Contents

Unit I  Food and Nutrition

1. Basic Nutrition 7
2. A Guide to Healthy Living 43
3. Nutrition for Self and Family 69
4. Diet Therapy 97
5. Food Preservation 121

Unit II  Fibre Science

6. Introduction to Fibre Science 135
7. Yarn-Production and Properties 163
8. Fabric Construction 175
9. Fabric Finishing 197
10. Finishing With Colour: Dyeing and Printing 211

Unit III  Extension Education

11. Introduction to Extension Education 229
12. Communication in Home Science Extension 249
   References 266
After the completion of this chapter, the learner:

- defines health, nutrition, nutrients, malnutrition, optimum nutrition, under nutrition, over nutrition
- classifies nutrients and differentiates their functions and sources.
- describes the effects of deficiency of various nutrients.
- explains the importance of dietary fibre and water.
- develops a positive attitude towards good food and for good health.

Food plays a vital role in maintaining proper health enabling man to live long. It also helps in the prevention and cure of diseases. Good nutritive food gives health while bad or unhealthy food gives rise to several diseases. Our cells, tissues and organs function effectively when we eat nutritious food. Body functions such as metabolic, hormonal, mental, physical or chemical actions cannot be performed by the body without nutritive food. Food provides us good nutrition, which is important for the cure of diseases and in building up the immunity of our body. Let us understand the components of food and its significance in the maintenance of health.
1.1 Nutrition-terms and definitions

Now, try to understand the meaning of certain terms related to food and nutrition.

What do you mean by health?

- ..........................................................

The word ‘health’ means different ideas to different people, depending on the situation. World Health Organisation (WHO) defines health as ‘a state of complete physical, mental and social well being and not merely the absence of disease or infirmity’.

A. Dimensions of health

Health is multi dimensional. Although these dimensions are interrelated, each has its own nature. The following are the dimensions of health (Fig 1.1):

a. **Physical dimension**: Physical dimension implies the concept of ‘perfect functioning of the body’. It conceptualizes health biologically as a state in which every cell and every organ is functioning at optimum capacity and in perfect harmony with the rest of the body.

b. **Mental dimension**: Mental health is the ability to respond to the varied experiences of life with flexibility and a sense of purpose. Mental health has been defined as ‘a state of balance between the individual and the surrounding world, a state of harmony between oneself and others, co-existence between the realities of the self and the rest of the people and that of the environment’.

c. **Social dimension**: Social well being implies harmony and integration with the individual, between each individual and other member of the society and between the individual and the world in which he/she lives. It has been defined as ‘the quantity and quality of an individual’s interpersonalties and the extent of involvement with the community.’

![Fig. 1.1 Dimensions of health]
d. **Spiritual dimension:** Spiritual health refers to that aspect of the individual which reaches out and strives for meaning and purpose in life. It is the intangible ‘something’ that transcends physiology and psychology.

e. **Emotional dimension:** Emotional health refers to feelings. This dimension reflects emotional aspects of humanness.

f. **Vocational dimension:** Work often plays a role in promoting both physical and mental health. Physical work is usually associated with an improvement in physical capacity, while goal achievement and self realization in work are sources of contentment and enhancement of self esteem. To maintain health in good condition we need good food.

**B. Food**

Food is that which nourishes the body. Food may also be defined as ‘anything eaten or drunk, which meets the need for energy, body building, regulation, and protection of the body.’ In short, food is the raw material by which our bodies are made. Food provides nutrition for our body.

**C. Nutrition**

Can you define nutrition?

- Nutrition is defined as food at work in the body. Nutrition includes everything that happens to food from the time it is taken in until it is used for various functions in the body. In simple terms nutrition is defined as the fate of food in our body. In a broader sense nutrition is defined as the combination of processes by which the living organism receives food, digests, absorbs and utilizes its contents for growth, maintenance and repair of the body. So this includes a balanced amount of all the varieties of nutrients.
D. Optimum nutrition

When all essential substances (nutrients) are present in the correct proportion, as required by our body, the person is said to be at optimum nutrition. Optimum nutrition provides health, happiness, efficiency and longevity. The signs of optimum nutrition are:

• Height for age
• Weight for height and age
• Clear complexion
• Fresh and lively skin
• Healthy hair
• Healthy pink nails
• Correct posture
• Correct gait
• Inquisitive and alert eyes
• Good appetite
• Proper bowel evacuation
• Emotional maturity
• Self confidence
• Pleasing personality
• Optimism in life and overall health

If this optimal nutrition is not achieved it will lead to ill health.

E. Malnutrition

Malnutrition means an undesirable kind of nutrition leading to ill-health. Malnutrition results from a lack, excess or imbalance of nutrients in the diet. It includes under-nutrition and over-nutrition. Under-nutrition is the state of an insufficient supply of essential nutrients. Over-nutrition refers to an excessive intake of one or more nutrients which creates a stress in the bodily function.

Try to find out some diseases caused by malnutrition.
Know your progress

Define the following.

a. Health  
b. Nutrition  
c. Optimum nutrition  
d. Under nutrition  
e. Over nutrition

1.2 Nutrients - Importance, Sources and Deficiency States

Nutrients are components of food that are needed by the body in adequate amounts in order to grow, reproduce and lead a normal healthy life.

Nutrients are defined as the constituents of food which help us to perform the functions of the body.

There are two basic groups of nutrients that the body needs to function. They are macronutrients and micronutrients. Some nutrients are required in relatively large amounts; hence they are called macronutrients, and some nutrients are required in small amounts; hence they are called micronutrients. Each of these types has very important and specific functions. Carbohydrates, proteins and fats are macronutrients and vitamins and minerals are micro nutrients. Nutrient composition in human body is tabulated in Table 1.1.

<table>
<thead>
<tr>
<th>Nutrients</th>
<th>Man (%)</th>
<th>Women (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>60-62%</td>
<td>54%</td>
</tr>
<tr>
<td>Proteins</td>
<td>17</td>
<td>15%</td>
</tr>
<tr>
<td>Fats</td>
<td>14</td>
<td>25%</td>
</tr>
<tr>
<td>Minerals</td>
<td>6</td>
<td>5%</td>
</tr>
<tr>
<td>Carbohydrates</td>
<td>1</td>
<td>1%</td>
</tr>
<tr>
<td>Vitamins</td>
<td>Negligible</td>
<td>Negligible</td>
</tr>
</tbody>
</table>

Table 1.1 Nutrient composition of human body

Analyse Table 1.1 and try to answer why carbohydrates (a macronutrient) not much found in human body.
For this, let us examine the significance of these nutrients namely carbohydrates, proteins, lipids, minerals, vitamins and water.

A. Carbohydrates

Carbohydrates are the main component of our food! Can you say why?
- .......................................................

Carbohydrates occur abundantly in nature. Plants manufacture carbohydrates through a process called photosynthesis. Carbohydrates form the principal constituent of most of the normal diets. It is the most important energy source. Carbohydrates are mainly present in plant food with few exceptions like glycogen in muscles, lactose in milk and ribose in animal cells.

Carbohydrates are simple sugars or a compound formed by the combination of two or more simple sugars. There are many carbohydrates all of which are compounds of hydrogen, oxygen and carbon but only a few of these are important.

a. Classification of carbohydrates

Carbohydrates are chemically known as saccharides. Carbon, hydrogen and oxygen form a saccharide group. The ratio of carbon, hydrogen and oxygen is 1:2:1.

Carbohydrates are classified based on the number of saccharide groups in them. They are monosaccharides, disaccharides and polysaccharides.

![Diagram of Carbohydrates]

Do you know!
The Greek word ‘Saccharon’ means ‘sugar’. Hence they are called saccharides.
i. **Monosaccharides**

If a person suddenly faints and is hospitalised, glucose solution is injected into his blood. Why?

Monosaccharides are the simplest forms of carbohydrates which cannot be hydrolysed to simpler compounds. All carbohydrates should be reduced to this form for absorption and utilization. The monosaccharides of nutritional importance are glucose, fructose and galactose.

Glucose is also called dextrose or grape sugar. It is the carbohydrate currency of the body. Glucose can easily be digested and absorbed. Sweet fruits contain glucose. Vegetables like sweet corn, carrots, onion etc. and honey also contain glucose.

A normal healthy person has 80-100 mg of glucose in 100 ml of blood.

What will happen, if the glucose level increases in our body? Note down your inference.

Fructose is also called levulose or fruit sugar. It is sweeter than glucose. Fructose is readily absorbed by the body. It is found in honey and ripe fruits.

Galactose, another monosaccharide is not present freely in nature but is widely distributed in the combined state. Lactose, the sugar present in milk, is a compound of glucose and galactose.

ii. **Disaccharides**

Disaccharides are formed by combination of two monosaccharides with the elimination of one molecule of water. They split into simple sugars by acid hydrolysis or digestive enzymes to be absorbed in the body.

The disaccharides of nutritional importance are sucrose, maltose and lactose.

Sucrose is also known as invert sugar. This is manufactured in large scale from sugar cane or beetroot. Many fruits and vegetables contain small amounts of sucrose. This is the common form of sugar in our diet.

**Sucrose = glucose + fructose with the elimination of one molecule of water**
Maltose is a sugar formed in cereal grains during germination. It is also known as malt sugar.

Maltose = 2 molecules of glucose with the elimination of one molecule of water.

Lactose is also known as milk sugar as it is found in the milk of mammals. Lactose can be added to the diet to increase the calorie content.

Lactose = glucose + galactose with the elimination of one molecule of water

iii. Polysaccharides

Polysaccharides are made up of many units of monosaccharides. The majority are insoluble or only slightly soluble in water. Some of the nutritionally important polysaccharides are starch, dextrines, glycogen and dietary fibres.

Starch is found in the plant kingdom. Starch is composed of several hundreds of glucose units linked together into a complex structure. The important sources of starch are cereals, millets and roots and tubers.

Dextrines are a group of substances formed during the breakdown of starch to maltose during the process of digestion in human body or in the germination of seeds or during some of the processes in cooking.

Glycogen is a reserve carbohydrate found in liver (3-7%) and muscles (0.3-1%) of animals and man. It is sometimes called animal starch. It must be converted back into glucose to be used by the body. Glycogen is formed by the condensation of large number of glucose molecules.

Dietary fibres are polysaccharides like cellulose, hemicelluloses, pectin, gums, mucilages and algal substances and lignins.

Cellulose is a polysaccharide made up of glucose which is an insoluble indigestible form of carbohydrate. But it provides bulk to the diet and helps in bowel movements.

Hemicellulose is found in bran, cereals, whole grain cereals and vegetables.

Pectin is a polysaccharide with no nutritional significance. But it is useful in the preparation of jam and jellies. Apples and citrus fruits are the important sources of pectin.

Gums are found in oatmeal, dried beans, and legumes.
Muscilages and algal substances are also found in food product thickeners and stabilizers.

Lignins are found in whole wheat, peach, pear, plum and mature vegetables. Fibre in food serves as a laxative by holding water and increasing the bulk of faeces, binds bile acids and cholesterol.

Prepare an organisation chart based on the details of polysaccharides given above.

b. Functions of carbohydrates
   1. The most important function of carbohydrate is to supply energy for the body. 1 gm of carbohydrate provides 4.3 K Cals of energy.
   2. Carbohydrates have a protective and detoxifying action on the liver. Toxic substances produced by bacterial action are removed from the liver by glycogen.
   3. Carbohydrate is used by the heart for muscular activities. Glycogen stored in the heart muscle is used for this purpose especially in an emergency.
   4. A continuous supply of glucose is essential for nervous tissues to function normally.
   5. Protein is another important nutrient in our body with special functions. If enough carbohydrate is not present in the diet, then protein is used for energy purposes. This function of carbohydrate to spare protein for energy purposes, is known as protein sparing action.
   6. Carbohydrate is used by the body in the synthesis of non-essential amino acids.
   7. Carbohydrate is essential for the oxidation of fat. Excess carbohydrate is converted to fat.
   8. Carbohydrate provides flavour and variety to the diet. It also retains water content in the colon. Cellulose adds bulk to the diet.

c. Sources

Important sources of carbohydrates are cereals and millets, sugar and jaggery, roots and tubers, pulses and dried fruits.

List the food containing carbohydrate included in your daily diet.
Do you know!

The term protein is derived from the Greek word ‘Proteos’ meaning “to take the first place”.

B. Proteins

Which nutrient is needed for our growth?

- .................................................

Proteins play a significant role in all activities of living organisms. It is present everywhere in our body. Proteins are present in our skin, hair, nails, muscles, skeletons, cells and in body fluids.

Proteins are made up of units that are amino acids, in various proportions and arrangements. They include carbon, hydrogen, oxygen, nitrogen and sulphur. The presence of nitrogen makes protein different from carbohydrates and fats.

There are twenty amino acids in proteins. They are grouped into essential amino acids and non-essential amino acids based on their biological importance. Nine of the amino acids are termed as essential amino acids as they have to be supplied through food every day. Eleven of the amino acids are known as non-essential amino acids as they can be synthesized by the body itself.

The essential amino acids are histidine, isoleucine, leucine, lysine, methionine, phenylalanine, threonine, tryptophan and valine. Non-essential amino acids are alanine, arginine, asparagine, aspartic acid, cysteine, glutamic acid, glutamine, glycine, proline, serine and tyrosine. Arginine is essential for growing children and patients recovering from injury or surgery.

a. Classification of proteins

Based on the proportion of amino acids, proteins are classified into complete proteins, partially complete proteins and incomplete proteins.
i. A complete protein (first class protein/high biological value) has a good proportion of essential amino acids to promote the normal growth rate and to maintain the body. eg. proteins in milk, fish, egg etc.

ii. Partially complete protein (proteins of lower biological value) lacks sufficient amount of some essential amino acids. These proteins can maintain life. eg. plant proteins like dhal and cereals.

iii. Incomplete proteins completely lack one or more essential amino acids and cannot even maintain life eg. gelatin and zein of corn.

b. Functions of proteins

• Proteins are the building blocks of our body. The most important function of protein is to supply amino acids to the cells for the continuous replacement throughout life.

• Protein with iron forms haemoglobin in the blood. Haemoglobin carries oxygen to the tissues and eliminates carbon dioxide from tissues.

• Plasma proteins like globulin and albumin regulates osmotic pressure and water balance in the body.

• Proteins supply raw materials to the body for the synthesis of enzymes like pepsin and trypsin.

• Hormones like insulin and thyroxine are protein in nature. Digestive juices and antibodies are protein in nature.

• When the diet is insufficient in carbohydrates and fats for fuel, proteins are used to give energy for the body.

• Proteins provide 5.56 KCal of energy.

• Actin and myosin are contractile proteins of muscle.

c. Sources

Milk, meat, fish, poultry and eggs are the best sources of proteins. Cereal grains and pulses are known as second class proteins. Pulses are known as ‘poorman’s meat’. All essential amino acids are not present in either cereals or pulses. But mutual supplementation of cereals and pulses rectify this limitation.
Lysine, an essential amino acid, is seen less in cereals. But lysine is seen more in pulses. Pulses are poor in methionine, an essential amino acid. Rice is rich in methionine. Thus cereals and pulses or cereals with little animal food can mutually supplement to the growth of the body.

**Identify protein rich food through market survey.**

**Effects of the deficiency of carbohydrates and proteins**

Read the news given below.

What are the causes of this condition?

- The lack of the above said two macronutrients namely carbohydrates and proteins together is responsible for the deficiency disease namely Protein Energy Malnutrition (PEM), which is discussed below.

The term Protein Energy Malnutrition covers a wide spectrum of clinical stages ranging from the severe forms like kwashiorkor and marasmus to the milder forms in which the main detectable manifestation is growth retardation. Protein Energy Malnutrition is due to the ‘food gap’ between the intake and the requirement.

PALAKKAD: In the last 15 months, as many as 29 children died of malnutrition, 13 of them this year. Two more deaths were reported from the area over the past two days. The number might be higher, for all deaths are not from the Kurumba tribal hamlets in the remote forest areas of Anavai, Edavani, etc., too are getting reported. Four tribal children and a woman have died of malnutrition in the Attappady hills during the past month, and two children are undergoing treatment for the condition.
There are 3 clinical forms of acute protein energy malnutrition.

1. Kwashiorkor
2. Marasmus
3. Marasmic-kwashiorkor

a. Kwashiorkor

Kwashiorkor is one of the serious forms of PEM. It is seen most frequently in children of one to three years of age, but it may occur at any age. It is found in children who have a diet that is usually insufficient in energy and protein and often in other nutrients.

Observe Figure 1.2 and identify the signs and symptoms of kwashiorkor.

The signs and symptoms of kwashiorkor are:

- Low body weight inspite of oedema showing growth failure and some degree of muscle wasting which is masked by oedema
- Oedema appears first on the feet and legs and later spreads to the whole body. The face looks puffy with sagging cheeks and swollen eyelids. Puffiness of oedema is known as moon face
- Mental changes like apathy and irritability are common
- Mental development is affected
- Scaly pigmentation of the skin
- The hair becomes thin, dry and brownish or reddish
- Anorexia is common in making it difficult to feed the child
- Diarrhoea may occur due to defective digestion and absorption.
- Vitamin A and B complex deficiencies are observed.

b. Marasmus

Marasmus, another severe form of PEM, is now much more prevalent than kwashiorkor. It may occur at any age, most commonly up to about three and a half years, but in contrast to kwashiorkor it is more common during the
first year of life. Nutritional marasmus is in fact a form of starvation, and the possible underlying causes are numerous. For various reasons, the child does not get adequate supplies of breast milk or any alternative food.

Observe the child with marasmus (Fig 1.3) and identify its signs and symptoms. Signs and symptoms of marasmus are the following:

- Severe growth retardation
- Loss of subcutaneous fat
- Severe muscle wasting
- The child looks appallingly thin and limbs appear as skin and bones
- Shrivelled body
- Wrinkled skin
- Bony prominence
- Associated vitamin deficiencies
- Failure to thrive
- Irritability, fretfulness and apathy
- Frequent watery diarrhoea and acid stools
- Mostly hungry but some are anorectic
- Dehydration
- Sub normal temperature
- Weak muscles
- Oedema and fatty infiltration are infrequent.

**c. Marasmic-kwashiorkor**

Marasmic-kwashiorkor is a mixed form of both marasmus and kwashiorkor and is characterized by the presence of both wasting and oedema. Both Kwashiorkor and Marasmic-kwashiorkor are very serious conditions and are classified as forms of severe acute malnutrition.
C. Lipids

Lipids include fats, oils and other fat like substances. They are composed of fatty acids and glycerol. In lipids carbon, hydrogen and oxygen are present. Compared to carbohydrates fats have a very lower proportion of oxygen.

- What are the oils/lipids that we use in our kitchen?
- .................................................................

Fatty acids are classified as saturated or unsaturated depending on the number of hydrogen atoms attached to each carbon atom. In the case of saturated fatty acids each carbon atom has two hydrogen atoms attached to it, other than two carbon atoms attached eg. coconut oil and animal fat. In unsaturated fatty acids one hydrogen atom is missing from each of the two adjoining carbon atoms due to which a double bond is formed between the two carbon atoms. They are liquids at room temperature.

Fat is the common household name given to lipids. Lipids that are solid at room temperature are called fats and those that are liquid are called oils.

Fat is present naturally in many food. This fat can be visible or invisible. Food like meat, poultry, fish and dairy products, eggs, nuts and oil seeds are rich in invisible fat. Lard, vegetable oils, butter, ghee and margarine are examples of visible fats.

**Essential fatty acids**

These are fatty acids which are nutritionally very important, essential for life and are to be supplied through our diet. These cannot be synthesized in our body.

a. **Classification of lipids**
Basic Nutrition

Based on chemical composition, lipids are classified into simple lipids, compound lipids and derived lipids.

i. Simple lipids are esters of glycerol and fatty acids eg. oils and fats.

ii. Compound lipids are the esters of glycerol and fatty acids with substitution of other compounds such as carbohydrate, phosphoric acids etc. eg. glycolipids, phospholipids, lipoproteins.

iii. Derived lipids are the substances derived from simple and compound lipids by hydrolysis eg. cholesterol

b. Functions of lipids

- Fat is high in calorie (energy) content. One gram of fat supplies 9.3 K cals
- Fats are the carriers of fat soluble vitamins like vitamin A, D, E and K.
- Fats have a protein sparing action
- Fats contain essential fatty acids which help to form components of cell membranes and tissues
- Adipose tissue where fat is stored serves as an insulation material. Adipose tissue protects the vital organs too
- In the growing stage fat promotes growth. It also enables proper sexual maturity
- Fats are slow in digestion and thus retards digestion
- Fats provide flavour and palatability to food. Food prepared in fat enhances satiety.

c. Sources

Most of the fats used in the preparation of food are 100% visible fat. Food of animal origin like meat, fish, milk, butter, cheese, eggs and fish liver oils contain varying amounts of fat. Food of plant origin with the exception of nuts contains very little fat.

Effects of deficiency

- Deficiency of fat in diet leads to the deficiency of essential fatty acids resulting in cessation of growth
- It also results in flaky skin, development of itchy sores on the scalp
• The common disorder in adults and children in India is phrynoderma or toad skin.

An article taken from a leading daily is given below. Identify the problems caused by the excessive use of oils and fats.

**KILLER FAT**

The major cause of high cholesterol is eating items rich in fat, especially saturated fat. High cholesterol is a major risk factor for heart disease. It isn’t something which should cause concern only to overweight, middle-aged people. It's something we should all be aware of. Heart disease is the biggest killer, and cholesterol is a major risk factor. Levels of artery clogging often rise with age, and cardiologists say that everyone age of 20 or older should be screened for high cholesterol, at least once every five years, with more frequent screening for anyone deemed to be at a high risk for heart disease.

D. **Minerals**

Minerals are inorganic substances. The mineral element found in the body forms only 4 to 6 percent of the weight of adult body. This means that about 2 to 3 kgs of our body weight consists of minerals. Of this 90 percent is accounted by seven minerals. They are calcium, phosphorous, sodium, sulphur, potassium, chlorine and magnesium. These minerals are required over 100 mgs/ day. They are called major mineral elements. Iron, molybdenum, zinc, selenium, fluorine, copper, manganese, iodine, cobalt and chromium are known as trace mineral elements, as these add together to about 10 percent of the total mineral content of the body and these minerals are required less than 100 mgs/day. However, the deficiency of only few of these elements is observed in humans. Iron and Iodine deficiencies are widespread while the deficiency of Cu, Zn, Cr and Se has been reported only in recent years.

The largest concentration of minerals is found in the bones and teeth as calcium and phosphorous are deposited on them. Minerals are also found in soft tissues such as nerves and muscles and in blood and other body fluids. Iron is found in blood as part of the red pigment, haemoglobin.

Minerals occur in food as salts and also in combination with organic substances.
The minerals which are significant in maintaining our health are discussed here.

a. **Calcium**

Calcium tablets are sometimes prescribed for patients on teeth treatment. Why?

- Calcium is the most abundant mineral element in the body. Bones and teeth contain about 99 percent of calcium in the body. The remaining one percent of calcium is present in the soft tissue and blood and is responsible for many regulatory functions.

i. **Functions of calcium**

- It is involved in normal muscle contraction, including the heartbeat
- Coagulation of blood takes place only in the presence of calcium
- It is essential for the normal nerve impulse transmission
- Maintains permeability of cell membranes to permit the movement of materials in and out of the cells
- Ensures the absorption of vitamin B12
- It activates the action of enzymes
- It reduces LDL cholesterol in blood.

ii. **Sources**

Milk and milk products are the best sources of calcium. Ragi is the cheapest source of calcium. So it is known as “poor man’s milk”. Sesame seeds and vegetables, small fishes consumed along with its bones, dried fruits, beans, peas and molasses are good sources of calcium.

iii. **Effects of deficiency**

The deficiency of calcium leads to the following conditions:

- **Osteoporosis**: Osteoporosis is a condition found primarily among middle aged and elderly woman, where the bone mass of the skeleton is diminished.
• **Osteomalacia**: Osteomalacia is a condition in which the quality, but not the quantity, of bone is reduced.

• **Tetany**: Tetany occurs when calcium in the blood drops below the critical level.

### b. Iron

Though the amount of iron in the body is only about 2 to 3 grams, its presence is very important. 90% of the iron is found in the red blood cells as the haem portion of haemoglobin. Another 5% of the total body iron is part of the muscle component —myoglobin. The remaining 5% of the total body iron is distributed throughout the cells as a major component of oxidative enzyme systems. About 20% of the total iron is stored as ferritin. It is an intracellular protein that stores iron and releases it in a controlled fashion. Iron is stored in the spleen, bone marrow and liver in the form of ferritin. Men have higher stores of ferritin than women.

#### i. Functions of iron

• It has specific regulatory function

• It is present in the nucleus of cells. It is very necessary for the oxidation in the tissues

• It is an essential constituent of haemoglobin which is responsible for carrying oxygen.

#### ii. Sources

Liver, kidney, heart, lean meat, egg yolk and shell fish are the best sources of iron. Dried beans, legumes, dried fruit, nuts, and green leafy vegetables, whole cereals and enriched grains also contain iron.

#### iii. Effects of deficiency

State any disease caused by the deficiency of iron.

• .......................................................

Dietary iron deficiency leads to nutritional anaemia. Anaemia occurs when the haemoglobin level falls below 12 gm /dl in adult man and woman. The normal haemoglobin level in male is 13.8 to 17.2 gm/dl and female is 12.1 to 15.1 gm/dl (decilitre). Haemoglobin is the pigment in red blood cells that gives red colour to blood. It is made of protein with iron linked to it.
Basic Nutrition

Haemoglobin carries oxygen in the blood to all parts of the body. In anaemia either the amount of haemoglobin in each red blood cell is low (hypo-chromic anaemia) or there is a reduction in the total number of red cells in the body.

b. Iodine

Iodine is present in very minute quantity in our body, about 25-30 mg. Of this, about 33 percent of iodine is present in the thyroid gland.

i. Functions of iodine

- Thyroxin is the hormone produced by the thyroid gland. Iodine combines with a binding protein and forms thyroxin. Thyroxin plays an important role in carbohydrate metabolism.
- During the growing period thyroxin is essential for the normal skeletal and physical development.
- Iodine helps tissues in oxygen consumption

ii. Sources

Iodine is present in minute quantities in all food. The iodine content of food depends on the iodine content of the soil. The soil of mountain regions are usually iodine poor. Sea food, common salt and vegetables are good sources of iodine. Cereals and pulses are poor source of iodine. Leafy vegetables and flowers of vegetables are good sources of iodine.

iii. Effects of deficiency

Iodine deficiency is responsible for endemic goitre and cretinism.

When the body does not get enough iodine for its needs, the thyroid gland enlarges to overcome the deficiency and this causes the swelling known as simple or colloid goitre.

In children, severe iodine deficiency may result in serious retardation of growth. This condition is known as cretinism.

c. Zinc

Zinc is primarily an intracellular substance. Its total quantity in the body
is 2.3 gm. The largest store of Zinc is present in the bones. It is a constituent of blood. Zinc is an important element performing a range of functions in the body, as it is a co-factor for a number of enzymes.

i. Functions of zinc

1. It is a constituent of enzymes.
2. It is a constituent of hormone insulin.
3. It plays a major role in the synthesis of DNA and proteins.

ii. Sources

Meat, un milled cereals and legumes are good sources. Fruits and vegetables are poor sources.

Apart from the above said minerals, copper, selenium and fluorine are essential trace elements.

Copper is an essential element for the absorption of iron.

Selenium is an essential element along with vitamin E for maintaining integrity of the liver cells.

Fluorine is required in minimum amounts to prevent dental caries. Its excessive consumption leads to mottling of teeth.

iii. Effects of deficiency

Deficiency of zinc leads to retardation of growth and genital development.

E. Vitamins

Vitamins are a group of potent organic compounds other than carbohydrate, protein and fat, that are necessary in minute amounts. Vitamins are necessary for maintenance, growth and reproduction.

Vitamins are usually classified into two groups on the basis of their solubility, stability, occurrence in food stuffs and distribution in body fluids. They are fat soluble vitamins and water soluble vitamins. About 15 vitamins are isolated in pure state from natural food.

Fat soluble vitamins are soluble in fats and fat solvents. They are insoluble in water. Therefore these vitamins are utilized only if there is enough fat in the body. Vitamin A, D, E and vitamin K are fat soluble vitamins.
Water soluble vitamins are soluble in water and so they cannot be stored in the body. Therefore, a day to day supply of these vitamins is essential. The nutritionally significant fat and water soluble vitamins are discussed below.

**a. Fat soluble vitamins**

1. **Vitamin A (Retinol)**

The first fat soluble vitamin to be recognized was vitamin A. Vitamin A in its pure form is a pale yellow substance soluble in fat which occurs in the food of animal origin.

Vegetable sources of vitamin A are carotenoids. Carotenoids are organic pigments that are found in the chloroplasts and chromoplasts of plants and some other photosynthetic organisms. Fish, animals and humans consume plant carotene which is converted to vitamin A and is stored in the liver.

i. **Functions of vitamin A**

- It is essential for building cells
- It enables growth of all cells especially of skeletal cells
- It helps normal tooth formation
- It is essential for the normal reproductive function in males

**Do you know!**

Vitamin P, more correctly called flavonoids or bioflavonoids, is a class of substances that are used for many different purposes in plants and are important for human health. It is found in a number of food and herbs, ranging from red pepper to tea.
• It plays a major role in maintaining normal vision
• It plays an important role in maintaining the myelin sheath of nervous tissues
• It is also known as anti-infective vitamin, as it provides resistance to infection. Diarrhoea, respiratory tract infections and morbidity are more common among children with severe vitamin A deficiency
• Vitamin A and carotenoids fight against cancer of skin
• Carotenoids with its antioxidant property reduce the risk of heart diseases.

ii. Sources

The best sources of vitamin A are shark, liver of animals like sheep, goat and cow. Egg yolk, milk and milk products are very good sources of vitamin A. Vegetable sources of vitamin A are leafy vegetables, yellow vegetables like carrot, sweet potato, pumpkin and yellow fruits like papaya and mango.

iii. Effects of deficiency

Vitamin A deficiency is due to low intake of vitamin A in the diet. During infectious diseases vitamin A is lost from the body. The following are the disease conditions related to the deficiency of vitamin A.

• Night blindness: Deficiency of vitamin A shows delayed adaptation to darkness on coming from the lighted area. This is because rhodopsin formation is poor. In dim light vision is poor and if neglected it develops into xerophthalmia. During this condition the conjunctiva becomes dry and lustreless. The transparent appearance of the eye and its opacity is lost. The eye becomes grey and opaque. If this condition persists eye becomes infected and ulcerated. It leads to blindness. Advanced softening of cornea results in its degeneration and develops to Keratomalacia.

• Bitots Spots: Grey coloured spots in triangular shapes are located in the conjunctiva during vitamin A deficiency. This is called Bitot’s spots.

• Phrynoderma: In vitamin A deficiency, the skin becomes rough due to the damage of epithelial cells. This condition is known as follicular keratosis or toad skin or phrynoderma.

2. Vitamin D
Vitamin D is otherwise known as ‘Sunshine vitamin’. Vitamin D is a group of sterol compounds. Vitamin D itself is an inactive form. It is stored in the liver.

i. Functions of vitamin D

- It promotes the absorption of calcium and phosphorus from the small intestine
- It also helps the deposit of calcium phosphate in the bone
- It increases renal excretion of phosphate
- It promotes mineralization of bones.

Vitamin D also reduces the risk of breast cancer, colon cancer, bone and skin cancer and prostate cancer.

ii. Sources

Sun light is the natural source of vitamin D. Fish liver oils, egg yolk, milk, butter and ghee are the best sources of vitamin D. Fishes like sardines and salmons are the best sources of vitamin D. Fortified items are also available in the market.

iii. Effects of deficiency of vitamin D

Deficiency of vitamin D leads to inadequate absorption of calcium and phosphorous from the intestinal tract which ultimately results in faulty mineralization of bones and tooth. Deficiency of vitamin D causes rickets, delayed and malformed teeth in children, osteomalacia in adults and osteoporosis in old age. These disease condition can also occur due to deficiency of calcium too.

- **Rickets**: It occurs in children. It is characterised by bone deformities (fig 1.4)
- **Osteomalacia**: Osteomalacia literally means bone softening. Osteomalacia is the adult counterpart of rickets.

3. **Vitamin E**

Vitamin E is known as antisterility vitamin because it is required for normal reproduction in animals and human beings.
i. **Functions of vitamin E**

- It prevents the oxidation of beta carotene and vitamin A
- It helps to maintain cell membrane integrity and protect RBC against haemolysis
- It reduces platelet aggregation
- It is essential for the iron metabolism and the maintenance of nervous tissues and immune function
- It is an anti-aging vitamin. Vitamin E prevents accumulation of lipid breakdown.

ii. **Sources**

Vitamin E is present in high concentration in vegetable oils and in cereal grains. Wheat germ, sunflower seeds, almonds, eggs and butter are good sources. Meat, fruits and vegetables contain small amounts of vitamin E.

iii. **Effects of deficiency vitamin E**

- Prolonged intake of vitamin E deficient diets produces uncoordinated movements, weakness and sensory disturbances
- It causes haemolytic anaemia in low birth weight infants
- Defective functioning of the retina leads to permanent blindness in premature infants
- It leads to reproductive failure in humans.

4. **Vitamin K**

Vitamin K is recognized as the anti haemorrhagic factor owing to its vital role in blood clotting mechanism.

i. **Functions of vitamin K**

Helps in the synthesis of blood clotting proteins.

ii. **Sources**

Dark green leafy vegetables are good sources of vitamin K. Fruits, tubers, seeds, dairy and meat products contain vitamin K.

iii. **Effects of deficiency**

Primary deficiency arises in infants resulting in delayed blood clotting and haemorrhage. This is because new born babies have a sterile intestinal
tract which lack in the colonic bacterial colonies that produces vitamin K.

b. **Water soluble vitamins**

B-complex vitamins [Thiamine (B₁), Riboflavin (B₂), Nicotinic acid or Niacin (B₃), Pyridoxine (B₆), Folic acid, etc.] Ascorbic acid or Vitamin C, Vitamin P (Bioflavonoid), Carbitine and Taurine are water soluble vitamins. Of the above said vitamins those which are nutritionally more significant are discussed here.

I. **B complex vitamins**

1. **Thiamine (B₁)**

Thiamine is a white crystalline powder with faint yeast like odour and salty nut like taste. It is readily soluble in water and stable until 120º C in acid medium. It is destroyed in alkaline or neutral medium.

i. **Functions of Thiamine (B₁)**

- It helps in carbohydrate and protein metabolism
- Daily supply of thiamine is essential for normal nervous function
- Movements in the gastro intestinal tract take place smoothly only in the presence of day to day supply of thiamine
- It is essential for normal heart function
- Thiamine is also called “Morale vitamin” because it helps the transmission of nerve impulses and maintains the stability of nerves.

ii. **Sources**

Rich sources of thiamine are rice polishing, dried yeast and wheat germs. Whole cereals like grains, wheat, oats etc. and legumes and oilseeds are good sources of thiamine. On milling thiamine is lost from cereals. Milled grain flour and maida are the poor sources of thiamine.

iii. **Effects of deficiency**

Clinically thiamine deficiency is of three types:

- **Infantile Beriberi:** Infantile beriberi occurs in the first few months of life if the mother has thiamine deficiency. Vomiting, green coloured diarrhoea, oedema, loss of appetite and restlessness are the symptoms.
• **Dry Beriberi**: In dry beriberi, involvement of peripheral nerves of legs and arms is seen. Numbness in the ankles and tenderness in the calf muscles are the symptoms.

• **Wet Beriberi**: Along with the symptoms of dry beriberi, oedema is also seen.

2. **Riboflavin (B<sub>2</sub>)**

Riboflavin was discovered after thiamine. It is less soluble in water than thiamine and more stable to heat, especially in acid solutions. Adding baking powder to B-complex sources destroys riboflavin.

i. **Functions of Riboflavin (B<sub>2</sub>)**

• It is a co-enzyme which takes part in biological oxidation in cells
• It helps cellular growth and cell respiration
• It takes part in carbohydrate and protein metabolism
• It is also essential for the health of skin, mucous membrane etc.
• It is required for good vision as it stimulates optic nerves.

ii. **Sources**

Fleshy food like liver, egg, skimmed milk powder and other milk products are rich sources of riboflavin. Meat, fish, legumes, whole grain cereals, oilseeds, nuts and leafy vegetables are good sources of riboflavin. Milled cereals, flours, roots and tubers, and other vegetables are fair sources.

iii. **Effects of deficiency**

Riboflavin deficiency is characterized by

• Soreness and burning of the mouth and tongue
• Lesions at the angles of the mouth called Angular Stomatitis
• The inflammation of the tongue called glossitis
• Dry chapped appearance of the lip with ulcers termed cheilosis
• The skin becomes dry and results in dermatitis
• Photophobia, lacrimation, burning sensation of the eyes and visual fatigue
• Decreased motor co-ordination
• Normocytic anaemia
3. **Niacin or Nicotinic acid (B₃)**

Niacin or Nicotinamide (amide form) is required by all the cells of our body. Like thiamine and riboflavin, it plays a vital role in the release of energy from carbohydrates, protein, fat and alcohol.

i. **Functions of Niacin**

- Nicotinic acid is essential for the normal functioning of the skin, intestinal tract and the nervous system.

ii. **Sources**

Dried yeast, liver, rice polishing, peanut, whole cereals, legumes, meat, and fish, are good sources.

iii. **Effects of Deficiency**

Deficiency of nicotinic acid causes a disease known as pellagra. It is characterized by three Ds, Dermatitis, Diarrhoea and Dementia.

- **Dermatitis:** Marked changes occur in the skin especially in the area exposed to sun and friction areas like elbows, surfaces of arms and knees. Lesions are symmetrically distributed, in the affected parts. At first there is reddening, thickening and pigmentation of the skin. Later on, there is exfoliation leading ultimately to the parchment of the skin – butterfly-like appearance.

- **Diarrhoea:** Diarrhoea enhances the deficiency state. There are structural and absorptive defects in the small intestine.

- **Dementia:** There is irritability, depression, poor concentration and loss of memory.

4. **Pyridoxine (B₆)**

Pyridoxine is unique among B – complex vitamins which functions primarily in protein metabolism.

i. **Functions of Pyridoxine (B₆)**

- Vitamin B6 in the form of pyridoxal phosphate functions as a co-enzyme in many biological reactions.
• It is involved in several biochemical steps for the conversion of the amino acid tryptophan to niacin
• In carbohydrate metabolism it aids in the release of glycogen from liver and muscle.

ii. Sources
Meat, pulses and wheat are rich sources. Other cereals are fair sources of this vitamin.

iii. Effects of deficiency
• Vitamin B₆ deficiency leads to abnormalities in protein metabolism which is manifested as poor growth, convulsions, anaemia, decreased antibody formation and skin lesions
• Severe deficiency leads to microcytic hypochromic anaemia. Symptoms such as weakness, nervousness, irritability, insomnia and difficulty in walking is predominant.

5. Folic Acid
Folic acid was first extracted from dark green leafy vegetables. It forms yellow crystals and is a conjugated substance made up of acids.

i. Functions of folic acid
• It is essential for the maturation of red blood cells.

ii. Sources
Green leafy vegetables, liver, kidney, gingelly seeds, cluster beans etc. are rich sources of folic acid.

iii. Effects of deficiency
Simple folate deficiency results in the bone marrow producing immature cells (megalo-blast cells) and few matured red blood cells. This results in reduced oxygen carrying capacity causing anaemia termed - Megaloblastic anaemia.
Folate deficiency during pregnancy causes neural tube disorders of the foetus.
Folate deficiency impairs the ability of the immune system to fight infection.
II. Vitamin C (Ascorbic Acid)

Ascorbic acid closely resembles glucose in structure. Vitamin C is a white crystalline odourless compound readily soluble in water. It is a strong reducing agent. It is comparatively stable in acidic medium but it is destroyed by the action of heat, oxygen and catalyst like copper.

i. Functions of vitamin C

- It takes part in oxidation and reduction reactions in the tissues
- It is also essential for the formation of collagen present between cells. Bones and muscles are fixed tighter by the collagen activity, like cement
- It is also necessary for the formation of red blood cells
- It also takes place in cholesterol metabolism
- For rapid healing of wounds vitamin C is necessary
- Folic acid is used properly only in the presence of vitamin C
- Vitamin C is a good antioxidant
- It helps in absorption of calcium.

ii. Sources

Citrus fruits like lime, orange, pineapple, mango, papaya, cashew fruit and tomatoes are excellent sources of vitamin C. Amla or the Indian gooseberry is the richest source of vitamin C. Pulses contain very little vitamin C, but if allowed to germinate the vitamin content rapidly increases.

iii. Effects of Deficiency

Prolonged deficiency of ascorbic acid produces a disease condition called ‘scurvy’ in both infants and adults.

- Infantile scurvy
  - There is a loss of appetite, failure to gain weight, irritability, defective growth of bones.
  - Haemorrhage occurs under the skin. Defective formation of teeth and gums become swollen.
**Adult Scurvy**
- General manifestation is fever, susceptibility to infection, and delayed wound healing. Gums become spongy and bleed easily
- Gums become swollen and ulcerated
- The blood vessels become fragile and porous due to defective formation of collagen. Joints become swollen and tender
- Clinical symptoms appear when total body pool of ascorbic acid decreases. Skin becomes rough and dry.

**Complete the following table with the help of the information given above.**

<table>
<thead>
<tr>
<th>Name of nutrients</th>
<th>Functions</th>
<th>Effects of deficiency</th>
<th>Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbohydrate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proteins</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fat</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calcium</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iron</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iodine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vitamin A (Retinol)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vitamin D</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vitamin E</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vitamin K</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thiamine (B 1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Riboflavin (B 2)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Niacin</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pyridoxine (B6)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vitamin C (Ascorbic acid)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Folic acid</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Know your progress

1. Define nutrients.
2. Explain the functions of the following nutrients
   a) Carbohydrates
   b) Proteins
   c) Iron
3. List the sources of the following nutrients
   a) Calcium
   b) Iodine
   c) Vitamin A
   d) Thiamine
   e) Vitamin C
4. Expand the term PEM.
5. Write any three symptoms of the following diseases.
   a) Marasmus
   b) Kwashiorkor

F. Water

How many litres of water are we supposed to consume per day?

Water is the major component of our body. Water is an important nutrient also. Approximately 55-70 percent of the total body weight is made up of water. The percentage of water tends to decrease as a person gets older. Deprivation of water even for a few days can lead to death. Water is an essential component of the cells of our body. The water content of various tissues varies. Metabolically active tissues such as brain, liver, muscles and blood contain more water than the less active bones and fat tissues.

Water holds innumerable body components in the form of solution or suspension. Therefore it is more appropriate to refer to these as fluids. The fluid which exists inside the cells is called intracellular fluids, which form about 55 percent of water in the body. The rest is found as extracellular fluids. Blood, lymph and interstitial fluid (fluid between cells or tissues) are part of extracellular fluids.
Kidneys and lungs carry out water from the body. Water is also lost as perspiration through the skin and as part of excreta from the bowel. The volume of urine voided depends on the intake of fluids.

The body maintains a water balance precisely, i.e. the amount of water ingested is equal to the water excreted or lost from the body. Certain regions of hypothalamus are believed to regulate the intake. The Table 1.4 indicates water intake and loss from the body.

<table>
<thead>
<tr>
<th>Water intake</th>
<th>ML</th>
<th>Daily excretion</th>
<th>ML</th>
</tr>
</thead>
<tbody>
<tr>
<td>All fluids</td>
<td>1500-1750</td>
<td>Urine</td>
<td>1200 – 1500</td>
</tr>
<tr>
<td>Water in solid food</td>
<td>600 – 900</td>
<td>Perspiration</td>
<td>700 – 900</td>
</tr>
<tr>
<td>Water from oxidative fat metabolism</td>
<td>300 – 350</td>
<td>Faeces</td>
<td>100 – 200</td>
</tr>
</tbody>
</table>

Table 1.4 Water intake and loss from the body

1. **Functions of water**
   - It serves as a building material for each cell of the body
   - It is a universal solvent and is able to dissolve all the products of digestion
   - It helps in the transport of the products of digestion to the appropriate organs
   - It is needed for many chemical reactions in our body
   - It acts as a lubricant preventing friction between the moving parts of the body
   - The body temperature is regulated through the evaporation of water from the skin and lungs.

ii. **Effects related to water in our body**
   - **Dehydration**: When the intake of water and other fluids is less than the body requirements, dehydration occurs. Dehydration results from excessive loss of water due to vomiting, diarrhoea and perspiration. Any loss of more than 10 percent of fluid from the body can be dangerous.
   - **Oedema**: Oedema is the accumulation of excess fluid in tissues. It occurs when the sodium content in the extracellular fluid increases due to the inability of the kidneys to excrete sodium. Water is retained with excess sodium resulting in oedema.
In addition to the above mentioned nutrients, dietary fibre also play a significant role in maintaining health. Let us understand its significance.

1.3 Importance of Dietary Fibre

Why should we include salads in our daily diet?

Fibre is made up of different components. Dietary fibre only comes from plants. Fibre is the part of a plant that is not digested and absorbed in the small intestine. It passes into the large intestine. What happens to fibre in the large intestine depends on the type of fibre.

There are two types of dietary fibres-soluble (i.e. soluble in water) and insoluble (that does not dissolve in water). Usually both types of fibre occur in the same food. For example the skin of an apple is high in insoluble fibre, and the flesh of the apple is high in soluble fibre in the form of pectin. Since soluble and insoluble fibres have different actions in the body, it is important to eat food containing both types.

Good sources of soluble fibre are apple, banana, citrus fruits, carrot, barley, oats, dates, peaches, potatoes, rice bran and kidney beans. Good sources of insoluble fibre are most fruits and vegetables, nuts, seeds, wheat bran and whole grain cereals.

Functions of Dietary Fibre

- One of the most important functions of insoluble fibre is the prevention of constipation. By adding bulk and softness to the stool, fibre eases its passage out of the body
- Insoluble fibre is important in preventing and treating diseases of the digestive system
- Fibres have some preventive or therapeutic benefits in irritable bowel syndrome
- Dietary fibre helps to maintain natural friendly bacteria in the large intestine
- High fibre food indirectly influence in weight control. They promote a feeling of fullness and satisfaction
Fibre slows down the absorption of glucose from food.

**Know your progress**

1. Define fibre.
2. What is the importance of water in our daily diet?

**Let us conclude**

Nutrients are defined as the constituents of food which help us to perform the functions of the body. There are six major nutrients. They are carbohydrates, proteins, fats (lipids) vitamins, minerals and water. Vitamins are a group of chemical substances with different structures and qualities. They are grouped into fat soluble and water soluble vitamins.

Kwashiorkor and Marasmus are the two conditions related to protein energy malnutrition. These are found among children. Nutritional anaemia is a condition in which there is reduction in the haemoglobin content of the blood. Night blindness, Bitot’s spot and phrynoderma are the major disease conditions due to deficiency of vitamin A.

Water is an important nutrient. About 60-70 percent of the total body weight is due to water. Water is present inside the cells of tissues and it is known as intracellular water. Water outside the tissue is known as extracellular water. Fibre is the skeletal remains of plant cells that are resistant to digestion by the enzymes. There are two types of dietary fibres—soluble and insoluble. Polysaccharides, cellulose, hemi-cellulose, pectin, gum and mucilage are soluble fibres.

**Lab activity**

Evolve recipes containing each of following nutrients.

1. Carbohydrate
2. Protein
3. Calcium
4. Iron
5. Vitamin A
6. Vitamin C

Make the dish and calculate the nutritive value of the prepared dish.
Let us assess

1. Describe the functions of carbohydrates, proteins and fats.
2. Match the following

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iron</td>
<td>Collagen formation</td>
<td>Lean meat</td>
</tr>
<tr>
<td>Vitamin C</td>
<td>Thyroxine formation</td>
<td>Sea food</td>
</tr>
<tr>
<td>Iodine</td>
<td>Haemoglobin</td>
<td>Indian gooseberry</td>
</tr>
</tbody>
</table>

3. List the symptoms of vitamin C and vitamin A deficiency?
4. Classify proteins with examples.
5. Evaluate the importance of dietary fibre and water in our daily diet.
7. Explain the significance of essential fatty acids.
8. Classify the following into groups and name the group.
   Pectin, glucose, sucrose, galactose, glycogen, lactose
After the completion of this chapter, the learner:

- classifies foods
- identifies food pyramid
- evaluates the loss of nutrients and take steps to minimize nutrient loss during preparation and cooking
- explains healthy food habits
- distinguishes different methods of enhancing nutrient availability
- develops a positive attitude towards healthy living

In the previous chapter we learned about various nutrients present in different foods. We know that food is vital to life. It can be defined as any solid or liquid substance which provides the body necessary materials to enable growth, to replace worn-out and damaged parts and to function normally. We saw that our body is made up of many nutrients we get from the food we eat. Food not only fills the stomach but also provides energy to do work, helps in the growth and repair of tissues, gives strength to fight against disease causing germs, helps the body to function normally and satisfies
hunger. Man must eat to live and what he eats will influence his ability to keep well, to work and to live long. Food are of different kinds and they perform many functions in the body. Let us learn it in detail.

2.1 Classification of Food

Food classification can be done based on the following factors

A. Based on its functions
B. Based on its keeping quality
C. Based on the various food groups.

Let us discuss this in detail.

Why do we classify food into various heads?

A. Classification of food based on its functions

According to the function, food is classified into Energy yielding food, Body building food, Protective and Regulatory food.

What might be the difference between these categories?

a. Energy yielding Food: Our body needs energy to carry out life processes like respiration, circulation, digestion and absorption of nutrients. Energy yielding nutrients are carbohydrates and fats. Food containing carbohydrates include cereals like rice, wheat, ragi, jowar, maize and barley and its flours. Sugar, molasses and jaggery are good sources of carbohydrates. Fats are the concentrated form of energy. They supply double the amount of energy compared to carbohydrates. Fat sources are butter, ghee, vegetable oils like coconut oil, groundnut oil, gingelly seed oil, peanut butter, vanaspathy, palm oil and soyabean oil. Nuts and seeds are store houses of fat. These foods are used by the body to provide energy for all activities both voluntary and involuntary.

b. Body building food: Body undergoes constant metabolic activities. As a result of these activities the tissues wear out and need to be repaired. New tissues are also added on during the period of rapid growth and development. Protein is the important nutrient responsible for the repair
and maintenance of tissues in the body. Foods rich in protein are called body building foods. Milk, meat, egg and fish are rich in proteins of high biological value. These proteins have all the essential amino acids in the correct proportion for the synthesis of body tissues. Pulses, oil seeds and nuts are rich in protein but may not contain all the essential amino acids required by the human body.

c. **Protective and regulatory food:** Food rich in minerals and vitamins are known as protective and regulatory foods. These regulate the various bodily functions and protect it from ill health and disease. They are essential for health and for the normal functioning of human body. Water is a regulatory food. It helps in digestion, excretion and maintenance of body temperature. Milk, egg, liver, fruits and green leafy vegetables are protective foods.

B. **Classification of food based on its keeping quality**

Based on keeping quality, food is classified into perishable foods and non perishable foods.

Can you list some food belonging to these categories?

- ....................................................

a. **Perishable food:** Perishable food stuffs have relatively shorter life span. i.e., within a short period of time undesirable physical and chemical changes start taking place. Perishable food items are easily damaged due to their high water content, bacterial action and enzymatic reaction. Vegetables and fruits, milk and milk products, eggs, fish and tender pear are easily damaged unless properly preserved. Most fresh vegetables keep their top quality for only a few days.

b. **Non perishable food:** Non perishable food items lack water content and hence microbial action is not possible in them. The shelf life of food products can be increased by using proper sanitation procedures during storage. Temperature, humidity and the atmosphere of the storage place and containers decide the shelf life of a product. Cereal grains, flours, legumes and pulses, spices and condiments, sugar and jaggery can be stored in proper form for many months.
C. **Classification of food based on various food groups**

Food is also classified into different categories depending upon the various food groups. Indian Council of Medical Research (ICMR) grouped all our food items into five food groups based on their nutrient content. They are cereal grains and products, pulses and legumes, milk & meat products, fruits and vegetables and fats and sugars. Table 2.1 shows the ICMR classification of food.

<table>
<thead>
<tr>
<th>Food</th>
<th>Nutrients Supplied</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Group – I</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Cereal grains and Products:</strong></td>
<td></td>
</tr>
<tr>
<td>Rice, Wheat, Ragi, Maize, Bajra,</td>
<td>Energy, protein</td>
</tr>
<tr>
<td>Jowar, Rice flakes, Puffed Rice</td>
<td>thiamine, folic acid, riboflavin, iron, fibre</td>
</tr>
<tr>
<td>etc.</td>
<td>and invisible fat</td>
</tr>
<tr>
<td><strong>Group II</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Pulses and Legumes</strong></td>
<td></td>
</tr>
<tr>
<td>Bengal gram, Black gram</td>
<td>Energy, protein, thiamine, folic acid, iron and fibre</td>
</tr>
<tr>
<td>Cowpea, Horse gram, Pea, Rajma,</td>
<td>riboflavin and calcium</td>
</tr>
<tr>
<td>Soya Bean etc.</td>
<td></td>
</tr>
<tr>
<td><strong>Group III</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Milk &amp; Meat Products</strong></td>
<td></td>
</tr>
<tr>
<td>Milk, Curd, Skimmed milk</td>
<td>Proteins, fat, riboflavin and calcium</td>
</tr>
<tr>
<td>Cheese</td>
<td></td>
</tr>
<tr>
<td>Chicken liver, Fish, Eggs, Meat</td>
<td></td>
</tr>
<tr>
<td>etc.</td>
<td></td>
</tr>
<tr>
<td><strong>Group IV</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Fruits and Vegetables</strong></td>
<td></td>
</tr>
<tr>
<td>Mango, Guava, Tomato, Papaya,</td>
<td>Carotenoids, vitamin ‘C’</td>
</tr>
<tr>
<td>Orange, Sweetlime, Water melon</td>
<td>riboflavin, folic acid and iron,</td>
</tr>
<tr>
<td>etc.</td>
<td></td>
</tr>
</tbody>
</table>
Green Leafy Vegetables
Amaranth, Spinach, Drumstick leaves, Riboflavin, folic acid
Coriander leaves, Fenugreek leaves etc. iron, fibre and carotenoids.

Other Vegetables
Carrots, Onion, Brinjal, Ladies finger, Beans, Carotenoids, folic acid, Capsicum, Cauliflower, Drumstick etc. calcium and fibre

Group V

Fats and Sugars
Butter, ghee, hydrogenated fats Energy, fat, soluble vitamins, Cooking oils, Sugar and Jaggery etc. essential fatty acids and iron.

Table 2.1 ICMR classification of food.

Know your progress
1. Expand ICMR.
2. What do you mean by perishable food?
3. Classify food based on nutrient availability.

2.2 Food Pyramid

The food guide pyramid is the foundation for a healthy living. There is no single food stuff which can contribute all the nutrients. Only a judicious selection can provide all the nutrients in required quantity. Food pyramids provide a guide for the selection of food in our diet.

The food guide pyramid helps us to choose what and how much to eat from each food group in order to obtain the proper balance of nutrients you need without taking in too much calories, fat, cholesterol, sugar or sodium.

The food pyramid shows the kind of healthy food found in each of the pyramid’s six categories. The size of the compartment in pyramid containing each type of food, indicate the relative proportion of our diet it should represent. Grains, vegetables and fruits should make up the bulk of our diet while servings of dairy products and protein should be fewer. Oil, sweets and fats should be eaten sparingly.
The general recommendations of food pyramid are:

- Eat variety of foods to get the energy, proteins, vitamins, minerals and fibre for good health.
- Balance the food that we eat with physical activity. Maintain or improve your weight to reduce the chances of having high blood pressure, heart diseases, stroke, certain cancers and diabetes.
- Choose a diet with plenty of grain products, vegetables and fruits which provide the necessary vitamins, minerals, fibre and complex carbohydrates.

Observe the food pyramid given in Fig 2.1.

![Food Pyramid Diagram](image)

**Know your progress**

1. What do you mean by food pyramid?
2. What are the general recommendations of food pyramid?

### 2.3 Cooking

Why do we cook our food?

- .....................................................

Food preparation helps in combining food ingredients in various ways with
delicate flavours, textures and colours which appeal to the senses. Food should be pleasing in appearance and taste as to be consumed. The process of subjecting food to the action of heat is termed as cooking.

A. Objectives of cooking food

a. Improves the taste and quality: Cooking improves natural flavour and texture of food. eg. roasting coffee seeds, ground nuts etc. will improve the flavour. However cooking for a long time lowers the flavour as flavouring compounds are volatile.

b. Destruction of microorganisms: Microorganisms are present everywhere and some are useful in making curd, cheese and bread. Some are harmful and cause infections or produce toxins. One of the most important methods to protect food against harmful microorganisms is the application of heat. Cooking food to the required temperature for a required length of time can destroy all harmful microorganisms in food.

c. Improves digestibility: Cooked food is easily chewed and swallowed. It is easily acted on by digestive juices.

d. Increases variety: Through cooking, the same food items are rendered into different dishes which makes eating a pleasure.

e. Increases consumption of food: Improvement in texture and flavour by cooking increases the consumption of food to meet our nutritional requirements. For example cooking improves the texture and makes the food chewable.

f. Increases availability of nutrients: Cooking increases the quality of protein by making some amino acids available to the body.

B. Principles of cooking

Application of scientific principles for our daily cooking ensures better family health and individual health. It is very important to learn these principles for better understanding and for higher degree of consumer awareness. The principles of cooking are:

a. To keep ‘flavour in’: When you cook food with or without a covering in a fatty medium, eg. cutlets, the aroma of the food is enclosed inside the crisp covering. It makes the food tasty and stimulates the digestive secretions for better utilization of nutrients.
b. **To keep ‘flavour out’**: Sometimes food is cooked to draw out its flavour into the gravy eg. mixed vegetable stew. Slow and steady cooking brings out changes in the texture. The water soluble nutrients are drawn into the broth, which is tasty besides being nourishing.

c. **To get maximum nutritive value by using appropriate cooking methods**: Cooking destroys most of vitamin C and B group vitamins because they are degradable by heat. Minerals are lost when large quantity of water is used for cooking. The loss further increases if the water is discarded. Prolonged and fierce cooking methods reduce the digestibility of proteins. Likewise most of the cooking methods affect the nutritive value of foods. We can adopt appropriate cooking methods to get maximum nutritive value.

C. **Methods of cooking**

The methods of cooking can be classified on the basis of the medium used for heat transfer. The medium normally used are water as such or in the form of steam, oil and air. It is presented in Table 2.2

<table>
<thead>
<tr>
<th>No.</th>
<th>Medium</th>
<th>Cooking methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>Water</td>
<td>i) Boiling  ii) Simmering  iii) Stewing  iv) Poaching</td>
</tr>
<tr>
<td>b.</td>
<td>Steam</td>
<td>i) Steaming  ii) Pressure cooking</td>
</tr>
<tr>
<td>c.</td>
<td>Fat</td>
<td>i) Deep fat frying  ii) Shallow frying or pan frying</td>
</tr>
<tr>
<td>d.</td>
<td>Air</td>
<td>i) Roasting  ii) Baking  iii) Grilling</td>
</tr>
<tr>
<td>e.</td>
<td>Combination</td>
<td>Braising-roasting and then cooking in water. Any two methods coming together from the above four groups.</td>
</tr>
<tr>
<td>f.</td>
<td>Electromagnetic Microwave cooking waves</td>
<td></td>
</tr>
</tbody>
</table>

Table 2.2 Methods of cooking

a. **Water**

Water is the most commonly used medium of cooking. Boiling, simmering and stewing are the methods in which moist heat is used.

i. **Boiling**: Boiling is cooking food in water at 100°C and maintaining the water at that temperature till the food is made tender. When food items
are cooked by boiling, the food should be brought to a vigorous boil first and the heat is then turned down, as violent boiling throughout tends to break the food. Boiling can be done with excess amount of water or sufficient amount of water. eg, boiling is the traditional method of cooking rice.

Advantages of boiling

- The simplest method. It does not require special skill and equipment
- Soluble starches can be removed and rice grains are separated
- Protein gets denatured, starch gets gelatinized and collagen gets hydrolysed
- Uniform cooking can be done.

Disadvantages of boiling

- Loss of nutrients: If excess water is used in cooking and if it is discarded, 30-70 % water soluble nutrients like vitamin C may be lost. To prevent this type of losses, cooked water should be used in soups, rasams etc. Some proteins may be lost, if vegetables are cooked in water containing salt and the stock is discarded. There is considerable loss of minerals especially sodium, potassium and calcium due to leaching
- Loss of colours: Water soluble pigments like betanin from beetroot may be lost. Beetroots should be cooked along with the skin to prevent the loss of colour
- Time consuming: Boiling may take time and fuel may get wasted
- Loss of flavour and texture: Boiled foods are not considered tasty because flavour compounds are leached into water. Over boiling may make the food mushy.

ii. **Simmering**: When food items are cooked in a pan with a well fitting lid at temperature just below the boiling point, ie, 82-99°C of the liquid in which they are immersed, the process is called simmering. It is a useful method when food items have to be cooked for a long time to make it tender.
Advantages of simmering
- Food gets cooked thoroughly
- Scorching or burning is prevented
- Loss due to leaching is minimum.

Disadvantages of simmering
- Loss of heat-sensitive nutrients, due to long period of cooking
- Takes more time and more fuel.

iii. Stewing: This is a gentle method of cooking in a pan with a tight fitting lid, using small quantities of liquid to cover only half of the food. The food above the liquid is cooked by the steam generated within the pan. The liquid is brought to a boiling point and then the heat applied is reduced to maintain the cooking at simmering temperature i.e. 98°C. Stewing is a slow method of cooking. Most vegetables and meat are prepared by this method.

Advantages of stewing
- Prevents leaching of nutrients
- Flavour is retained.

Disadvantages of stewing
- Time consuming.

iv. Poaching: This involves cooking food in minimum amount of liquid at a temperature of 80-85°C, that is below boiling point. Food items generally prepared by this method are poached eggs, fish and fruits.

Advantages of poaching
- Very quick method of cooking
- Easily digestible since no fat is used.

Disadvantages of poaching
- It is bland in taste
• Water soluble vitamins may be leached into the water.

b. Steam

Steaming of food involves the use of moist heat. When food is cooked in water vapour with or without pressure it is said to be steamed.

i. Steaming: This is generated from vigorously boiling water or liquid in a pan so that the food is completely surrounded by steam and not in contact with the water or liquid. Here the food is cooked at 100°C.

Advantages of steaming
• It does not require constant attention
• Nutritive value is maintained because there is no leaching and cooking time is less
• Easily digestible since no fat is added
• There is less chance of burning and scorching
• In double boilers, sudden increase in temperature can be avoided while making custards and boiling milk
• Texture of food is better and becomes light and fluffy
• Steamed foods have good flavour.

Disadvantages of steaming
• Special equipment (steamer) is needed
• Many foods cannot be prepared by this method.

ii. Pressure cooking: When steam under pressure is used, the method is known as pressure cooking and the equipment used is known as pressure cooker. In the food cooked with steam under pressure temperature is elevated quickly and the cooking period is reduced.

In pressure cooking, escaping steam is trapped and kept under pressure so that the temperature of the boiling water and steam can be raised above 100°C.
Advantages of pressure cooking
- It takes less time to cook
- Different items may be cooked at the same time
- Fuel is saved
- Requires less attention
- Nutrient or flavour loss may be less
- There is an indication when the cooking is completed
- There are less chances of burning or scorching.

Disadvantages of pressure cooking
- Thorough knowledge of using the equipment (pressure cooker) is required. Otherwise accidents may occur
- There may be mixing of flavours
- Food may get undesirably soft.

c. **Fat**

Here oil or fat is used as a medium of cooking. The fat cooking methods are:

i. **Deep fat frying:** Here food is totally immersed in hot oil and cooked by vigorous convection currents and cooking is uniform on all sides of the food. Cooking can be rapidly completed in deep fat frying because the temperature used is 180-220°C.

Advantages of deep fat frying
- Taste is improved along with texture
- Increases calorific value
- The fastest method of cooking.

Disadvantages of deep fat frying
- Sometimes the food may become oily or soggy with too much absorption of oil
- More attention is required while cooking and care should be taken to avoid accidents
- The food becomes very expensive
- Fried food takes more time to digest
- Repeated use of heated oils may produce harmful substances and reduce the smoking point.

ii. **Shallow fat frying:** Here food is cooked in large amounts of fat but not enough to cover it. Heat is transferred to food partially by conduction by contact with the heated pan and partially by the convection currents of the foods. Only a thin layer or thin pieces of food are cooked in this manner. The food must be turned from one side to another to ensure complete cooking.

Advantages of shallow fat frying
- In shallow fat frying, the amount of oil used can be controlled
- Improves the taste of the food
- Improves the flavour and texture of food.

Disadvantages of shallow fat frying
- These foods are not digested easily due to the fat absorbed during frying
- This method is limited to certain foods.

d. **Air**

Methods in which air is used as a main cooking medium include roasting, baking, grilling or broiling.

i. **Roasting:** It is traditionally carried out over an open fire, with meat being rotated on a spit. Nowadays, roasting is generally described as the cooking of meat or vegetables in the oven, smeared with hot fat to prevent drying and to enhance colour and flavour.

Advantages of roasting
- Flavour can be enhanced
• Little attention is required while the meat is roasted
• Fuel can be saved if other items are roasted at the same time.

Disadvantages of roasting
• Moisture loss by evaporation is quite marked and can cause undesirable drying of food
• Fat from the meat will spatter at high temperatures
• Food items may shrink in size as a result of moisture loss and protein denaturation
• High temperatures may cause toughening of protein and reduce digestibility.

ii. Baking: Here food gets cooked by hot air. Baked foods items are generally brown and crisp on the top, soft and porous at the centre. The temperatures that are normally used for baking are 120-260°C.

Advantages of baking
• Flavour and texture are improved
• Variety of dishes can be made
• Uniform and bulk cooking can be achieved.

Disadvantages of baking
• Special equipment and skill are required.

iii. Grilling or broiling: Grilling consists of placing the food below or above or in between a red hot surface. This refers to cooking of food by exposing it to direct heat.

Advantages of grilling
• Quick method of cooking
• Less or no fat required
• Flavour is improved.

Disadvantages of grilling
• It requires careful timing to prevent over cooking
• Grilled foods may be expensive.

e. Combination- Braising

Braising is a combination of stewing and roasting in a pan with a tight fitting lid. It prevents loss of liquid, while the food is cooked in the steam rising from the stock. During cooking, the liquid should simmer, not boil to prevent toughening of food.

Advantages of braising
• A whole meal can be cooked in one pan, which saves time and fuel.
• Tough cuts of meat can be used.

Disadvantages of braising
• Food may not develop a good colour.

f. Electromagnetic waves

Electromagnetic waves from a power source magnetron are absorbed by the food and the food gets heated at once. Thus microwaves do not require any medium of transfer of heat in cooking. The microwaves can be absorbed, transmitted or reflected. They are reflected by metals and absorbed by food. When food is kept in the cavity of the microwave oven for cooking, the microwave generated by the magnetron strikes the food and the metal walls of the oven. Microwave that strikes the metal walls are reflected and bounced back, so they disperse throughout the oven and accomplish uniform heating of the food.

Advantages of microwave cooking
• Food is cooked very quickly
• There is less destruction of nutrients as cooking time is short
• Food gets cooked uniformly
• Preserves the natural colour of vegetables and fruits.
Disadvantages of microwave cooking

- It is easy to overcook the food; so careful attention must be paid to timing
- Deep frying cannot be done
- The short cooking time may not give a chance of blending of flavours as in conventional methods.

Whatever may be the method of cooking, some basic principles of cooking may help to keep the nutrients of food.

*Try to cook food with the different methods mentioned above and prepare a note on these.*

**Know your progress**

1. List the main objectives of cooking.
2. What are the advantages of pressure cooking?
3. Define Broiling.
4. List the different methods of cooking.

### 2.4 Loss of Nutrients and Steps to Minimize Nutrient Loss

It is better to eat raw vegetables rather than cooked. Why?

---

Nutrient loss is a consequence in all cooking process. Exposure to heat, light or oxygen will alter the nutrients found in food, and methods that involve water often reduce the amounts of nutrients as these get ‘washed out’ and left behind.

**A. Loss of nutrients during cooking**

Nutrients are lost during the various processes in cooking. They are:

1. Over washing: Vitamin B and minerals are lost when pulses and cereals are over washed.
2. Over peeling: If vegetables are over peeled, the vitamins and minerals are lost. Vitamin B is lost when potatoes are peeled without boiling.
3. Washing after cutting: Water soluble vitamins and minerals of vegetables especially green leafy vegetables are lost when washed after cutting.
4. Over soaking: If pulses are soaked in water for too long i.e., more than
2-3 days, it can lead to severe food poisoning.

5. Discarding leaves: Green leaves of turnip, broccoli, carrots etc when discarded results in loss of calcium, iron and carotene.

6. Throwing stock: Water soluble vitamins dissolve in water; so the stock left after boiling if thrown results in their loss.

7. Preparation: Using excessive water for cooking rice and draining the excess water leads to the loss of vitamin B.

8. Cooking uncovered: Vitamin B and C are water soluble and can easily evaporate along with water vapour, if the container is not covered.

9. Using cooking soda: Cooking soda is mostly used to cook pulses like channa, destroys Vitamin B.

10. Over frying: All fat soluble vitamins A, D, E, and K are lost in the oil when fried or fried repeatedly.

11. Over cooking: Eggs, meat, cheese become leathery upon overcooking which makes them indigestible. When vegetables are over cooked, they burst and vitamin B leaks into the water.

12. Reheating: Reheating food after cooking also destroys nutrients.

Maximum nutrient loss takes place in vegetables while cooking. When vegetables are cooked in water using boiling methods 15-32% of thiamine, 9-20% of riboflavin and 23-45% of vitamin C are lost. In steam cooking the loss is lesser. Table 2.3 shows the loss of vitamins in some vegetables during cooking.

<table>
<thead>
<tr>
<th>Name of vegetables</th>
<th>Method of cooking</th>
<th>Loss of thiamine</th>
<th>Vitamin C</th>
<th>Riboflavin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beans</td>
<td>Boiling</td>
<td>29%</td>
<td>20%</td>
<td>42%</td>
</tr>
<tr>
<td>Cabbage</td>
<td>Boiling</td>
<td>32%</td>
<td>18%</td>
<td>45%</td>
</tr>
<tr>
<td>Carrot</td>
<td>Boiling</td>
<td>20%</td>
<td>10%</td>
<td>30%</td>
</tr>
<tr>
<td>Pear</td>
<td>Boiling</td>
<td>28%</td>
<td>17%</td>
<td>40%</td>
</tr>
<tr>
<td>Spinach</td>
<td>Boiling</td>
<td>15%</td>
<td>10%</td>
<td>28%</td>
</tr>
<tr>
<td>Potato</td>
<td>Boiling</td>
<td>25%</td>
<td>9%</td>
<td>25%</td>
</tr>
</tbody>
</table>
Sweet potato Boiling 20% 17% 24%
Beans Steaming 22% 14% 32%
Cabbage Steaming 18% 9% 38%
Carrots Steaming 15% 10% 25%
Potato Steaming 20% 12% 25%

Table 2.3 The loss of vitamins in some vegetables during cooking

B. Conservation of nutrients

The following practices should be adopted for saving nutrients during cooking.
a. Do not over soak pulses.
b. Wash in minimum water.
c. Wash vegetables before cutting, do not scrub more than necessary.
d. Use unsifted flour as it contains bran which is rich in fibre, iron, vitamin B and minerals.
e. Cut vegetables in large pieces lengthwise to minimize exposure to heat.
f. Peel the skin of carrots with a peeler. Peel potatoes after boiling.
g. Use minimum water to cook the vegetables.
h. Do not throw stock but use it for further cooking.
i. Use boiling water if vegetables are to be cooked in water.
k. Cover food while Cooking.
l. Avoid overcooking or reheating repeatedly.
m. Serve cooked food immediately.

Make an awareness poster to retain vitamins and other nutrients in vegetables while cooking.

Know your progress
1. Name the nutrients that are lost when pulses and cereals are over washed.
2. List some practices that should be adopted for saving nutrients during cooking.
2.5 Healthy Food Habits

Now we know the nutrients available in different vegetables and how to keep it while cooking. Our health is related to proper utilisation of nutrients in our food.

Health is related to the food consumed. To maintain good health, ingesting a diet containing the nutrients in correct proportion is essential. The human body is like a complex piece of machinery which is prone to faults and weaknesses if it is poorly maintained. This can happen if too little or too much food is eaten or if the daily food intake is in any way unbalanced. So we should eat food which can give all the nutrients and keep us healthy. Have you observed how people eat their food? Some people like sweets, while others like savouries. All these describe the food habits of people. Food habits is therefore the way in which people select, cook, serve and eat foods that are available to them. Food habits differ from one ethnic group to another. These differences come about because of many influences on people. For a healthy living, one should know something about healthy food habits.

List some of the healthy food habits.

- Buying good food items ensures good health. Each and every step in handling, cooking and serving food, decides the quality of food.

A. General Guidelines for a Healthy living

a. Maintain regularity in routine: Our body can adapt to changes, but it has its own biological clock which is adapted to our daily routine and also changes with seasons. Once we have conditioned our body to a certain routine, it is necessary to maintain it. Regularity in maintaining our routine presents certain advantages in determining regular sleeping habits, elimination habits and taking at least two proper meals.

b. Eat as much natural foods as possible: Most natural foods are more nutritious than preserved foods. For example, a glass of fresh lime juice contains more vitamin C than lemon squash which is artificially flavoured.
c. **Adapt yourself to seasonal variations:** Changes in seasons have tremendous impact on our body and this affects our health. If the diet is modified according to the climatic conditions, our body suffers minimum shock and adapts very easily to seasonal variations. During summer, since sweat loss is greater, more water and electrolytes have to be taken to replace the lost fluid.

d. **Eat well but do not ‘overeat’:** Eat three to four meals a day and at each meal eat well but do not overeat. A meal should be eaten at the right time. Its quantity also should be in such a way that two parts of the stomach are occupied by the food, one part by water and one part should be left empty in order to permit the flow of gastric juices and the contents of the stomach to be churned so as to avoid indigestion.

e. **Avoid excessive salt and spices:** Anything that is done in moderation cannot harm the body, but a slight excess everyday can be harmful for the body in the long run. A simple example: salt is a substance the daily intake of which varies from person to person. Salt which contains large amounts of sodium must be carefully handled by people who have a tendency towards high blood pressure. Foods which are highly salted and spiced such as peanuts, potato chips, salted popcorn, masalas, pickles etc should be minimized in our daily diet. Very spicy foods must be avoided since they are harmful to the delicate lining of the gastro intestinal tract.

f. **Avoid too much sweets:** Sucrose has been proved to be one of the causative agents of dental problems. Consumption of concentrated sugars such as jam, jellies, marmalades etc must be minimized.

g. **Eat foods which contain carbohydrates especially starch and fibre:** Consumption of complete carbohydrate such as starches present in cereals is more advisable than that of simple sugars found in honey, fruits, table sugar and milk. This is because the digestion of complex sugars is relatively slower than that of simple ones. Foods rich in fibre like whole grain cereals, green leafy vegetables, etc should be included in the diet as they help in the proper digestion of foods.

h. **Avoid food which contain large amounts of cholesterol and saturated fats:** This can be achieved by eating food low in cholesterol content. It is essential to restrict consumption of fried food and high
sugar food for this. Moderate consumption is the key to good health.

i. **Check weight regularly and maintain ideal weight:** It is always better to be underweight than to be overweight. Every gram of excess weight is a burden on the heart and vital body organs. The process of reducing weight depends on good eating habits. It is important to increase certain physical activities which help you to reduce weight. Weight loss should never be drastic as it leads to major health problems and can be fatal.

j. **Avoid eating the same kind of foods all the time:** Eat a variety of food. Most foods contain several nutrients, but no single food provides nutrients in the right quantity for good health. For example, milk is a complete food yet it is a poor source of vitamin C and iron. So it is necessary to include citrus fruits which are rich sources of vitamin C. This example only goes to show that the more the variety of food in the diet, the better is the nutritional status and lesser is the chance of nutritional deficiency.

**B. Junk foods**

Do you like to have pizzas, burger and soft drinks like cola? Is it advisable to eat such food items? Why?

- .....................................................

Observe the poster given below.

What is the message in the poster?

Increasing urbanization, changing life styles and diminishing gender specific roles in the family and the society are the major forces that contribute to changes in the dietary patterns. Fast food joints are sprouting up like mushrooms. Processed and semi processed food industry is blooming and spreading like wild fire. Convenient food is the trend of the day. Choice of foods, cooking methods and meal patterns of the family are also changing. This has a profound bearing on nutrition. Wholesome food consumption is replaced by junk food.
Junk food contains artificial colours, sweeteners and gluing agents which provide variety to drinks and snacks. Softness and smoothness, crisp and cool food items are mines of chemicals. Shelf life or the keeping quality of food items are enhanced by adding chemicals.

a. Harmful effects of junk food

Read the extract from one of the articles that appeared in a health-related magazine.

**RISING OBESITY AMONG CHILDREN**

**The fast food bomb**

Obesity among children due to rampant consumption of junk food has reached epidemic proportions. With India already in the grip of this dangerous global trend, the government needs to remove its blinkers on the processed food industry.

One of the first declarations of the newly elected government in June was a proposal to ban unhealthy or junk food (defined as food high on fat, sugar and salt) in school canteens across the country. This was followed up with an increase in the prices of soft drinks in the recent budget.

What is the impact of junk food among children?

Junk food lacks many nutrients. Nutrition deprivation is the result of consumption of junk foods. Junk food often creates damage to nerves, digestive organs, brain, liver, heart and kidneys. Methanol gives cooling effect to tongue. Bitter taste and sour taste is created to food items by adding ‘sinmalohide’. Citral bensalolitude gives lime’s flavour and taste to food and drink. Peach flavour and pineapple taste is produced to foods by adding diacetyl formite or ethyl acetate, methyl salicytate or menthol.

FAO/WHO has banned some of these chemicals. Fizzy drinks have sodium and ammonium bicarbonate in them. Tartaric acid gives bitter taste. These chemicals damage mucous membranous structures of intestine and liver. A burning sensation in the oesophagus, gas formation in the stomach and stomach pain are caused by these. Soft drinks have more phosphorus and this upsets calcium phosphorus ratio in the blood. Bones are often damaged by the over indulgence of cool drinks. Cola consumption results in skeletal depletion of calcium and pain in the legs.
Artificial sweeteners are 300 times sweeter than cane sugar. Dulcin, saccharine, cyclamates are the artificial sugars used in soft drinks and bakery items. The constant use of this causes many diseases.

To enhance the keeping quality of fried items and sweets and pastries, dalda is used. Use of trans-fats in the diet may results in heart diseases. Many processed food manufacturers use stabilizers, colour, aromatic flavours and preservatives above the safe level and its consumption results in liver and kidney diseases.

Wholesome and natural food items are far better than junk food. Junk food also has high concentration of fats which makes one obese and leads to cardiac diseases. More sugar consumption damages brain and results in emotional disturbance.

Prepare a notice and circulate among your friends about the healthy food habits.

Know your progress

1. What are the general guidelines for a healthy living?
2. What are the disadvantages of consuming junk food?

2.6 Methods of Enhancing Nutrient Availability

The term ‘enhancing nutrient availability’ means improving the nutritive quality of a food item at no additional cost. The common methods are detailed below:

**A. Germination:** In this method, pulses and grains are soaked overnight, usually for 8-16 hours in minimum water, enough to get absorbed by the grain. When the seeds swell up to their maximum size, they are tied to a moist muslin cloth, for another 12-24 hours depending on the atmospheric temperature in a warm well -lit place. This results in the sprouting of white shoots. Soya bean, green gram, black gram etc can be easily germinated. It may become longer at low temperature.

Germinated foods have the following advantages:
• The grains and pulses become enriched in vitamin C
• Proteins and carbohydrates are broken down into easily digestible forms
• The food becomes softer, chewable and more digestible
• Niacin, riboflavin and folic acid content increases by 60-100%
• Iron gets loosed from its bound form and becomes easily available
• Fenugreek seeds lose their bitterness
• It is an economical way of increasing the nutrient content of food
• It also reduces cooking time.

Sprouted food can be used in salads, chaats, pulao, filling for snacks and as garnishing in soups.

List some fermented food.

• ..........................................................  

B. Fermentation: It is a process in which microorganisms added to the food brings desirable physical and chemical changes in them. Carbon dioxide is mostly produced, making the mixture rise 2-3 cm and making it porous, spongy and sour. Curd and yeast are mostly used to ferment foods.

Fermented food has the following advantages.
• The food becomes porous, light and digestible
• Vitamin C content increases
• Thiamine, riboflavin and niacin content also doubles
• Iron gets released from its bound form and is easily available. Texture and flavour of foods are enhanced.

Dals, rice flour, wheat flour etc are fermented to make delicious foods.

C. Combination: It is a process in which commonly available food from different food groups are mixed in one dish to enhance nutrients and get a better taste.

Since different food groups give different nutrients, when combined together, they contribute to the meal with their respective nutrients.
The most common examples are combining pulses and cereals, rice and green gram, wheat and dal etc. eg. Idli, dosa mix.

Combining food has the following advantages:

- Cereals, pulses and vegetables supply a very good amount of proteins, minerals and carbohydrates.
- Cereals are rich in methionine but lack lysine, which is abundant in pulses, so when these two are combined, the protein quality of the combination is superior to either cereals or pulses when taken alone.
- Combination of cereal and milk improves the protein and calcium content of food.
- Cereal and vegetable combination enhance the vitamin A, calcium and iron content of the foods.
- It also helps to provide a balanced diet to all family members.
- More variety can be brought to meals.

D. Fortification: Food fortification is commonly defined as the addition of one or more essential nutrients to food, whether or not it is normally contained in the food, for the purpose of preventing or correcting a demonstrated nutrient deficiency. eg. Fortified atta, Iodised salt.

Fortified food has the following advantages.

- Fortified food items are likely to contain micronutrients.
- It maintains body stores of nutrients more efficiently and effectively.
- It improves the nutritional status of a large proportion of the general population.
- Food fortification is more cost effective than any other methods.

Know your Progress

1. List the methods of enhancing nutrient availability.
2. Suggest some examples of combination of foods as a means of enhancement of nutrients.
3. What do you mean by fortification?

Collect more details about different kinds of foods, its methods of cooking and methods of enhancing its nutrient availability from internet.
Let us conclude

Food is obtained from plants and animal resources. Food is classified into energy yielding food, body building food and regulatory food based on functions. Based on the keeping quality of food they are classified into perishable and non perishable food. Perishable food becomes stale easily due to its high water content, bacterial action and enzymatic reaction. Non perishable food items lack water content and hence microbial action is not possible. Using proper sanitation procedures during storage improves the shelf life of products. Grilling, frying, boiling, poaching, steaming, stewing, braising, broiling, microwave cooking and pressure cooking are the different methods of cooking. Germination, combination, fermentation and fortification are the methods of enhancing nutrient availability of foods.

Lab activity

Prepare a dish involving the following methods:

a. Germination
b. Fermentation
c. Combination

Let us assess

1. Nutrient deprivation is the result of continuous consumption of junk food. Justify.
2. Classify food based on their functions and explain.
3. Nutrients are lost during the various processes used in cooking. Substantiate the statement with valid arguments.
4. Name a method to enhance nutrient availability. Write its advantage.
5. Choose the incorrect answer from the following statements.
   a. Food fortification is cost effective than any other methods.
   b. Combination of cereal and milk improves the protein and calcium content of the food.
   c. The grains and pulses become enriched in vitamin D after germination.
   d. Enhancing means improving the nutritive quality of food at no additional cost.