middle income group is given below.

Meal	Menu	Quantity
Breakfast	Milk Dal parathas Apple	1 glass 2-3 1
Lunch	Chapatis Dal Cabbage and peas Dry vegetable Mint Raita Salad	4-5 1 Katori 1 Katoroi 1 Katori 1 small plate.
Tea	Tea Paneer and vegetable Sandwitch	1 Cup 2
Dinner	Chapatis Rice Rajmah curry Mixed vegetable Custard /kheer	2 1 Small Katori 1 Katori 1 Katori 1 Katori .

LESSON 6

MEAL PLANNING

Meal planning means planning diets which will provide all nutrients in required amounts and proportions i.e. adequate nutrition. As the family's well being and health are depended on how well they are fed. It is a challenge to every meal-planner to meet it and when well done, it proves to be a satisfying and rewarding experience. Besides others factors such as digestibility, palatability, economy, family customs, related to religion, food fads etc, it also determines whether the food can be actually supplied and utilized by the individual.

What are the characteristics of a well-planned meal? First of all it should be remembered that food has to be palatable before it can become nutritious, as majority of people will not eat something they do not like, even if it has excellent nutritive value. We should remember that appetite is the pleasurable anticipation of foods and depends not only on hunger but also on taste, texture, appearance and attractiveness of the foods, pleasantness of the surrounding and a cheerful frame of mind.

Meal planning thus, is both an art and a science: an *art* in the skillful blending of colors, texture and flavor: and a *science* in the wise choice of food for optimum nutrition and digestion.

Importance of Meal Planning

The meal planning helps to make the best use of the material, time and financial resources. To obtain meals that meet the physical, social and psychological needs of the individual and families. It is very important to plan family meals in order to fulfill the nutritional requirement of the family members. This is essential to keep them strong, healthy, and free from any disease and deficiency of any kind.

Meal planning is of utmost importance because it economizes on time, labour and fuel. While planning meals, the methods of working can be carefully through out, so that there is maximum retention of nutrients and minimum losses.

Meals can be planned according to the budget of the family. There can then be maximum utilization of money, if it is spent in the best possible way. Once can have a rich diet without buying expensive foods. Meal Planning therefore, encourage one to plan within the family means.

Meal planning allows one to select different foods from the same food group and avoid monotony. Besides, use of variety of foodstuffs is important from nutritional points also.

Meal planning determines the adequacy of the diet, the kinds of foods purchased, its quality and cost, the way it is stored, prepared and served.

Objectives of Meal planning

1. To satisfy the nutritional needs of the family members.
2. To keep expenditure within family food budget.
3. To take into account the food preference of individual members.
4. Using methods of cooking to retain maximum nutrients.
5. To economize on time, fuel and energy.
6. To serve attractive and appetizing meals.

Factors affecting Meal Planning

Meal planning whether for the simplest family meal or for an elaborate company dinner, involve consideration of a number of factors. These are:

- (1) **Nutritional adequacy** – Meal pattern must fulfill the family needs, so that the nutrition requirement of each individual in the family are met. These requirements differ from person to person according to age, sex, activity and physiological condition, therefore, due consideration should be given to each member of the family. The best way to ensure nutritional adequacy of a diet is to select the food from all the five food groups. (Fig : 1)

The different requirements for different family members does not mean that separate cooking is to be done for all of them. But the diet can be planned in such a way that while cooking the same food the nutritional requirements of all the members can be catered. eg. by increasing or decreasing the amount of certain foodstuff by including some extra protein food for growth periods. For instance, the same salad can be used for both the overweight and the underweight members of the family if the dressing is omitted for the former.

2. **Economy:** The amount of money available, depending upon the socio-economic status also effects the meal planning. The major part of the income is spent on food. Therefore, one should spend economically to get maximum utilization. Although the budget of a family of moderate-income group may not provide for foods of the luxury class, it can still offer variety and opportunity for choice. Food budgets in lower income families permit even more limited choice and it may become increasingly necessary to depend on cereal foods for the main or substantial part of the meal. Then the problem faced is the supplementation of these cereal with foods necessary for a balanced diet. Although it may become difficult to plan, it is nevertheless possible. Thereby, it is very important to know the less expensive alternative for the more expensive recommended foods, having high nutritive value. Such recipes and foods should be included in meal preparation like using cereal pulse combination e.g. khichri, paushitik roti, seasonal vegetables; butter milk; jaggery, pickle and chutney.

Fig 1 : A Daily Food Guide

3. ***The facilities and help available:*** The time spent in cooking depends on other facilities and other help availability of servant, using readymade foods, using labour saving devices. However, time like money needs to be budgeted for its best use. Time management in the preparation of foods is essential for the home maker who is also employed outside the home.
4. ***Satiety Value:*** Any individual meal should provide enough satiety value, so that one does not feel hungry till it is time for the next meal. Proteins and fats have greater satiety value as compared to carbohydrates e.g. a breakfast of just tea and toast will not provide enough satiety value till lunch, whereas, a breakfast of milk, cereal, eggs and fruit will provide enough satiety value till lunch.
5. ***Personal likes and dislikes:*** Although the recommended dietary allowances for each of the classes of food should be followed, there is room for individual preference amongst the foods in each class. Some people make personal likes and dislikes the only basis for the inclusion or exclusion of certain foods in their meals – the failure to include milk is a common practice. It is always better to change the form of the food rather than to completely omit it. For example, milk can be given in the form of curd, cheese, custard or other sweet dish, soyabeans in the form of soya flour chapattis mixed with wheat flour.
6. ***Religion, traditions and customs:*** They are important in determining the food included in the diet, type of meal and the dishes served to the individual of family. For instance, Muslims don't eat pork, whereas Hindus do not eat beef. Rice is considered an auspicious dish at festivals and marriages. Widows are generally not served fish in Bengal. Therefore, religion, traditions and customs should be kept in view while planning meals for a family.
7. ***Food fads and fallacies:*** It often receive more publicity than sound nutrition information. Therefore, while planning the meals, one must try and remove these foods fads, so that notorious meals are provided.
8. ***Availability of foods stuffs and climate:*** In earlier times, the dietary habits depended mainly upon the foods produced in a particular area or community, but today with improved methods of foods preservation and distribution, even the most perishable foods are available over large areas. The wide variation in dietary patterns throughout the world depend largely upon the available food supply and which depends on the climate. Thereby, only seasonal foods should be included in the diet. Also, the season of the year requires some consideration, for the type of dishes selected e.g. inclusion of hot soups etc. in cold winter days and chilly salads and juices in summers.
9. ***Variety:*** It is very important, because nobody likes to eat even his favourite food stuff over and over again. Therefore, to introduce variety, do not repeat same food items during daymeal. Also variety in meal planning is the sum total of many kinds and classes of food served in pleasing colour combinations, with judicious mixture of soft and crisp foods, blunt and sharp flavours, hot and cold dishes. It ensures better nutrition and also

result in more interesting meals with an attractive variety of texture, colour, taste and appearance which in turn stimulates appetite and please the palate. Various methods of working can also introduce a variety – a meal consisting of tandoori roti, dal and seasonal green vegetable also with a crisp salad.

10. **Schedules of family members:** When planning meals, one needs to think of the schedules (time table) of the family members – meal times and the number of meals eaten at home and those that are eaten away from home. If packed lunches are made, the menus need to be modified to ensure that the items can be packed and the menu is appetizing even when cold.
11. **Family size and composition:** The family size affects the foods that can be served. It is known that the money spent for food per person decreases as the family size increases, when the family income remains constant. Staples such as wheat and rice are bought in larger amounts but quantity of milk, vegetables and fruits is lowered. Thus, the quality of the diet is affected. Family composition affects the kind and amounts of food needed and pattern of meals served. For eg when children are below 5 years of age, more milk is required, the numbers of meals are more, as the child cannot take large amount at a time. As the child grows the meal pattern changes to accommodate the school hours and the need to pack lunch or snack may arise. Older members of the family may require change in consistency of food due to faulty teeth.
12. **Meal Times:** It is also an important factor in meal planning. The meals should be planned according to the time for meal i.e. whether it is breakfast, lunch or dinner. Normally while planning the meal for whole day, it is seen that 1/3rd of days requirement are met by lunch 1/3rd by dinner and 1/3rd by breakfast and evening tea. But this is not a rigid schedule and can be changed according to individual requirement. But as long as the total nutritional requirements are being met.
13. **Occasion:** For daily meals the first importance is given to nutritive value. However, for special occasion, special importance has to be given to colour, appearance, number of dishes to be included, but at the same time nutritive value can not be ignored. Similarly each festival has its specific food item which should always be given importance e.g. preparing sweets for Deepawali, cake for X'mas, Sewian for Id etc.

Meal Planning for Different meals in a Day

- (1) **Breakfast:** It is very important meal as taken after 10-12 hours long gap between dinner and breakfast the next day. It should be well planned, nutritious attractive and should provide 1/3rd to 1/4th of the day's requirements, but don't make it very heavy which would lead to lethargy. The school children usually miss breakfast and as a result, they cannot concentrate on studies after some time.

Breakfast should include

- (1) Fruit or fruit juice

- (2) Cereal preparation – Parantha, puri, toast, porridge.
- (3) Protein food – eggs, sausages, milk.

Low cost menu

- (1) Banana (any seasonal fruit)
- (2) Cereal and protein food – ‘missi’ roti,
- (3) Tea/Butter milk/milk

Middle cost menu:

- (1) Apple or orange
- (2) Parantha (stuffed) with curds or toast and butter, milk/tea and pickle, or puri, vegetable preparation and a glass of milk lassi.

Western menu/High cost Menu:

- (1) Fruit juice (orange, pineapple).
- (2) Porridge (cornflakes, rice, flakes, oatmeal etc.) with milk.
- (3) Fried eggs with sausages/Poached egg/panner-subzi.
- (4) Buttered toast.
- (5) Coffee/Tea.

- (2) ***Lunch:*** It is the main meal, hence an important meal. About 1/3rd of the total day’s requirements should be provided. The members who are not at home for the lunch, should be given packed lunch, which should be nutritious, easy to carry, attractive and with some variety.

Packed lunch menu (for school children):

- (1) Dal/Paneer stuffed Parantha.
 - (2) Fruit, e.g. orange.
 - (3) Piece of cake.
- Or
- (1) Sandwiches (Paneer/egg/beans)
 - (2) Sweet (Peanut chikki/ besan laddoo/halwa/burfi)

For children food stuff should have variety, but it has to be handy too.

Packed lunch menu for (adults):

- (1) Paranthas/ chapattis
- (2) Dry vegetable
- (3) Dry dal.
- (4) Salad/Fruit

However, on holidays when everyone is at home, menu with difference is prepared.

Normal lunch menu (on holidays):

- (1) Soup
- (2) Cereal preparation – rice/pulao/chapatti/puri/Parantha
- (3) Meat curry/egg curry/kabuli Channas, Pulse preparation etc.
- (4) Vegetable preparation – carrot, pea, subzi/koftas
- (5) Curd preparation.
- (6) Salad.
- (7) Desert/fruit – custard/kheer/carrot – halwa/soufflé/pudding/fruit salad.

The selection of food items and number of dishes can vary according to the socio-economic status.

On the other hand, where normally lunch is eaten at home, the menu should be simpler. Also dishes like curries, rice, curd etc. can be included which are otherwise difficult to carry, some of the examples are:

- (1) Moong whole, brinjal bhurtha, rice/chapatti, curd fruit.
- (2) Stuffed tandoori paranthe, curd, potato-pea curry, fruit.
- (3) Chapatti, pea-paneer curry, pumkin Subzi, curd fruit.
- (4) Rice, sambhar, sweet curd mixed with fruits.

3) **Evening Tea:** It is generally light and usually includes snacks, sweets, pakoras, cutlets, mathri and tea/coffee/juice.

For children something heavy should be given like sandwiches, ladoos, burfi, cakes etc.

It tea time is special occasion, 3-4 snacks and beverage can be served.

Normal evening tea menu:

- (1) Pakoras, Tea
- (2) Tomato Sandwich, Tea
- (3) Mathri, Ladoo, Tea.
- (4) Biscuit, Vadas, Tea
- (5) Jalebi, Wafers, Tea

Evening tea menu (for special occasion):

- (1) Rainbow sandwich, coconut rolls, cashewnuts fried, tea.
- (2) Cutlets, rasgullas, chirwa, biscuit, tea.
- (3) Chocolate burfi, samosa, pastry, wafers, tea.
- (4) Coconut burfi, khandwi, gulabjamun, dal-month, tea.
- (5) Cashewnut burfi, peanut cutlets, chocolate cake, chirwa, tea.

- (4) **Dinner:** it is also the main meal and should provide 1/3rd of day's requirements and should make up for all deficiencies in person's meal e.g. if curd has not been taken in the morning, include it in the dinner.

Menu has to be elaborate when someone is invited. Otherwise, menu is like lunch.

For festivals, prepare particular food according to sanity of festivals e.g. various sweets on Deepawali, cake on Christmas, Sevian on Id, Gujiya on Holi etc.

Suggestions for Menu Planning

1. Consider whole day as a unit rather than individual meals.
2. Try to distribute carbohydrates, fats and proteins throughout the day, so that no meal has predominance of any kind of food stuff.
3. Use seasonal foods because they are best in flavour and cheap, however, avoid giving the same food stuff and especially in the same meal e.g. don't give tomato soup, tomato macroni and tomato salad for the same meal. But, during the day things like cereals, butter, milk have to be repeated.
4. Take care of colour, flavour and texture by giving contrast in each meal e.g. keep the colour combination of dishes in mind while planning the meal. The dishes can be garnished to bring about more colour in diet. Flavour of food should be blended with each other. There should also be some contrast in texture e.g. some dishes can be soft and some dishes can be crisp, like with the soup we can given toasted bread etc.
5. There should be a balance between the dishes like some dishes should be light and some should be heavy e.g., filling soup can be served with light main meal and vice-versa.
6. Include the favourite foods of the family at different meals, but at the same time don't be limited to only these foods and try to introduce new dishes, so that food habits can be expanded.
7. Money can be saved on food by following methods:
 - (a) Buying bigger packs.
 - (b) Compare the prices before buying.
 - (c) Wholesale markets are cheaper than retail ones.
 - (d) Cook just the required amounts: if food is left over then make use of it by converting to another dish etc.
 - (e) Use seasonal fruits and vegetables.
 - (f) Keep accounts.

8. Time can also be saved by following methods:
- (a) Plan meal for several days at a time.
 - (b) Buy dry ingredients together at least for a month.
 - (c) Avoid going market during crowded hours.
 - (d) Arrange things properly in kitchen so as to save the time while working.
 - (e) Use pressure cooker.
 - (f) Plan your time while working.
 - (g) Use labour saving devices e.g. mixer, but possible only in case the money is available to purchase them.

How to plan a Diet

Keeping in mind, all the points discussed above for meal planning, the diet is planned as a day's menu with suitable meal pattern for particular individual.

Further, to judge the adequacy of diet in terms of various nutrients, it is treated for detailed calculations. For this purpose, food composition tables (Nutritive Value of Indian Foods, NIN, ICMR) are used which give the nutritive value of several food stuffs per 100 gram of the edible portion. Generally detailed calculations are done for three important nutrients – 1st for energy, then 2nd is for protein and the 3rd important nutrients is variable depending upon the requirements for the individual for whom the diet is planned.

The following example illustrates the planning of diet along with the detailed calculations. **Aim-** to plan a day's diet for an adult man aged 28 years, who is a moderate worker belonging to middle income group.

General Information

Age	-	28 years	Sex	-	Male
SES	-	Middle income group	Activity	-	moderate Worker

Recommended Daily Dietary Allowances

Energy	-	2875 K. cal	Thiamine	-	1.4 mg
Protein	-	60 gms.			

General Considerations

- (1) The subject is a moderate worker, so his RDA is taken accordingly and the diet should be nutritionally balanced.
- (2) His traditions, customs and beliefs should be kept in mind.
- (3) His likes and dislikes should be kept in mind.
- (4) The third important nutrient for the subject is thiamine, as thiamine's allowances are related energy intake i.e., to carbohydrate utilization.
- (5) Variety in the menu is essential and it should be provided in forms of colour, texture and flavour.
- (6) Food items included should be of moderate cost with the inclusion of seasonal fruits and vegetable etc. hereby economic factor is also kept in mind.
- (7) The planned meal should be able to provide enough satiety value.

(8) Planned diet should be according to the climate and availability of food should be kept in mind.

(9) The meal should be served in a pleasant atmosphere.

Menu

(1) ***Breakfast***

- (i) Besan Parantha
- (ii) Curds
- (iii) Coffee

(2) ***Lunch***

- (i) Chapatti
- (ii) Palak- Paneer
- (iii) Banana

(3) ***Evening Tea***

- (i) Potato Chops with Chutney
- (ii) Tea

(4) ***Dinner***

- (i) Rice (Fried)
- (ii)Chappati
- (ii)Pineapple and lemon ice cream.

Detailed Calculations for Breakfast

Menu	Ingredients	Amount (gm)	Energy (K. Cal)	Protein (gm)	Thaimine
<i>(i) Breakfast</i>					
(i)Besan Parantha	Wheat Flour	100	341	12.1	0.49
	Besan	20	77	4.1	0.08
	Onion	25	12	0.3	0.02
	Fat	15	135	--	--
(ii) Curds	Curds	100	60	3.1	0.05
(iii)Coffee	Milk	50	33	1.6	0.02
	Sugar	10	39	--	--
Total			697	21.2	0.56

LESSON 7

PLANNING DIETS FOR ADOLESCENTS, ADULTS AND DURING OLD AGE

ADOLESCENCE

This is a stage of rapid growth and covers almost a span of ten years. Individual variation is also great in this group. A number of physical changes and mental changes occur in this period of life. Girls mature between 11-14 years of age and boys between 13-16 years. The pattern of body water, lean body mass, bone and fat show noticeable differences between boys and girls.

As may be expected, the nutritional needs during this second very rapid growth period are tremendous. Anyone who has seen a teenager diet's during this period will attest to his voracious appetite. If plenty of foods are available, they will be eaten especially by boys. Unfortunately, enough of even a poor choice of foods will also satisfy the appetite, but will not supply the essential nutrients required for growth. The difference between poorly nourished and well nourished becomes evident during this period. Normally, the poor diet is inadequate in both calories and calcium, but the adolescent boy may not show any obvious evidence of calcium deficiency because of stunted growth resulting in decreased calcium requirements. Also, a deficient supply of calcium may lead to reduction in food intake and stunted growth. Occasionally, a fast growing adolescent may have an adequate calories supply combined with a deficiency of calcium, and this results in poor skeletal growth and an uneven gait. Symptoms such as bowed legs, and flat feet becomes exaggerated during this period. In the scarcity areas of Gujarat, feeding a good lunch was found to increase the weight of adolescent boys 4-6 Kgs, whereas younger children were found to show an increase of only 1-2 Kgs. Much of the difference in the physical stature between Indians and Westerners is due to slowing down of growth this period.

Nutritional Requirements

Nutrients required by adolescents are discussed below and the same are tabulated in Table I.

The spurt in growth is earlier in for girls and a little later for boys. Therefore, The *energy* intake is higher for girls at 13-15 years and for boys at 16-18 years. Also the difference in energy intake between adolescent girls and boys is partly due to a lower metabolic rate in females as compared to males. The boys require 2450 K.cals at 13-15 years, while 2640 K.cals. at 16-18 years of age. Adolescent girls require 2060 K.cals. at 13-18 years of age.

Protein intake for boys is significantly higher than girls due to a bigger stature of boys. At the end of growth period boys have one and a half times more lean mass as compared to girls. Girls have larger portions of fat deposits. The boys require 71g and 79g of protein at 13-15 years and 16-18 years of age respectively.

Since the bones grow in size and number and mineralization continues even after full length is attained, the calcium requirements are higher during peak of growth and slightly lower thereafter for both boys and girls. Both the sexes require about 600mg during 13-15 years and 500 mg during 16-18 years of age.

Iron need is higher than during childhood due to continuous increase in the blood volume. Adolescent boys require about 41-50mg of iron at 13-18 years of age. Girls require 28mg at 13-15 yrs. and 30mg at 16-18 yrs.

TABLE I
Recommended Daily Dietary intake of Nutrients for Adolescents
(as revised in 1990, ICMR)

<i>Group</i>	<i>Parti Culars</i>	<i>Net Calories (Kcal)</i>	<i>Proteins (g)</i>	<i>Fat (g)</i>	<i>Cal- cium (mg)</i>	<i>Iron (mg)</i>	<i>Retinol (mcg)</i>	<i>Carotene (mcg)</i>	<i>Thiamin (mg)</i>	<i>Ribo- Flavin (mg)</i>	<i>Nicotinic Acid (mg)</i>	<i>Vitamin B6 (mg)</i>	<i>Ascor-bic Acid (mg)</i>	<i>Fo (m</i>
Boys	13-15 Years	2450	70			41			1.2	1.5	16			
Girls	-do-	2060	65	22	600	28	600	2400	1.0	1.2	14			
Boys	16-18 Years	2640	78			50			1.3	1.6	17	2.0	40	100
Girls	-do-	2060	63	22	500	30	600	2400	1.0	1.2	14			

Requirement for *vitamin A* is the same as during childhood i.e. both the sexes require 600 mcg of retinol from 13-18 years of age. *Thiamin*, *riboflavin* and *nicotinic acid* requirements are recommended in relation to increased calories intake. The requirements of these vitamins is always higher for boys due to increased energy requirement. Vitamin C requirement is the same as during childhood i.e. 40 mg. Dietary intake of *Vitamin D* has been fixed at 200 I.U. for all the age groups, hence the requirement. 100mcg of folic acid has been recommended, taking in to account the bioavailability of food folates. Since *vitamin B₁₂* is present only in animal foods and Indian diets are basically vegetarian, dietary allowance of 1 mcg has been recommended, which also takes into account cooking losses and the uncertainty about the extent of absorption of vitamin B₁₂. The requirement for *vitamin B₆* is considered to be related to protein intake and adolescents require 2.0mg daily.

Factors to be kept in mind while planning diets

The following points should be kept in mind.

- (1) The planned diet should be well balanced. With the increase in calcium requirement, extra milk can be provided, if possible. For an adolescent, from low SES, cheaper calcium rich sources should be provided like parched grains, whole grain cereals and pulses and green leafy vegetables. The diet should also contain sufficient energy sources to meet the increased energy requirements. Girls tend to be anaemic as their iron requirement increases considerably. This increased iron requirement should be taken care of by providing green leafy vegetables, whole grain cereals and pulses, and if possible, egg, meat, liver and fish.
- (2) Likes and dislikes should be considered.
- (3) Socio Economic status (SES) of the family should be kept in mind. An adolescent from low SES may want to copy his classmates from high SES with respect to the purchase of high cost snacks. To avoid that, they should be given cheap yet attractive and nutritious snacks in tiffin.
- (4) There should be variety in terms of colour, texture and flavour. The adolescents are more fussy, especially girls about eating at home. Meals served if attractive, will encourage them to eat at home.
- (5) If tiffin is to be given it should be nutritionally balanced, more so if it is in place of a main meal.
- (6) Seasonal drinks like cold/soft drinks and tea/coffee may be included to make the day's diet interesting.
- (7) Satiety value of the diet should be taken care of, especially for the boys. If they are still hungry extra salad, can be provided.
- (8) The meals should be served in a pleasant atmosphere.
- (9) 'Snacking' in between meals is common amongst adolescents. Snacks should be wholesome and not only a source of energy but also proteins and other essential nutrients.

A day's sample Menu for a 16 year old adolescent girl

Recommended Dietary Allowance

Energy 2060 Kcal
Protein 63g
Calcium 500mg
Iron 30mg

Meal	Menu	Food Stuffs	Amount (g)
Breakfast	Mango-Milk shake	Milk	200
		Mango	100
		Sugar	10
	Toasted Bread	Bread	60
		Butter	12
	Sprouted Chanas	Chana	30
		Tomato	25
Lemon		10	
Packed Lunch	Paushtik Parantha	Wheat Flour	60
		Chana Flour	20
		Ghee	15
	Patato, Spinach Vegetable	Potato	70
		Spinach	100
	Apple	Onion	25
		Ghee	5
		Apple	75
Tea	Cold Coffee	Milk	125
		Sugar	8
	Besan Laddoo	Besan	20
		Ghee	10
		Sugar	20
	Chirwa	Rice flakes	30
		Peanuts	20
Fat		5	
Dinner	Boiled Rice Rajmah	Rice	80
		Rajmah	30
		Onion	25
		Tomato	25
		Fat	5
	Plain curd Salad	Curd	75
		Cucumber	50
		Tomato	50
		G. Chillies	5

ADULTS

Adulthood represents the steady state in life when a person would have completed his/her growth in terms of body size. People at this age do not have to include nutrients for growth and strenuous activity of youth. The nutritional needs are for maintenance of body functions. The energy needs in adults are mainly to sustain body functions and activity. Adulthood also represents the productive stage of life, Therefore, it is important that the nutritional needs of an adult be met adequately so as to keep vitality and a positive attitude to life which is essential for optimum productivity. A good diet fosters a vigorous maturity and can do much to delay the characteristics of old age. Inadequate amount of certain nutrients in the diet in earlier years, if continued at this age, may have serious repercussions. Therefore, good nutrition, as well as other health habits should be stressed.

Nutritional needs of Adults

As mentioned earlier, the nutritional needs are mainly for maintenance of body functions and to bear daily wear and tear. The requirements of different nutrients for adults are given in Table II and since recommended dietary allowances for various nutrients cannot be given for any individual person, ICMR has based the recommendations for adults in terms of reference of Indian man and woman all discussed below:

Reference Indian Man has been defined as “an adult man between 20-39 years of age, weighing 60 kg. He is free from disease and is physically fit for active work. On each working day, he is employed for eight hours in occupation that usually involves moderate activity. While not at work, he spends eight hours in bed, four to six hours in sitting moving about and two hours in walking, active recreation on household duties”. For such a reference man, ICMR has taken a height of 163 cms.

Similarly, the **Reference Indian Woman** is defined as “an adult woman between 20-39 years of age, weighing 50 kg. She may be engaged for eight hours in general household work, in light industry or in any other moderately active work. Apart from eight hours in bed, she spends four to six hours in sitting or moving around (light activity) and two hours in walking, active recreation or household duties”. For such a reference woman, ICMR has taken a height of 151 cm.

Energy: The energy need in adults is mainly to sustain body functions and activity. While planning meals for adults occupied in different occupations, consideration should be given to their energy requirements. Occupation of adults can generally be as follows :

Light Work (Sedentary Work)

Men -- Office workers, professional like lawyers, doctors accountants, teachers and architects.

Women -- Office workers, housewives using mechanical appliances or servants, teachers and most other professionals.

Moderate Work

Men -- Most men in light industry, construction works (excluding heavy labour), many farm workers, shopkeepers.

Women -- Workers in light industry, housewives without mechanical household appliances or servants, departmental store workers.

Heavy Work (very active)

Men -- agricultural workers, labourers, soldiers or active service, mine and steel workers, athletes.

Women -- Farm workers, dancers and athletes.

In addition to physical activity and to the type and nature of non-occupational activities, the energy requirements of individuals also depends on factors such as body size and composition, age, sex and climate. Energy expenditure depending on body size and composition will be influenced by resting metabolism, the physical effort of moving the whole body, the work of standing or maintenance of posture and small movements of the limbs. Also, the total physical activity of an individual may be influenced by the quantity of adipose tissue in the body. The energy requirement of women is less than that of men, because they have a larger proportion of fat. The energy expenditure of adults may change with age because of changes in body weight or body composition (as in old age). It is generally recognized that the energy requirements of people in cold climates is more than that of those in hot climates.

Protein: It is required by a normal adult for maintaining the tissue integrity and repairing and replacing the protein loss by wear and tear. An allowance of 1g/kg body weight has recommended. Thus, the total daily allowance of protein of an average Indian man weighing 60 kg will be 60 g and for an average Indian woman weighing 50 kg will be 50 g.

Minerals : The recommended allowance of calcium for men and women is 400 mg. The iron requirement is 30 mg for women and 28 mg for men. The women normally lose upto 2mg of iron per day in the menstrual blood and thus iron deficiency anaemia is more common among women.

Vitamins : Recommended allowances of Vitamin A, ascorbic acid, folic acid and Vitamin B₁₂ are the same as for normal adult men and women i.e. 600mcg of vitamin A in form of retinol or 2400 mcg in the form of B carotene; 40 mg of ascorbic acid; 100 mcg of folic acid and 1mcg of vitamin B₁₂. Thiamin, Riboflavin and Niacin requirements vary according to the energy requirements. For men, Thiamin requirement varies from 1.2 to 1.6 mg per day for women 0.9 to 1.2 mg day. Riboflavin for men varies from 1.4 to 1.9 mg per day and for women 1.2 to 1.5 mg day. There is no variation in the requirement of Vitamin D, which is 200 I.U. for all the age groups.

TABLE II
Recommended Daily Dietary intake of Nutrients for Adults
 (as revised in 1990, ICMR)

<i>Group</i>	<i>Parti Calories Culars (Kcal</i>	<i>Net</i>	<i>Body wt (Kgs)</i>	<i>Proteins (g)</i>	<i>Fat (g)</i>	<i>Calcium (mg)</i>	<i>Iron (mg)</i>	<i>Retinol (mcg)</i>	<i>Caroten e (mcg)</i>	<i>Thiamin (mg)</i>	<i>Ribo- Flavin (mg)</i>	<i>Nicotinic Acid (mg)</i>	<i>Vita min B₆ (mg)</i>
Man	Sedentary work	2425								1.2	1.4		
	Moderate work	2875	60	60	20	400	28	600	2400	1.4	1.6	2.0	2.0
	Heavy Work	3800								1.6	1.9		
Woman	Sedentary Work	1875								0.9	1.1		
	Moderate Work	2225	50	50	20	400	30	600	2400	1.1	1.3	2.0	2.0
	Heavy Work	2925								1.2	1.5		

Factors to be kept in mind while planning diets

- 1) The diet should be nutritionally balanced. Emphasis should be that each meal is nutritionally balanced.
 - The day's nutritional needs of the individual should be divided almost equally in the three main meals i.e. breakfast, lunch and dinner.
- 2) In case of persons going to office a nutritious, well balanced, attractive and easy to carry packed lunch must be provided.
- 3) Careful attention needs to be given to the amount and type of fat to be included in the diet so as to reduce risk of hypertension/high B.P. and heart diseases.
- 4) Traditions, customs and religious attitude of the person should be considered.
- 5) His likes and dislikes should be taken into consideration. If, however, a particular group is not liked, then its form can be e.g. instead of milk, curds, paneer, custard etc. may be given.
- 6) Variety in the food is a must, if should be provided in terms of colour, texture and flavour.
- 7) The diet should be planned according to the socio-economic status the person. Selection of the food stuffs should be such that they are purchased within the budget. If expensive foods cannot be afforded, then emphasis should be on cheap, yet, nutritious food stuffs e.g. peanuts, green leafy vegetables etc.
- 8) Availability of time and energy of the person should be considered. If the plan is for a working woman/wife, then elaborate cooking can be avoided.
- 9) The planned menu should be according to the season. Seasonal vegetables and fruits should be selected as they are tastier, nutritious, cheaper and easily available. Seasonal drinks may be included to make the plan interesting.
- 10) The diet should be planned such that provides us sufficient satiety value. Adequate amounts of raw fruits & Vegetable should be included to provide sufficient dietary fiber.
- 11) Meals should be served in a pleasant atmosphere.

A day's sample Menu for a lady (Business executive) doing light work

Recommended Dietary Allowances

Activity Sedentary

Energy -- 1875 K.cals

Protein -- 50 g

Iron -- 30 mg

Meal	Menu	Food Stuffs	Amount (g)	
Bed Tea	Tea	Milk	25	
		Sugar	5	
Breakfast	Coffee	Milk	120	
		Sugar	5	
	Stuffed Omelette	Egg	40	
		Onion	40	
		Mushroom	25	
		Fat	10	
		Butter	10	
	Toasted Bread	Bread	50	
		Butter	10	
	Lunch	Stuffed Paranthas	Wheat Flour	75
Methi			25	
Fat			10	
Cheese			50	
Peas			30	
Dry Peas & Paneer or Minced Meat		Onion	25	
		Tomato	25	
		Fat	5	
Coffee (from office)		Milk	50	
		Sugar	5	
Tea	Orange	Orange	80	
		Milk	25	
	Tea	Sugar	5	
		Bread	50	
		Cheese	20	
Dinner	Tomato and Cheese Sandwiches	Tomato	50	
		Butter	10	
		Arhar Dal	30	
		Onion	30	
		Potato	30	
	Dal Soup	Butter	6	
		Pulao	Rice	70
			Beans	30
			Peas	30
			Carrot	20
Potato	30			
	Onion	30		

	Fat	5
Bathua Raita	Curd	75
	Bathua	50
Salad	Cucumber	30
	Capsicum	30
	Tomato	30
Bhuji	Khoa	25
	Sugar	5

A day's diet for a woman labourer doing heavy work

Recommended dietary Allowances

Activity : Heavy

Energy	--	2925 K.cals
Protein	--	50 g
Iron	--	30 mg

Meal	Menu	Food Stuffs	Amount (g)
Breakfast	Tea	Milk	25
		Sugar	10
	Besan Roti	Atta	160
		Besan	40
		Onion	30
Lunch	Coriander Chutney	Coriander	50
		Onion	30
	Chapati	Wheat Flour	200
		Fat	10
	Spinach and Potato Vegetable	Spinach	100
		Potato	100
	Salad	Fat	5
		Onion	50
		G.Chillies	20
		Jaggery	40
Tea	Banana	Banana	100
		Tea	Milk
	Rusk	Sugar	10
Dinner	Guava	Rusk	30
		Guava	80
	Rice	Rice	200
		Chana Dal with	Chana Dal
	Vegetable	Bottle Gourd	100
		Radish-leaves Bhuji	Radish-leaves
		Radish	100
		Fat	5
	Onion	50	
	Jaggery	40	

ELDERLY

The process of ageing brings about some physiological, psychological and immunological changes which influence the nutritional requirements. There is a decrease in the water content and the lean body mass is accompanied by an increasing proportion of body fat. By 80, it is estimated that half of the muscle cell remain. There is a decrease in the number of functioning parenchymal cells. Such changes are particularly evident in tissues without generation capacity, such as brain, cartilage, heart, kidney and skeletal muscles. Specific functioning cells are replaced in part by non-specific fat and connective tissues. With time there is a decline in the number of functioning cells of various organs, so that their performance is reduced. Demineralization of bone has been observed commonly in aged persons. This condition is known as *Osteoporosis*.

The sense of taste and smell are less acute in later years, so that some of the pleasure derived from food is lost. Loss of teeth due to increased decay of teeth and gums is common in aged persons. Consequently, these individuals eat more soft and carbohydrate rich foods that fail to provide adequate intake of essential nutrients such as calcium, proteins and vitamins. Decreased secretion of saliva and decreased ability to digest starch have been observed in elderly. Gastric acidity decreases in a large percentage of old people. Peptic, tryptic amylolytic and lipolytic activities of the digestive secretions are decreased. The stomach empties rapidly in persons having hypoacidity of the stomach contents. Due to reduced mobility of gastro-intestinal tract, there is more likelihood of abdominal distention from certain foods. Due to lesser cardiovascular sufficiency, digestion, absorption and distribution of nutrients is retarded.

Nutritional Requirements

Data regarding the nutritional requirements is given in Table VI.

From 25 years of age the basal metabolism decreases about 2 per cent for each decade. The decline in the basal metabolism is less in person who remains healthy and pursue vigorous activity in their later years. The lower metabolic rate and reduced activity in elderly stage reduces the energy requirement. For the calculation of energy requirement, ICMR has recommended the decrease in energy requirement with age as shown in table V.

Age (years)	<i>Decrease in % requirement</i>
20-39	0
40-49	5
50-59	10
60-69	20
70	30

Table V
Energy requirement of Elderly Males and Females
with different Body Weights (Kcal/24hrs.)

Body Weight (Kg)	Age 60 years and above (Sedentary Activity)	
	Males	Females
40	--	1544
45	1664	1624
50	1768	1704
55	1872	1784
60	1976	1864
65	2072	1944
70	2176	2024
75	2280	--

Source : ICMR; 1990

The *energy (calorie)* intake should be adjusted to maintain the body weight constant in case of old people with normal body weight (table V). In case of obese people, the calorie intake should be adjusted to reduce the body weight gradually to about normal level.

In view of the tendency to eat less as a result of decreased appetite and poor digestive capacity, old people are likely to consume less proteins and suffer from protein deficiency. Hence, adequate intake of *protein* should be ensured. Since milk is a good source of protein besides vitamins and minerals, adequate quantities of milk should be consumed. The daily protein intake should be at least 1.0 to 1.4g per kg body weight.

The diet should contain at least about 50g *fat*, as it is a concentrated source of energy. Half of this quantity should be in the form of vegetable oils, which are rich in essential fatty acids.

Calcium and iron deficiencies occur frequently as absorption of these nutrients is less efficient than in normal adults. The calcium intake should not be less than 0.5g and the iron intake 28mg. Since even mild anaemia affects the health of old people due to less efficient circulation of blood, iron intake should be adequate to prevent anaemia.

Mild deficiencies of several *vitamins* occur frequently among old people. It is, therefore, essential to ensure adequate intakes of all essential vitamins. If the diet consumed does not contain adequate amounts of all vitamin, a multivitamin tablet providing the daily requirements of different vitamins should be taken daily. Requirements of thiamin, riboflavin and niacin are based on energy requirements. *Ascorbic acid* requirement is 40 mg, *Folic acid, vitamin B₁₂* and *vitamin B₆* are required about 100 mcg, 1.0 mcg and 2.0 mg respectively. It is essential to include 400 IU of *vitamin D* daily as it will help in the absorption of calcium to prevent osteoporosis.

TABLE VI
Recommended Daily Dietary intake of Nutrients for Elderly
 (as revised in 1989, ICMR*)

Group	Body Wt. (kg)	Energy (Kcals)	Protein (g)	Calcium (g)	Iron (mg)	Vitamin A (mcg)	Thiamine (mg)	Riboflavin (mg)	Niacin (mg)	Ascorbic Acid (mg)
Male	60	1945	60	500	28	600	1.0	1.1	13	40
Female	50	1500	50	500	30	600	0.8	0.8	10	40

**Energy intake 20% less than required for normal adults doing sedentary work.*

The importance of adequate *fluid* intake so as to maintain the volume of urine excreted at a minimum of 1.5 litres is not generally recognized. Water can be consumed as such or in the form of butter milk, fruit juices, porridge, soups etc. during summer season.

Adequate intake of soft unavoidable carbohydrate (*roughage*) in the form of non-fibrous vegetables and fruits should be ensured to avoid constipation. The senile intestinal mucosa does not tolerate fibre from mature vegetables and bran of cereals.

Factors to be kept in mind while planning diets

- 1) The diet should be nutritionally balanced and emphasis should be given on the adequate intake of protein, calcium, vitamin and fibre, which are liable to be deficient in most cases.
- 2) Since chewing may be a problem, the meals prepared should be soft and one or two liquid items may be given such as soup, dal or gruel so that swallowing becomes easy, Salads can be grated. As such the food should be well cooked. Chapati can be made thicker if chewing is a problem, and if needed they may be soaked in milk, soup or other liquid preparation.
- 3) An adequate intake of calcium, should be ensured to compensate for its losses due to gradual demineralization of bones associated with ageing.
- 4) With the advancement of age the capacity to digest and tolerate large meals often decreases. Therefore, the quantity of food given at a time needs to be decreased. The number of meals may be increased as per individual's tolerance.
- 5) Soft unavoidable carbohydrates should be included in the diet to avoid constipation.
- 6) Excess consumption of sweet rich desserts should be cut to a minimum as they provide empty calories but take away the appetite.
- 7) Calorie intake should be adjusted to keep the body weight constant in case of normal old people.
- 8) For poor appetite low bulk, concentrated calorie food, prepared and served in an appetizing way should be planned. These people may be given mid-morning or mid-afternoon snack.
- 9) Factors such as likes and dislikes, special needs, fear of new foods, food prejudices lack of money, poor appetite should be considered.

TABLE VII
Some suggested Menu for Elderly

Breakfast	Lunch	Dinner
Broken wheat porridge Poached Egg Toast with butter Papaya	Lentil dal Palak Saag Grated salad Chapati Fruit custard	Ghia Kofta curry Rice/Chapati Boondi raita Grated Carrot Salad
Wheat flour/ Suji halwa Milk	Chapati Dal Palak Curds	Chapati/Rice Vegetable Khadi Papaya
Upma with crushed Groundnuts Banana	Rice Sprouted Black Gram Cooked carrots	Khichri Milk/curd Tomato Salad Carrots
Rice and green gram Porridge with milk	Chapati Chana Dal Grated Carrot	Rice Sambhar Grated carrot
Bread/Toast Scrambled Egg Milk	Vegetable fried rice Coriander chutney Curds	Rice Egg curry Dry Vegetable

When meal time appetite is poor, in-between nourishments may be planned.

Some suggestion for in-between meals

- Milk and biscuits/rusks/toast
- Lassi and Fruit chat
- Curd and Banana
- Cornflakes nad Milk
- Egg sandwiches
- Tomato and cheese sandwiches
- Custard
- Kheer
- Vegetable pakora with curd
- Idli and groundnut chutney
- Halwa with milk
- Curd and chirwa
- Cereal gruels with milk

REFERENCES

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Fig:1 Energy needs vary with age, occupation and physiological state.

Fig: 2

Fig: 3

Fig : 8 Angular Stomalitis

Fig: 9 Chelosis

Fig: 1 Goitre

Fig: 1

Fig: 2

Fig: 3

Fig: 1 A Daily Food Guide