

Learning Objectives

After completing this lesson, students will be able to:

- understand the classification of nutrients.
- list the sources, functions and deficiency disorders of vitamins and minerals.
- gain knowledge about different methods of food preservation.
- identify the adulterants in food.
- explain the role of different food quality certifying agents of our country.



Introduction

Food is the basic necessity of life. Food is defined as any substance of either plant or animal origin consumed to provide nutritional support for an organism. It contains essential nutrients that provide energy, helps in normal growth and development, repair the worn out tissues and protect the body from diseases. Food contamination with microorganisms is a major source of illness either in the form of infections or poisoning. Food safety is becoming a major concern these days.

Adulteration of foodstuffs is commonly practiced in India by traders. Food is contaminated or adulterated from production to consumption for financial gain. The physiological functions of a consumer are affected due to either addition of a deleterious substance or the removal of a vital component. Food laws have come into existence to maintain the quality of food produced in our country. Let us study about them in detail here.

21.1 Classes of Nutrients

Nutrients are classified into the following major groups as given below.

- Carbohydrates
- Proteins
- Fats
- Vitamins
- Minerals

21.1.1 Carbohydrates

Carbohydrates are organic compounds composed of carbon, hydrogen and oxygen. Carbohydrate is an essential nutrient which provides the chief source of energy to the body. Glucose, sucrose, lactose, starch, cellulose are examples for carbohydrates.

Carbohydrates are classified as monosaccharide (Glucose), disaccharide (Sucrose) and polysaccharide (Cellulose). The classification is based on the number of sugar molecules present in each group.

21.1.2 Proteins

Proteins are the essential nutrients and also the building blocks of the body. They are essential for growth and repair of body cells and tissues. Proteins are made of amino acids.

Essential amino acids are those that cannot be biosynthesized by the body and must be obtained from the diet. The nine essential amino acids are phenylalanine, valine, threonine, tryptophan, methionine, leucine, isoleucine, lysine and histidine.

21.1.3 Fats

Fat in the diet provides energy. They maintain cell structures and are involved in metabolic functions.

Essential fatty acids cannot be synthesized in the body and are provided through diet. Essential fatty acids required in human nutrition are omega fatty acids.

21.1.4 Vitamins

Vitamins are the vital nutrients, required in minute quantities to perform specific physiological and biochemical functions.



More to Know

Dr. Funk introduced the term vitamin. Vitamin A was given the first letter of the alphabet, as it was the first vitamin discovered.



Human skin can synthesize Vitamin D when exposed to sunlight (especially early morning). When the sun rays fall on the skin dehydro cholesterol is converted into Vitamin D. Hence, Vitamin D is called as **Sunshine vitamin**. Vitamin D improves bone strength by helping body to absorb calcium.

21.1.5 Minerals

Minerals are inorganic substances required as an essential nutrient by organisms to perform various biological functions necessary for life. They are the constituents of teeth, bones, tissues, blood, muscle and nerve cells.

The **macrominerals** required by the human body are calcium, phosphorus, potassium, sodium and magnesium. The **microminerals** required by the human body also called **trace elements** are sulfur, iron, chlorine, cobalt, copper, zinc, manganese, molybdenum, iodine and selenium.

21.2 Protein Energy Malnutrition (PEM)

Absence of certain nutrients in our daily diet over a long period of time leads to deficiency diseases. This condition is referred as Malnutrition. Deficiency of proteins and energy leads to severe conditions like: Kwashiorkar and Marasmus.

Table 21.1 Dietary sources of major foodstuffs

Major food stuffs	Dietary sources	Daily requirements (grams)
Carbohydrates	Honey, sugarcane, fruits, whole grains, starchy vegetables, rice	150-200
Proteins	Legumes, pulses, nuts, soya bean, green leafy vegetables, fish, poultry products, egg, milk and dairy products	40
Fats	Egg yolk, saturated oil, meat	35

Table 21.2 Vitamins-Dietary sources, Deficiency disorders and Symptoms

Vitamins	Sources	Deficiency disorders	Symptoms
Fat Soluble Vitamins			
Vitamin A (Retinol)	Carrot, papaya, leafy vegetables, fish liver oil, egg yolk, liver, dairy products	Xerophthalmia Nyctalopia (Night blindness)	Dryness of Cornea Unable to see in the night (dim light) Scaly skin
Vitamin D (Calciferol)	Egg, liver, dairy products, Fish, synthesized by the skin in sunlight	Rickets (in children)	Bow legs, defective ribs, development of pigeon chest
Vitamin E (Tocopherol)	Whole wheat, meat, vegetable oil, milk	Sterility in rats, Reproductive abnormalities	Sterility
Vitamin K (Derivative of Quinone)	Leafy vegetables, soyabeans, milk	Blood clotting is prevented	Excessive bleeding due to delayed blood clotting
Water Soluble Vitamins			
Vitamin B1 (Thiamine)	Whole grains, yeast, eggs, liver, sprouted pulses	Beriberi	Degenerative changes in the nerves, muscles become weak, paralysis
Vitamin B2 (Riboflavin)	Milk, eggs, liver, green vegetables, whole grains	Ariboflavinosis (Cheilosis)	Irritation in eyes, dry skin, inflammation of lips, fissures in the corners of the mouth
Vitamin B3 (Niacin)	Milk, eggs, liver, lean meat, ground nuts, bran	Pellagra	Inflammation of skin, loss of memory, diarrhoea
Vitamin B6 (Pyridoxine)	Meat, fish, eggs, germs of grains and cereals, rice polishings	Dermatitis	Scaly skin, nervous disorders
Vitamin B12 (Cyanocobalamine)	Milk, meat, liver, pulses, cereals, fish	Pernicious anaemia	Decrease in red blood cell production, degeneration of spinal cord
Vitamin C (Ascorbic acid)	Leafy vegetables, sprouts, citrus fruits like goose berry (Amala), lemon, orange	Scurvy	Swollen and bleeding gums, delay in healing of wounds, teeth and bones malformed

Table 21.3 Minerals - Dietary sources, Functions and Deficiency disorders

Minerals	Sources	Functions	Deficiency disorders
Macronutrients			
Calcium	Dairy products, beans, cabbage, eggs, fish	Constituent of bones and enamel of teeth, clotting of blood and controls muscle contraction.	Bone deformities, poor skeletal growth, osteoporosis in adults.
Sodium	Common salt	Maintains fluid balance and involved in neurotransmission.	Muscular cramps, nerve impulses do not get transmitted.
Potassium	Banana, sweet potato, nuts, whole grains, citrus fruits	Regulates nerve and muscle activity.	Muscular fatigue, nerve impulses do not get transmitted.
Micronutrients			
Iron	Spinach, dates, greens, broccoli, whole cereals, nuts, fish, liver	Important component of haemoglobin.	Anaemia
Iodine	Milk, Seafood, Iodised salt	Formation of thyroid hormones.	Goitre

Kwashiorkar: It is a condition of severe protein deficiency. It affects children between 1-5 years of age, whose diet mainly consists of carbohydrates but lack in proteins.

Marasmus: It usually affects infants below the age of one year when the diet is poor in carbohydrates, fats and proteins.



Kwashiorkar



Marasmus

Figure 21.1 Malnutrition

21.3 Food Hygiene

Poor personal hygiene may allow pathogenic microorganisms to cause food spoilage. Food spoilage is an undesirable change in the normal state of food and is not suitable for human consumption. Signs of food spoilage include a change in appearance, colour, texture,

odour and taste. Factors responsible for Food Spoilage are given below.

Internal factors: It includes enzymatic activities and moisture content of the food.

External factors: It includes adulterants in food, contaminated utensils and equipment, unhygienic cooking area and lack of storage facilities.

21.4 Food Preservation

Food preservation is the process of prevention of food from decay or spoilage, by storing in a condition fit for future use. Food is preserved to:

- increase the shelf life of food
- retain the colour, texture, flavour and nutritive value
- increase food supply
- decrease wastage of food

21.4.1 Methods of Food Preservation

The various methods of food preservation are explained below.



Drying: Drying is the process of preservation of food by removal of water/moisture content in the food. It can be done either by sun-drying, (e.g. cereals, fish) or vacuum drying (e.g. milk powder, cheese powder) or hot air drying (e.g. grapes, dry fruits, potato flakes). Drying inhibits the growth of microorganism such as bacteria, yeasts and moulds.

Smoking: In this process, food products like meat and fish are exposed to smoke. The drying action of the smoke tends to preserve the food.

Irradiation: Food irradiation is the process of exposing food to optimum levels of ionizing radiations like x-rays, gamma rays or UV rays to kill harmful bacteria and pests and to preserve its freshness.

Cold storage: It is a process of storing the perishable foods such as vegetables, fruits and fruit products, milk and milk products etc. at low temperature. Preserving the food products at low temperature slows down the biological and chemical reactions and prevents its spoilage.

Freezing: Freezing is one of the widely used methods of food preservation. This process involves storing the food below 0°C at which microorganisms cannot grow, chemical reactions are reduced and metabolic reactions are also delayed.

Pasteurization: Pasteurization is a process of heat treatment of liquid food products. e.g. For preservation of milk and beverages. This process also involves boiling of milk to a temperature of 63°C for about 30 minutes and suddenly cooling to destroy the microbes present in the milk.



Bananas are best stored at room temperature. When it is kept in a refrigerator, the enzyme responsible for ripening becomes inactive. In addition, the enzyme responsible for browning and cell damage becomes more active thereby causing the skin colour change from yellow to dark brown.

Canning: In this method of food preservation, most vegetables, fruits, meat and dairy products, fruit juices and some ready-to-eat foods are processed and stored in a clean, steamed air tight containers under pressure and then sealed. It is then subjected to high temperature and cooled to destroy all microbes.

21.4.2 Addition of Preservatives

Food can be preserved by adding natural and synthetic preservatives.

A. Natural preservatives

Some naturally available materials like salt, sugar and oil are used as food preservatives.

Addition of salt: It is one of the oldest methods of preserving food. Addition of salt removes the moisture content in the food by the process of osmosis. This prevents the growth of bacteria and reduces the activity of microbial enzymes. Meat, fish, gooseberry, lemon and raw mangoes are preserved by salting. Salt is also used as a preservative in pickles, canned foods etc.

Addition of sugar: Sugar/Honey is added as a preservative to increase the shelf life of fruits and fruit products like jams, jellies, squash, etc. The hygroscopic nature of sugar/honey helps in reducing the water content of food and also minimizing the process of oxidation in fruits.

Addition of oil: Addition of oil in pickles prevents the contact of air with food. Hence microorganisms cannot grow and spoil the food.

B. Synthetic preservatives

Synthetic food preservatives like sodium benzoate, citric acid, vinegar, sodium meta bisulphate and potassium bisulphate are added to food products like sauces, jams, jellies, packed foods and ready-to-eat foods. These preservatives delay the microbial growth and keep the food safe for long duration.

More to Know

October 16th is World Food Day. It emphasizes on food safety and avoiding food wastage.

21.5 Food Adulteration

Adulteration is defined as the addition or subtraction of any substance to or from food, so that the natural composition and the quality of food substance is affected. **Adulterant** is any material which is used for the purpose of adulteration.

Some of the common adulterated foods are milk and milk products, cereals, pulses, coffee powder, tea powder, turmeric powder, saffron, confectionary, non-alcoholic beverages, spices, edible oils, meat, poultry products etc. The adulterants in food can be classified in three categories:

1. Natural adulterants
2. Incidental/unintentionally added adulterants
3. Intentionally added adulterants

1. Natural adulterants

Natural adulterants are those chemicals or organic compounds that are naturally present in food. e.g. toxic substances in certain poisonous mushrooms, Prussic acid in seeds of apples and cherry, marine toxins, fish oil poisoning, environmental contaminants

2. Incidental/unintentionally added adulterants

These types of adulterants are added unknowingly due to ignorance or carelessness during food handling and packaging. It includes:

- a. Pesticide residues
- b. Droppings of rodents, insects, rodent bites and larva in food during its storage
- c. Microbial contamination due to the presence of pathogens like *Escherichia coli*, *Salmonella* in fruits, vegetables, ready-to-eat meat and poultry products

3. Intentionally added adulterants

These adulterants are added intentionally for financial gain and have serious impact on the health of the consumers. These types of adulterants include:

- a. Additives and preservatives like vinegar, citric acid, sodium bicarbonate (baking soda), hydrogen peroxide in milk, modified food starch, food flavours, synthetic preservatives and artificial sweeteners.
- b. Chemicals like calcium carbide to ripen bananas and mangoes.
- c. Non certified food colours containing chemicals like metallic lead are used to give colours to vegetables like green leafy vegetables, bitter gourd, green peas etc. These colours are added to give a fresh look to the vegetables.



- d. Edible synthetic wax like shellac or carnauba wax is coated on fruits like apple, pear to give a shining appearance.

21.5.1 Health Effects of Adulterated Foods

Consumption of these adulterated foods may lead to serious health effects like fever, diarrhoea, nausea, vomiting, gastrointestinal disorders, asthma, allergy, neurological disorder, skin allergies, immune suppression, kidney and liver failure, colon cancer and even birth defects.

21.6 Food Quality Control

The government always ensures that pure and safe food is made available to the consumers. In 1954, the Indian Government enacted the Food Law known as Prevention of Food Adulteration Act and the Prevention of Food Adulteration Rules in 1955 with the objective of ensuring pure and wholesome food to the consumers and protect them from fraudulent trade practices.

Minimum standards of quality for food and strict hygienic conditions for its sale are clearly outlined in the Act.

DO YOU KNOW? A slogan **From farm to plate, make food safe** was raised on World Health Day (7th April 2015) to promote and improve food safety.

- Distributing food grains throughout the country.
- Maintaining satisfactory levels of operational and buffer stock of food grains to ensure national security.
- Regulate the market price to provide food grains to consumers at reliable price.

21.6.1 Food Quality Control Agencies

ISI, AGMARK, FPO, FCI and other health departments enforce minimum standards for the consumer products. **FCI (Food Corporation of India)** was set up in the year 1965 with the following objectives:


- Effective price support operations for safeguarding the interest of farmers.



Activity 1

Let each of the student bring any food packet (jam, juice, pickle, bread, biscuit, etc). Note down the details like name of the product, manufacturer's details, contents/ingredients, net weight, Maximum Retail Price (MRP), date of manufacture, date of expiry/usage from the date of manufacture and standardized marks (ISI, AGMARK or FPO) printed on the label for each of the item. What is the aim of such practice?

Food Control Agencies- Their Standardized Mark and Role in Food Safety

	ISI - (Indian Standards Institution) known as Bureau of Indian Standard (BIS)	Certifies industrial products like electrical appliances like switches, wiring cables, water heater, electric motor, kitchen appliances etc.
	AGMARK - (Agricultural Marking)	Certifies agricultural and livestock products like cereals, essential oils, pulses, honey, butter etc.
	FPO - (Fruit Process Order)	Certifies the fruit products like juice, jams, sauce, canned fruits and vegetables, pickles etc.
	Food Safety and Standards Authority of India	Responsible for protecting and promoting the public health through regulation and supervision of food safety.

Activity 2

Some simple techniques used to detect adulterants at home

1. Milk: Place a drop of milk on a slanting polished surface. Pure milk flows slowly leaving a trail behind while the milk adulterated with water will flow fast without leaving a trail.

- Honey: Dip a cotton wick in honey and light it with a match stick. Pure honey burns while adulterated honey with sugar solution gives a cracking sound.
- Sugar: Dissolve sugar in water. If chalk powder is added as an adulterant, it will settle down.
- Coffee powder: Sprinkle a few pinches of coffee powder in a glass of water. Coffee powder floats. If it is adulterated with tamarind powder it settles down.
- Food grains: They have visible adulterants like marble, sand grit, stones, etc. These are removed by sorting, hand picking, washing etc.

Points to Remember

- ❖ Food is necessary for normal growth and development of living organisms.
- ❖ Prolonged deficiency of certain nutrients cause deficiency diseases leading to malnutrition.
- ❖ Drying, smoking, irradiation, refrigeration, freezing, pasteurization and canning are some of the methods of food preservation.
- ❖ Adulterants are undesirable substances added to the food against the Food Safety Standards.
- ❖ Prevention of Food Adulteration Act, 1954 laid down the minimum standards for consumer products.

A-Z GLOSSARY

Fatigue	Extreme tiredness due to mental or physical illness.
Hygroscopic	The property of absorbing moisture from the air.
Muscular cramps	Sudden and involuntary contractions of one or more muscles.
Nutrients	Substance that provide nourishment for normal growth and development.
Nerve impulse	Electric signals that travels along a nerve fibre.
Nourishment	Food that you need to grow and stay healthy.
Osteoporosis	A diseases which weakens the bones and makes it brittle.
Paralysis	Loss of muscle function in any part of our body which can be either temporary or permanent.
Shelf life	Time for which a food can be kept fresh.
Toxins	Any poisonous substance produced by bacteria, animals or plants.



TEXT BOOK EXERCISES



I. Choose the correct answer.

- The nutrient required in trace amounts to accomplish various body functions is _____
 a) carbohydrate b) protein
 c) vitamin d) fat
- The physician who discovered that scurvy can be cured by ingestion of citrus fruits is _____
 a) James Lind b) Louis Pasteur
 c) Charles Darwin d) Isaac Newton



3. The sprouting of onion and potatoes can be delayed by the process of _____
 a) freezing b) irradiation
 c) salting d) canning
4. Food and Adulteration Act was enforced by Government of India in the year _____
 a) 1964 b) 1954
 c) 1950 d) 1963
5. An internal factor responsible for spoilage of food is _____
 a) wax coating
 b) contaminated utensils
 c) moisture content in food
 d) synthetic preservatives

II. Fill in the blanks.

1. Deficiency diseases can be prevented by taking _____ diet.
2. The process of affecting the natural composition and the quality of food substance is known as _____
3. Vitamin D is called as _____ vitamin as it can be synthesised by the body from the rays of sunlight.
4. Dehydration is based on the principle of removal of _____.
5. Food should not be purchased beyond the date of _____
6. AGMARK is used to certify _____ and _____ products in India.

III. State whether true or false. If false, correct the statement.

1. Iron is required for the proper functioning of thyroid gland.
2. Vitamins are required in large quantities for normal functioning of the body -

3. Vitamin C is a water soluble vitamin
4. Lack of adequate fats in diet may result in low body weight
5. ISI mark is mandatory to certify agricultural products.

IV. Match the following.

Column A

1. Calcium
2. Sodium
3. Potassium
4. Iron
5. Iodine

Column B

- a. Muscular fatigue
- b. Anaemia
- c. Osteoporosis
- d. Goitre
- e. Muscular cramps

V. Fill in the blanks with suitable answers.

Vitamins	Dietary Source	Deficiency Disease
Calciferol		Rickets
	Papaya	Night blindness
Ascorbic acid		
	Whole grains	Beriberi

VI. Give abbreviations for the following.

- i. ISI _____
- ii. FPO _____
- iii. AGMARK _____
- iv. FCI _____
- v. FSSAI _____

VII. Assertion and Reason.

Direction: In the following question, a statement of a Assertion is given and a corresponding Reason is given just below it. Of the statements given below, mark the correct answer as:



- If both Assertion and Reason are true and the Reason is the correct explanation of Assertion
- If both Assertion and Reason are true but Reason is not the correct explanation of Assertion
- If Assertion is true but Reason is false
- If both Assertion and Reason is false

1. **Assertion:** Haemoglobin contains iron.

Reason: Iron deficiency leads to anaemia

2. **Assertion:** AGMARK is a quality control agency

Reason: ISI is a symbol of quality

VIII. Give reasons for the following statements.

- Salt is added as a preservative in pickles _____
- We should not eat food items beyond the expiry date _____
- Deficiency of calcium in diet leads to poor skeletal growth _____

IX. Answer briefly.

- Differentiate
 - Kwashiorkar from Marasmus
 - Macronutrients from Micronutrients
- Why salt is used as preservative in food?
- What is an adulterant?
- Name any two naturally occurring toxic substances in food.
- What factors are required for the absorption of Vitamin D from the food by the body?
- Write any one function of the following minerals

- Calcium
- Sodium
- Iron
- Iodine

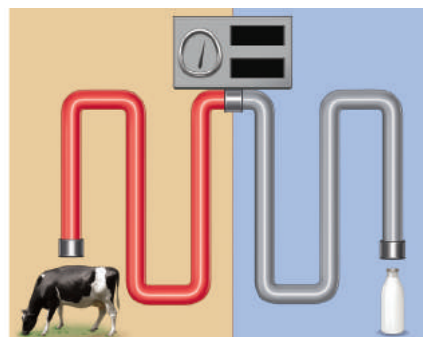
- Explain any two methods of food preservation.
- What are the effects of consuming adulterated food?

X. Answer in detail.

- How are vitamins useful to us? Tabulate the sources, deficiency diseases and symptoms of fat soluble vitamins
- Explain the role of food control agencies in India.

XI. Higher Order Thinking Skills.

- Look at the picture and answer the question that follows



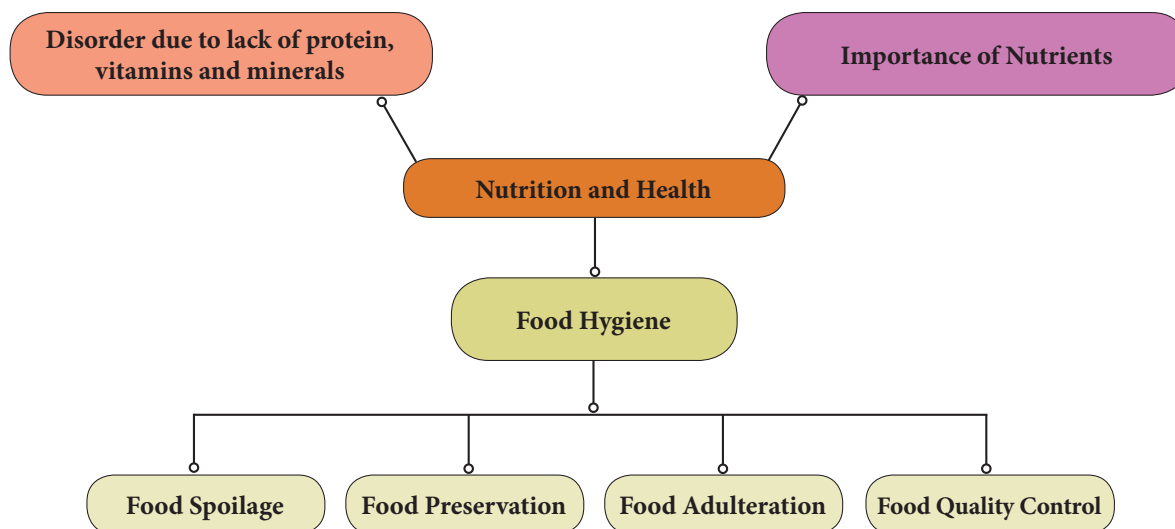
- Name the process involved in the given picture.
 - Which dairy food is preserved by this process?
 - What is the temperature required for the above process?
- The doctor advises an adolescent girl who is suffering from anaemia to include more of leafy vegetables and dates in her diet. Why so
 - Sanjana wants to buy a jam bottle in a grocery shop. What are the things she should observe on the label before purchasing it?



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Concept Map



ICT CORNER

Steps

1. Type the following URL in the browser or scan the QR code from your mobile.
2. A home of ICMR opens, Select Nutri Guide you can find various nutrients like Vitamins, Minerals Proteins.
3. Now Click on the Vitamins and you can find different types of Vitamins.
4. Click on any Vitamins button and a new screen will open with Vitamin chart with Biochemical, RDA, Dietary Sources Signs & Symptoms.



Deficiency Diseases