GOVERNMENT OF TAMIL NADU

HIGHER SECONDARY FIRST YEAR

NUTRITION AND DIETETICS

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Department of School Education

Untouchability is Inhuman and a Crime

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HOW TO USE THE BOOK?

Introduction	The subject to be discussed in the lesson is introduced
Role of Ingredients	The usage of food ingredients in cookery is explained
Text Book	This text book provides a tiny spark of information that ignites a mightly flame of knowledge in children.
Message Box	Gives information in short and crisp form and definitions also
Do You Know?	Provides additional information related to the subject in boxes to stir up the curiosity of students
Activity	For self-study and self evaluation
QR Code	Given to make content more interesting and dynamic in nature to enhance the thinking skills
ICT Corner	The access to digital resources on the content through a series of linkage in a specialised app. This provides scope for students things which are inaccessible to them
Summary	Describes the main points briefly in bullets for recapitulation
Glossary	The highlighted key terms at the end of the lesson for conceptual clarity
Reference	References and web resources have been provided for getting additional information

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Assessment

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Unit 1

INTRODUCTION TO FOOD

Food is considered as a prime necessity for living beings especially for humans. It supplies energy for activities, maintain and repair tissues and gives protection from diseases. Food is a substance, which after ingestion, digestion and absorption is capable of being utilized by the body for its various functions.

In this lesson, the students will be able to:

- know the evolution of food
- define the term Food
- explain the functions of food and their food groups
- learn about the food pyramid and Eatwell plate
- understand balanced diet
- know the objectives of cooking
- describe the methods of cooking

Evolution of Food

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1.1 Evolution of Food:

Some of our knowledge of what early man ate comes from archaeological studies of cave drawings of food gathering and preparation activities. primitive men collected their food from wild animals and plants. They depended upon fruits, nuts, roots and other plant foods, meat from animals and fish from seas, lakes and rivers. They were forced to spend their days and nights in search of food. They roamed from place to place to correspond the changing season, the appearance and disappearance of various fruits and leaves, or the migration and movement of game animals. They lived as hunters and gatherers. In this way they lived till 10000 years ago in a few places and 5000 years ago in most places of the world.

Gradually food gatherers learned to domesticate plants and animals. One of the first great changes which occurred in man's food pattern must have been when he learnt to use fire to cook. They settled down, build shelters and raised plants and animals to provide food. The first crop to be grown were wheat and barley from wild grasses. Milk was probably the first food to be extracted from animals. Man eats most of his food cooked and this is one of the many characteristics which separate him from other animals. The development of agricultural skills over the last two centuries and consequent supply of a sufficient amount of food, its preservation and storage, resulted in the emergence of cities and urban civilization.

Today in our diet, traditional foods are being replaced by fast foods. Traditional foods are nutrient rich, does not contain any artificial colouring, flavours or preservatives. Whereas fast foods contain all these things. In addition, food insecurity and nutrition insecurity are challenging public health in the present trend.

Definition

The term 'food' refers to what we eat and which nourishes the body. It includes solids, semi-solids and liquids. so, two important features for any item to be called food are:

- It should be worth eating, that is, it should be 'edible'.
- It must nourish the body.

1.2 Functions of food

Food is important for life. To be healthy and active, we should certainly have enough food. The food we eat should be safe and rich in all the nutrients for our body needs. We should choose from a wide variety of foods and we should eat them regularly, every day. Do not forget that we should also enjoy the food that we eat; it should look, smell and taste good. Without good nutrition, children and young people cannot develop their potential to the full and adults will have difficulty in doing their best.

Food provides our body with what they need to

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- Stay alive, be active, move and work
- Build new cells and tissues for growth;
- Stay healthy and heal themselves;
- Prevent and fight infections.

Foods are classified according to their functions in the body. The functions of food can be broadly classified into three main categories

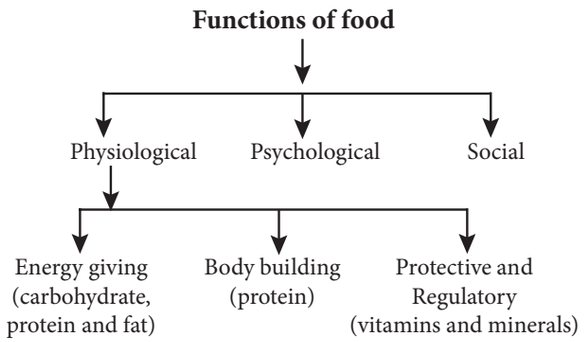

Fig 1.1: Functions of food

1.2. 1 Physiological functions of food

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

a. Energy giving

b. Body building

c. Protective and Regulatory

a) Energy giving

This group includes foods rich in carbohydrate, fats and proteins. Energy is defined in terms of kilo calories and thus one gram of carbohydrate gives 4 kcal, one gram of protein gives 4 kcal, while one gram of fat gives 9 kcal. This group may be broadly divided into two groups:

- Cereals, pulses, nuts and oilseeds, roots and tubers.
- Simple carbohydrates like sugars, fats and oils.

In addition to energy cereals provide large amounts of protein, minerals and vitamins in the diet. Pulses also give protein and B vitamins besides giving energy to the body. Nuts and oilseeds are rich in energy yielding as they are good sources of fats and proteins. Roots and tubers though mainly provides energy, contribute to some extent to minerals and vitamins.

Simple carbohydrates like sugars provide only energy. Fats and oils provides fat,energy and fat soluble vitamins.

What are empty calories?

Simple carbohydrates like sugars provide only energy (empty calories) and do not provide any other nutrients.

b) Body Building:

The food we eat is a part of us. Thus one of the most important functions of food is that of building the body. They are classified into two groups:

- **Milk, egg, meat and fish:** They are rich in protein of high biological value. These proteins have all essential amino acids in correct proportion for the synthesis of body tissues.
- **Pulses, oilseeds and nuts:** They are rich in protein but may not contain all the essential amino acids required by the human body.

c) Protective and Regulatory function

Foods rich in protein, vitamins and minerals have regulatory functions in the

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body eg. maintaining the heart beat, water balance and body temperature. Protective foods are broadly classified into two groups.

- Foods rich in vitamins, minerals and proteins of high biological value eg. milk, egg, fish and liver.
- Foods rich in certain vitamins and minerals only eg. green leafy vegetables and fruits.

1.2.2 Psychological Functions of food

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

1.2.3 Social functions of Food

Food and eating has significant social meaning. Food is also a symbol of our social life Sharing food with any other person implies social acceptance. When you share a meal with someone, you are expressing your acceptance of friendship and respect for that person. Food is a medium through which we express our happiness. For example, feasts are given at specific stages of life, such as birth, birthday, marriage etc.

1.3 ICMR Five Food Groups

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

It is also important to enjoy a variety of foods within each of the Five food groups because different foods vary in the amount of the key nutrients that it provide. 'Basic Five food group, suggested by ICMR can be used for planning diets.

ACTIVITY - 1

Notes: which activity shown in the picture needs more energy. Why?

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Table 1.1 Basic Five Food Groups	
Food groups	**Nutrients**
1.Cereal and products : Rice, Wheat, ragi, maize, bajra, rice flakes, wheat flour, sprouted cereal	Energy, protein, Invisible fat, B vitamins, iron, calcium, fiber
2.Pulses and legumes Bengal gram, black gram, cow pea, peas (dry), soybeans	Protein, energy , invisible fat, thiamine, riboflavin, folic acid, calcium, iron and fibre
3.Milk & Meat products: I) Milk and skimmed milk, cheese, curd II)Chicken, liver, fish, egg and meat	Protein, fat, riboflavin, calcium.
4.Fruits & vegetables : I) Mango, guava, tomato, papaya, orange, sweet lime, watermelon **Green leafy vegetables :** II) Amaranth,spinach, drumstick leaves, coriander leaves, fenugreek leaves **Other vegetables :** Carrot,onion,brinjal,ladiesfinger, beans, capsicum, cauliflower, drumstick	Carotenoids, vitamin C, riboflavin, folic acid, iron, fibre Riboflavin, folic acid, calcium, fibre, iron, carotenoids Carotenoids, folic acid, calcium and fibre
5.Fats & sugars : I) **Fats :**Butter, ghee, groundnut oil, coconut oil, hydrogenated fat, cooking oils II) **Sugar and jaggery**	Energy, Essential fatty acids and fat soluble vitamins Energy and iron

Recently ICMR has prescribed Basic IV food groups, which is given below:

Table 1.2 Basic Four Food Groups	
Food groups	**Nutrients**
1.Cereal Millets and Pulses : ➢ **Cereals and Millets :** Rice, Wheat, ragi, maize, bajra, jowar, rice flakes, Puffed rice. ➢ **Pulses and legumes:** Bengal gram, black gram, cow pea, peas (dry), rajma, soybean.	Energy, protein, Invisible fat, B vitamins, iron, calcium, fiber. Protein, energy , invisible fat, thiamine, riboflavin, folic acid, calcium, iron and fibre.

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2.Milk and Animal products: ➢ Milk and skimmed milk , cheese, curd ➢ Chicken, liver, fish, egg and meat	Protein, fat, riboflavin, calcium. Protein, fat and iron.
3. Vegetables and Fruits : **Green leafy vegetables :** ➢Amaranth spinach, gogu, drumstick leaves, coriander leaves, fenugreek leaves. **Other vegetables :** ➢**Vegetables:** Carrot, onion, brinjal, ladies finger, beans, capsicum, cauliflower, drumstick ➢**Fruits:** Mango, guava, tomato, papaya, orange, sweet lime, watermelon.	Riboflavin, folic acid, calcium, fibre, iron, carotenoids. Carotenoids and fibre. Carotenoids, vitamin C, riboflavin, folic acid, iron and fibre.
4.Oils, Fats and Nuts : **Oils And Fats:** Butter, ghee, hydrogenated fat, cooking oil. Sugar and jaggery. Nuts	Energy, Essential fatty acids and fat soluble vitamins. Energy, Jaggery has iron. Protein and omega fatty acids.

Fig 1.2: Food Groups

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ACTIVITY - 2

Read the table above showing food groups and fill in three of your favorite foods for each group.

1.4 Food Pyramid

Food pyramid is meant for use by the general healthy population as a guide for the types of foods and its proportion to be included in the daily diet. In order to assist in selecting food items from each food group the food pyramid has been developed.

The food pyramid was introduced in1992 by USDA. It is a valuable tool for planning a health promoting diet.

The Food Pyramid clearly indicates that we should consume food from each of the five food groups to ensure good health. This also tells us to include food items which are at the top of the food pyramid such as fats and sugar in less quantity as compared to cereals and pulses which are at the bottom of the pyramid. Use of food pyramid not only ensures good health but also helps in planning a balanced diet and facilitates selection of alternate foods.

1.5 The Eatwell Plate

The Eatwell plate is a pictorial food guide showing the proportion and types of foods that are needed to make up a healthy, varied and balanced diet. The plate has been produced by the Food Standards

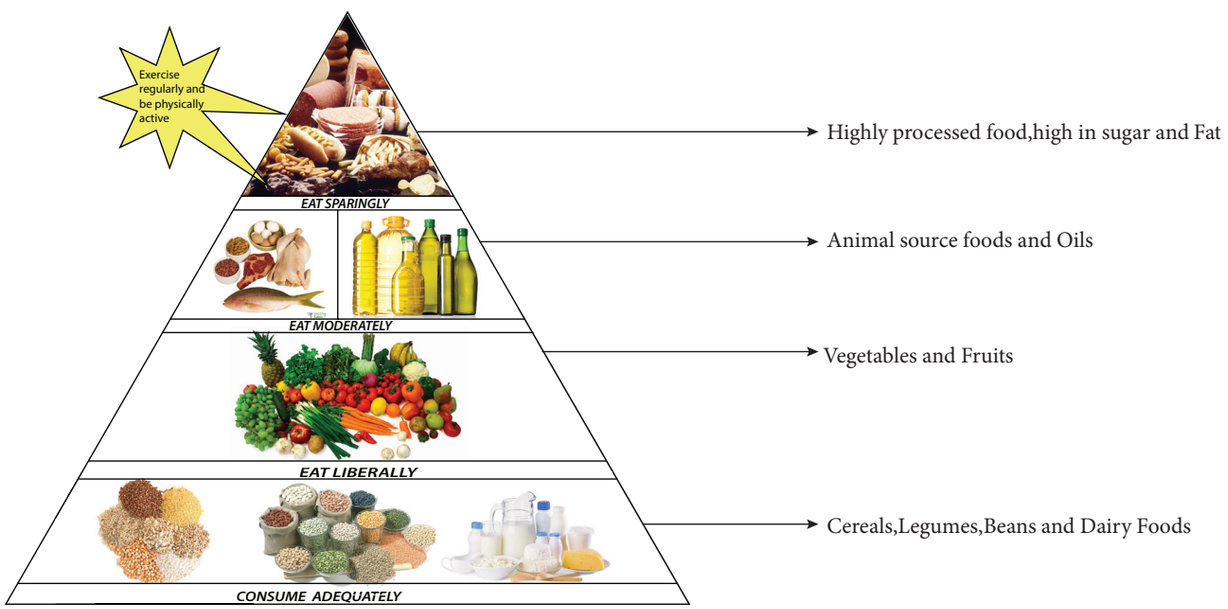

Fig 1.3: Food Guide Pyramid

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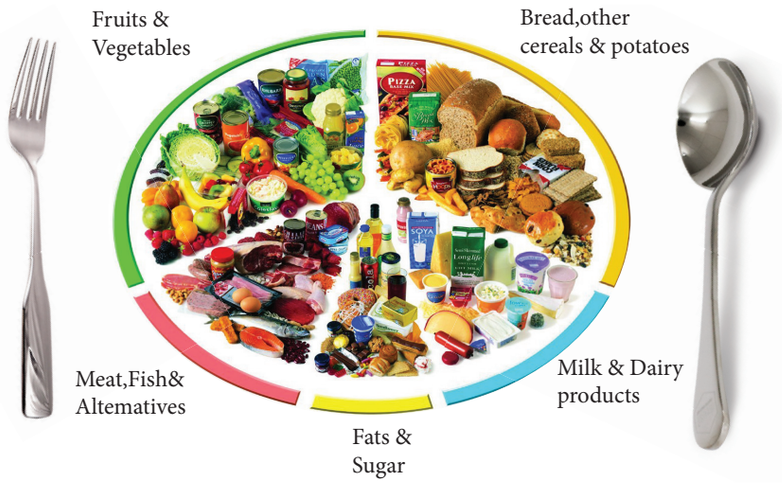

Fig 1.4: Eatwell plate

Agency as a guide that aims to help people to understand and enjoy healthy eating. The Eatwell plate.

Eight Tips for Eating Well

1. Base your meals on starchy foods.
2. Eat lots of fruit and vegetables.
3. Eat more fish.
4. Cut down on saturated fat and sugar.
5. Try to eat less salt
6. Get active and maintain a healthy weight.
7. Drink plenty of water.
8. Don't skip breakfast.

Food from the largest group should be eaten most often and food from the smallest group should be eaten occasionally. The guide is shaped like a dinner plate which has been designed to make healthy eating simpler to understand and interpret.

People should be encouraged to choose a variety of foods from the four largest groups every day to ensure that they obtain the wide range of nutrients their bodies need to grow, develop and function properly and stay healthy.

1.6 Balanced diet

Being familiar with the food groups, let us learn about balanced diet. In a meal, if we include food items from all the five food groups then our body will be able to get all the nutrients collectively.

A balanced diet is one which contains different types of foods in such quantities that the individual's need for the various nutrients is adequately met, and some amounts of nutrients are stored in the body to withstand short periods of low dietary intake.

Fig 1.5: Balanced diet

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ACTIVITY - 3

Assess your family meals using the food pyramid to find out whether your meals are balanced or not. Do you realize how much effort your parents make to serve balanced meals to the family? For every meal they plan, purchase, prepare and cook, they try to include most of the food groups.

Fig 1.5

Fig 1.6

If you see the contents of each food in fig1.5 and 1.6 you will observe that a traditional Indian meal includes food items from most of the food groups. This is the result of collective wisdom of our society and we should adhere to it. Mention the names of food

1) South Indian foods

_____

_____

_____

_____

2) North Indian foods

_____

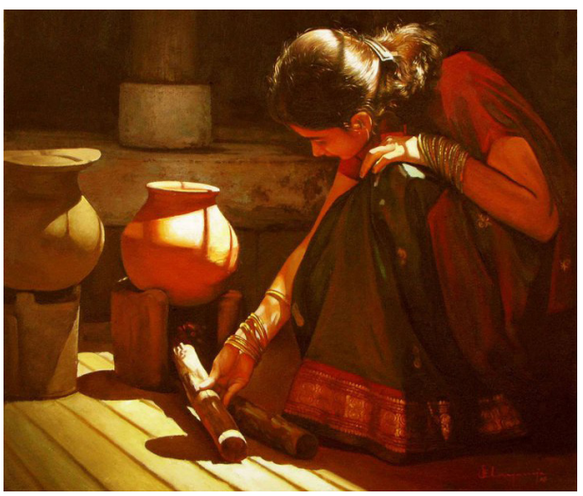
_____

_____

_____

1.7 Cooking

Food preparation helps in combining food ingredients in various ways with delicate flavours, textures and colour which apply to the senses. Food has to be pleasing in appearance and taste so that it is consumed. Understanding food behavior in scientific terms helps in choosing best method of cooking. Food preparation is an important step in meeting the nutritional needs of the family.



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Foods like fruits, vegetables and nuts are eaten raw but most of the foods are cooked to bring about desirable changes. The process of subjecting foods to the action of heat is termed as "**Cooking**". Heat is transferred to food during cooking by conduction, convection, radiation or microwave energy. Cooking takes place by moist and dry heat. Moist heat involves water and steam. Air or fat is used in dry heat.

Cooking can be defined as the transfer of energy from one source to another. This energy alter the foods molecular structure, changing its texture, flavour, aroma and appearance and thus making it safe to consume.

1.7.1 Objectives of cooking

- Improves the taste and food quality
- Destruction of micro-organisms
- Improves digestibility
- Increases variety
- Increases availability of nutrients
- Increases antioxidant value
- Concentrates nutrients
- Removes pesticide residues
- Removes natural toxins

1.7.2 Classification of Cooking Methods

The methods of cooking are classified as given in **table 1.1**

1.7.2 a Moist Heat Method

In this method, food comes in contact with moisture either by water or steam under pressure. Some common ways of cooking food by moist heat are described below.

ACTIVITY - 4

Water soluble nutrients present in food dissolve in water in which the food is boiled. If you throw this water, nutrients will be lost. Suggest some useful ways for the utilisation of the stock.

_____

_____

_____

_____

Table 1.1 Methods of Cooking

Moist Heat Method	Dry Heat Method	Combination Method
Boiling	Roasting	Braising
Stewing	Grilling	
Steaming	Toasting	
Pressure Cooking	Baking	
Poaching	Sauteing	
Blanching	Frying	

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1. Boiling

Boiling is cooking foods in a liquid (water, bouillon, stock, milk) at boiling point. **"Boiling"** is a method of cooking foods by just immersing them in water at 100 ^{0}C and maintaining water at the temperature till food is tender. Rice, egg, dhal, meat, roots and tubers are cooked by boiling method.

Advantages

- Boiling is a safe and simple method of cooking.
- It is suitable for large scale cooking. Boiled food is also digested easily

Disadvantages

- While boiling, water soluble nutrients are lost if the water in which the food is boiled is discarded. Some people may not like boiled food as they find it bland.

2. Stewing

When food is cooked with the heat from water vapors, it is called **"Stewing"**. This method requires the food to be cooked in steam. Stewing is a long and slow cooking method where food is cut into pieces and cooked in the minimum amount of liquid, water, stock or sauce. The food and the cooking liquid are served together. In this slow method of cooking the liquid is heated to boiling point and heat is reduced to maintain simmering temperatures (82 ^{0}C – 90 ^{0}C).

Advantages

- In stewing, the juices of the food are retained and the food tastes good.
- The nutrients are also conserved better.

Disadvantages

- Food takes longer to cook.
- The process is time consuming and there is wastage of fuel.

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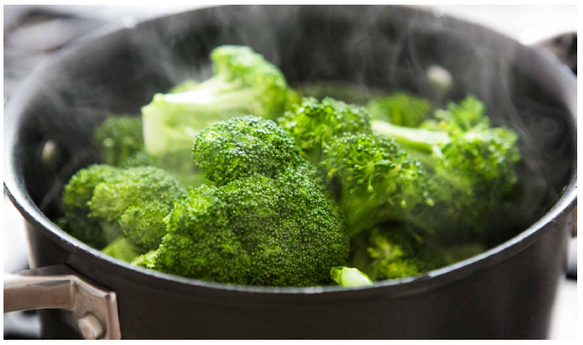
3. Steaming:

It is a method of cooking food in steam generated vigorously from boiling water in a pan. The food to be steamed is placed in a container and is not in direct contact with the water or liquid. Idli, custard and idiappam are made by steaming. Vegetables can also be steamed.



Advantages

- Steaming shortens the duration of cooking and helps to conserve nutritive value, colour, flavour and palatability of food.
- Steamed food is light, nutritious and easy to digest. Such foods are good, especially for people who are sick or people with weak digestion or for the elderly. Young children can be served with steamed food.

Disadvantages

- Steaming equipment is required.
- This method is limited to the preparation of selected foods.

4. Pressure cooking :

When steam under pressure is used, the method is known as **"Pressure cooking"** and the equipment used is the pressure cooker. In this method the temperature of boiling water can be raised above 100 ^{0}C. Rice, meat, roots and tubers are usually pressure cooked.

Advantages

- Pressure cooking kills all bacteria and hence the food is safe and hygienic to eat.
- The food gets cooked faster i.e. almost 1/3rd time than boiling.
- Saves fuel, time and energy.
- Several foods can be cooked together in the pressure cooker by using separators.
- It is not necessary to immerse food in water while cooking and this reduces the loss of water soluble vitamins and minerals.

Disadvantages

- If food is cooked for very long, it loses its texture and may even burn.
- Knowledge of the usage, care and maintenance of cooker is required to prevent accidents.
- Careful watch on the cooking time is required to prevent over cooking.

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ACTIVITY - 5

Your friend's family loves to eat boiled rice and dhal. Rice has to be boiled with lots of water and the extra water is thrown away.

- Is this way of wasting water right or wrong? Explain why?
- How can this problem be solved?

5. Poaching:

This involves cooking in minimum amount of liquid at temperatures of 80°C – 85°C that is below the boiling point. Foods generally poached are egg, fish and fruits. For poaching eggs, the addition of little salt or vinegar to the cooking liquid lowers temperature of coagulation. Eggs get cooked quickly by poaching.

Advantages

- A variety of liquids can be used (stock, wine, milk, syrup).
- Liquid can improve flavor.
- Food becomes more digestible.
- Ideal for high-protein foods, eg. fish

Disadvantages

- Requires constant attention.
- Range of suitable foods is limited.
- Food overcook quickly.

6. Blanching:

In meal preparation, it is often necessary only to peel off the skin of fruits and vegetables without making them tender. This can be achieved by blanching. eg. tomatoes can be blanched in this method, food is dipped in boiling water for 5 seconds to 2 minutes depending on the texture of the food. This helps to remove the skin or peel without softening the food.

Advantages

- Peels can easily be removed to improve digestibility.
- Destroys enzymes that bring about spoilage.
- Texture can be maintained while improving the colour and flavour of food.

Disadvantage

- Loss of nutrients if cooking water is discarded.

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1.7.2. b. DRY HEAT METHOD

Dry heat cooking gives a crisp texture, brown colour and pleasant flavor to the foods. Some common ways by which you cook food by dry heat are described here.

1. Roasting:

This method of cooking food by dry heat is **roasting**. While roasting, the food is subjected directly on a hot tava, girdle, sand or fire and cooked. Eg. Groundnuts

Advantages

- Food is tastier when cooked in this way. It also adds variety to a meal.
- It improves the appearance, flavor and texture of the food.
- Spices are easily powdered if they are first roasted.

Disadvantages

- It is a relatively slow method of cooking. Roasted food sometimes become too dry, therefore, it may be served with a chutney or sauce.
- Roasting denatures proteins reducing their availability.

2. Grilling:

Grilling or broiling refers to the cooking of food by exposing it to direct heat. In this method food is placed above or in between a red hot surface. Papads, corn, phulkas, chicken can be prepared by this method.

Advantages

- Like roasting, grilling also gives nice flavour to the food.
- A variety of dishes can be prepared using this method.

Disadvantage

- Constant attention is required to prevent charring.

Tips for healthy grilling:

1. Grill up fruit for dessert
2. Grill your vegetables.
3. Use gas rather than charcoal.
4. Marinate your meat.
5. Substitute grilled fish for meet./

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3. Toasting:

This is a method where food is kept between two heated elements to facilitate browning on both sides. Bread slices are cooked by toasting.Eg. sandwiches.

Advantages

- Easy and quick method.
- Flavour improved.

Disadvantages

- Special equipment is required.
- Careful monitoring is needed to prevent charring.

4. Baking:

In this method, the food gets cooked in an oven or oven like appliance by dry heat. The temperature range maintained in an oven is 120 ^{0}C - 260 ^{0}C. The oven has to be heated slightly more than required temperature before placing the food in it. Foods prepared by baking are custards, pies, biscuits, pizzas, buns, bread and cakes. The same principle is used in tandoor ovens were you get tandoori chicken, tandoori meat and fish.

Advantages

- Food cooked using this method adds a variety to the texture in our plate.
- Baking lends a unique flavor to foods.
- Foods become light and fluffy. Eg. cakes, custards, bread.
- Certain foods can be prepared only by this method – bread, cakes.
- Uniform and bulk cooking can be achieved. Eg. Bun, bread.
- Variety of dishes can be prepared.

Disadvantages

- Special equipment like oven is required.
- Baking skills are necessary to obtain a product with ideal texture, flavor and colour.

ACTIVITY - 6

List some baked products.

_____

_____

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5.Sauteing:

This method involves cooking in just enough of oil to cover the base of the pan (greasing the pan).The food is tossed occasionally or turned over with a spatula to enable all the pieces to come in contact with the oil and get cooked evenly. Sometimes the pan is covered with lid, reducing the flame and allowing the food to be cooked till tender in its own steam. The product obtained by this method is slightly moist, tender but without any liquid or gravy. Foods cooked by sautéing are generally vegetables used as side dishes in a menu. Eg. poriyels in Indian cuisine.The heat is transferred to the food mainly by conduction.

Advantages

- Takes less time.
- Simple technique.
- Minimum oil is used.

Disadvantage

- Constant attention is needed as there is chance of scorching or burning

Some precautions while frying food

(i) Food should be cut into even sized pieces to ensure even cooking

(ii) The ghee or oil should be heated well and then the flame or heat should be reduced a little

(iii) A few pieces of food should be fried at a time as adding a lot of food may lower the temperature of fat and increase fat absorption

(iv) Fried food should be placed on a clean, absorbent kitchen napkin or brown paper

(v) All the pieces of food should be removed from the oil or ghee to avoid burning of these food pieces and spoiling of the ghee or oil.

6. Frying:

In this method, the food to be cooked is brought into contact with a large amount of hot fat. Frying is of two types namely deep fat frying and shallow fat frying.When food is totally immersed in hot oil, it is called deep fat frying. Samosa, chips, pakoda are examples of deep fat frying. In shallow fat frying, only a little fat is used and the food is turned in order that both the sides turn brown. Eg. Omelets, cutlets, parathas.

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Advantages

- The calorific values of fried food is increased since fat is used as the cooking media.
- Frying lends a delicious flavor and attractive appearance to foods.
- Taste and texture are improved.

Disadvantages

- Fried food especially deep fried food is difficult to digest and has high calorific value. Excessive consumption of fried foods are bad for health.
- Can be a risk factor to develop life style diseases.

1.7.2.c. COMBINATION OF COOKING METHODS

Braising

Braising is a combined method of roasting and stewing in a pan with a tight fitting lid. Flavourings and seasonings are added and food is allowed to be cook gently. Food preparations prepared by combination methods are :

Uppuma - Roasting and boiling.

Cutlet - Boiling and deep frying.
Vermicilli payasam - Roasting and simmering.

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1.7.3 Other Methods of Cooking

I. Microwave Cooking:

Microwaves are electromagnetic waves of radiant energy with wave lengths in the range of 250 x 10^6 to 7.5 x 10^9 Angstroms. It is a comparatively new method of cooking and gradually becoming popular. In this method food is cooked by microwave radiation. Water molecules in the food vibrate rapidly due to microwaves. The heat generated in the process cooks the food.

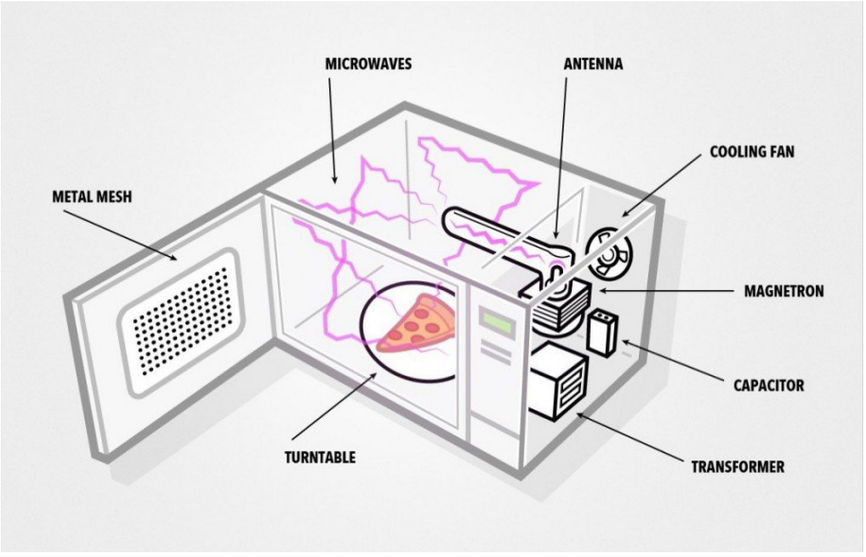

Fig 1.6: Microwave Oven

Advantages:

- It is a quick method of cooking.
- Cooking time is reduced significantly as compared to other methods of cooking.

Disadvantages

- It uses electrical energy and therefore may not be useful in places where continuous electricity supply is not available.
- It may dry up the food products.

Precaution while using a microwave oven: Remember to open a microwave oven a few seconds after it has stopped. This will decrease your exposure to radiation

ACTIVITY - 7

Debate on the pros and cons of olden traditional method of cooking using fire wood and todays modern methods of cooking.

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II. Solar Cooking:

A solar cooker is a device that changes the light energy of the sun to heat energy to cook food. There are three main types of solar cooker:

1. Panel-type

A hybrid of reflector and box-type solar cookers, using both a curved reflector and a cooking container into which the food is placed. This combines the reflective properties of a curved surface with the heat retaining properties of a container.

2. Parabolic type

A solar cooker that uses reflective surfaces to collect, concentrate and direct the sun's rays onto the food being cooked.

3. Box-type or oven-type

A solar cooker that uses plane reflectors (such as mirrors) to reflect radiation through a glass or plastic window into an insulated cooking container. The container normally has reflective sides and a black metal base.

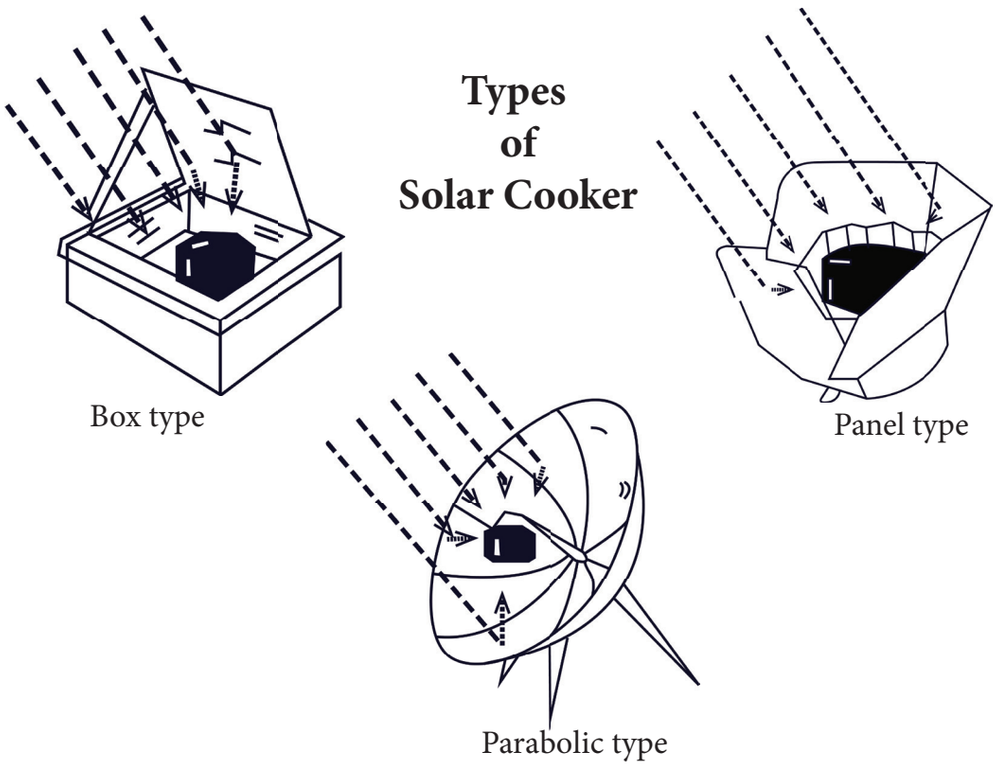

Fig.1.7: Types of Solar Cookers

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Advantages

- A solar cooker does not produce smoke. It has low maintenance and practically no running cost.
- It is an environment friendly method of cooking food.
- Solar cooking can be successfully done in many parts of India.

Disadvantages

- Solar cooker is used only in outdoor and works only when there is enough sunshine.
- Slow cooking process.
- Cannot be used in the absence of sunlight as in rainy seasons, late evenings and nights.

Summary

- The term 'food' refers to anything that we eat and which nourishes the body. It includes solids, semi-solids and liquids.
- Food pyramid is meant for use by the general healthy population as a guide for the types of foods and its proportion to be included in the daily diet.
- The Eat well plate is a pictorial food guide showing the proportion and types of foods that are needed to make up a healthy, varied and balanced diet.
- Microwaves are electromagnetic waves of radiant energy with wave lengths in the range of 250 x 106 to 7.5 x 109 Angstroms.
- Solar cooking is a very simple technique that makes use of sunlight or solar energy which is a non-conventional source of energy.
- Solar cooker is classified in to three different kinds box cookers, panel cookers and parabolic cookers.

Glossary

Saturated	Containing the largest possible amount of a particular solute
Conduction	The process by which heat or electricity is transmitted through a substance
Convection	The process by which heat travels through air, water and other gases
Radiation	The emission of energy as electromagnetic waves
Charring	Burning so as to blacken the surface
Coagulation	The action or process of a liquid especially blood, changing to a solid or semi solid state
Angstroms	A unit of length equal to one hundred-millionth of a centimetre

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Questions

Part – A

Choose the correct answer(1 mark)

1. A method of cooking where food is cooked without direct contact of water is called _____.

a) steaming

b) boiling

c) stewing

d) poaching

2. Out of the given four methods of cooking select one method which preserves the maximum nutrients.

a) steaming

b) stewing

c) pressure cooking

d) roasting

3. Stewing is characterized by

a) high temperature and lots of water

b) low temperature and little water

c) low temperature and lots of water

d) high temperature and loss of water

4. Pressure cooking is done at.

a) above 100^0 C

b) below 100^0 C

c) 100^0 C

d) 200^0 C

5. Match the food items given in column I with the method used in cooking it from the column II.

Column I	Column II
(i) Dhokla	(a) Simmering
(ii) Dal	(b) Deep-frying
(iii) Puri	(c) Shallow frying
(iv) Paratha	(d) Steaming
	(e) Boiling

Part – B

Write short answers (2 marks)

1. Differentiate between baking and toasting.
2. State two advantages of solar cooking.
3. State any two advantages and disadvantages of solar cooking.

Part - C

Answer in Brief (3 mark)

1. Define poaching.
2. Bring out the differences between stewing, steaming and sauteing.
3. Which is the best method of preparing rice and dhal? Justify your choice of cooking method.
4. Write a note on baking, and its merits and demerits?
5. List the series of cooking methods followed to prepare a samosa.

Part – D

Answer in detailed (5 marks)

1. Classify different methods of cooking and explain any two methods in detail.
2. Give a brief account about the principles, merits and demerits of microwave cooking.
3. Explain the cooking method employed in the preparation of

(a) Bread (b) Idli (c) Chapaths

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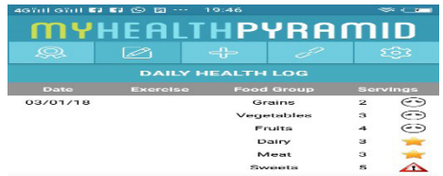
ICT CORNER

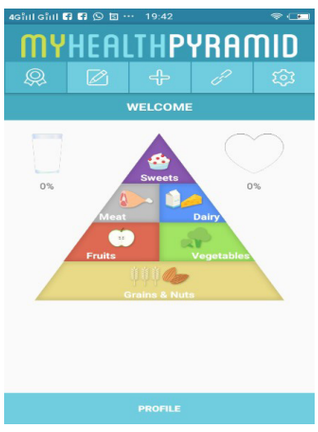
MY HEALTH PYRAMID (HEALTHY FOOD- NUTRITION AND DIETETICS)

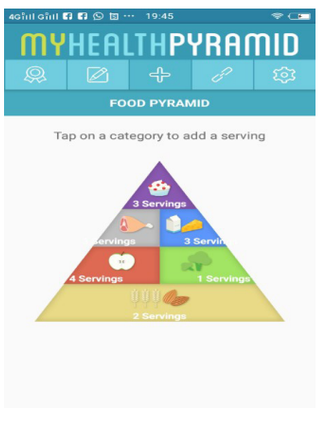
Health Pyramid presents the simple nutritional habits. It provides what we should eat referring to the various families of nutrients.
This activity will enable the students to enhance their knowledge about the Nutritious Food and also what to eat and how to eat.

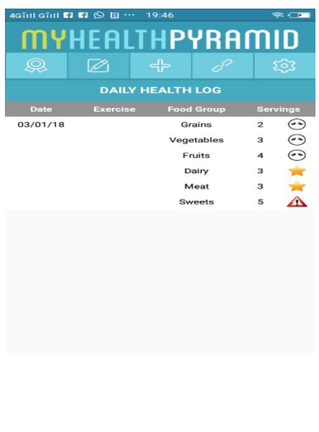


STEPS:

1. Scan the QR code from your mobile. You can see "**MyHealthPyramid**" on the screen with options.
2. When you click the first option it opens for water and exercise with a glass of tumbler and a heart. When you select the glass and heart it asks for the amount of water and the period of exercises. You have to choose from the options. Third option opens with diet there also you have to choose the servings.
3. The second option gives you the feedback about the servings with smiley, stars and warning sign.







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To go inside the app directly you can either use **QR code** or the **given link.**

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Unit 2

CEREALS AND PULSES

Cereals form the staple food of the human race. In their natural form (as in whole grain), cereals are a rich source of carbohydrates, protein, vitamins and minerals. Pulses are the dried seeds of the leguminous plants. They are non perishables, i.e., they do not get spoilt easily if proper storage conditions are followed.

The word Cereal is derived from an ancient Greek word '*Cerealia*', a major festival celebrating *Ceres* the Roman Goddess of harvest and agriculture.

In this lesson, the students will be able to:

- Learn about different cereals and millets available in the market.
- Know the nutritive value of cereals and millets available in the market.
- Understand the importance of using a combination of cereals in the diet.
- Understand the nutritional importance of pulses and legumes.
- Promote and practice germination of pulses to enhance the nutrient content of the diet.

Cereals and pulses

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A cereal is any grass cultivated for the edible components of its grain (botanically, a type of fruit called a caryopsis), composed of the endosperm, germ and bran. The ease with which grains can be produced and stored together with the relatively low cost and nutritional contribution has resulted in widespread use of cereal foods. They are the staple foods in the diets of most population groups. Millets are hardy plants capable of growing in areas where there is low rainfall and poor irrigation facilities.

2.1. Structure of cereal grains

All grains have the same basic structure. The seedcoat consists of an epidermis (outer layer) and several inner layers. Just underneath the seedcoat is the aleurone layer, which contains oils, and other nutrients like minerals, proteins and vitamins. The seedcoat and aleurone make up the outer layer called the bran, which represents about 13 percent of the grain. The aleurone layer surrounds the endosperm, which is the largest part of the grain (usually about 85 percent). The endosperm consists of storage cells containing starch granules embedded in a matrix of protein. The germ is the sprouting section of the grain. In wheat, it comprises only about 2 percent of the seed, but contains 65 percent of the B group vitamins and 33% of oil.

2.2. Nutritive value of cereals

Cereals are the main source of energy, contributing 70-80 percent of our

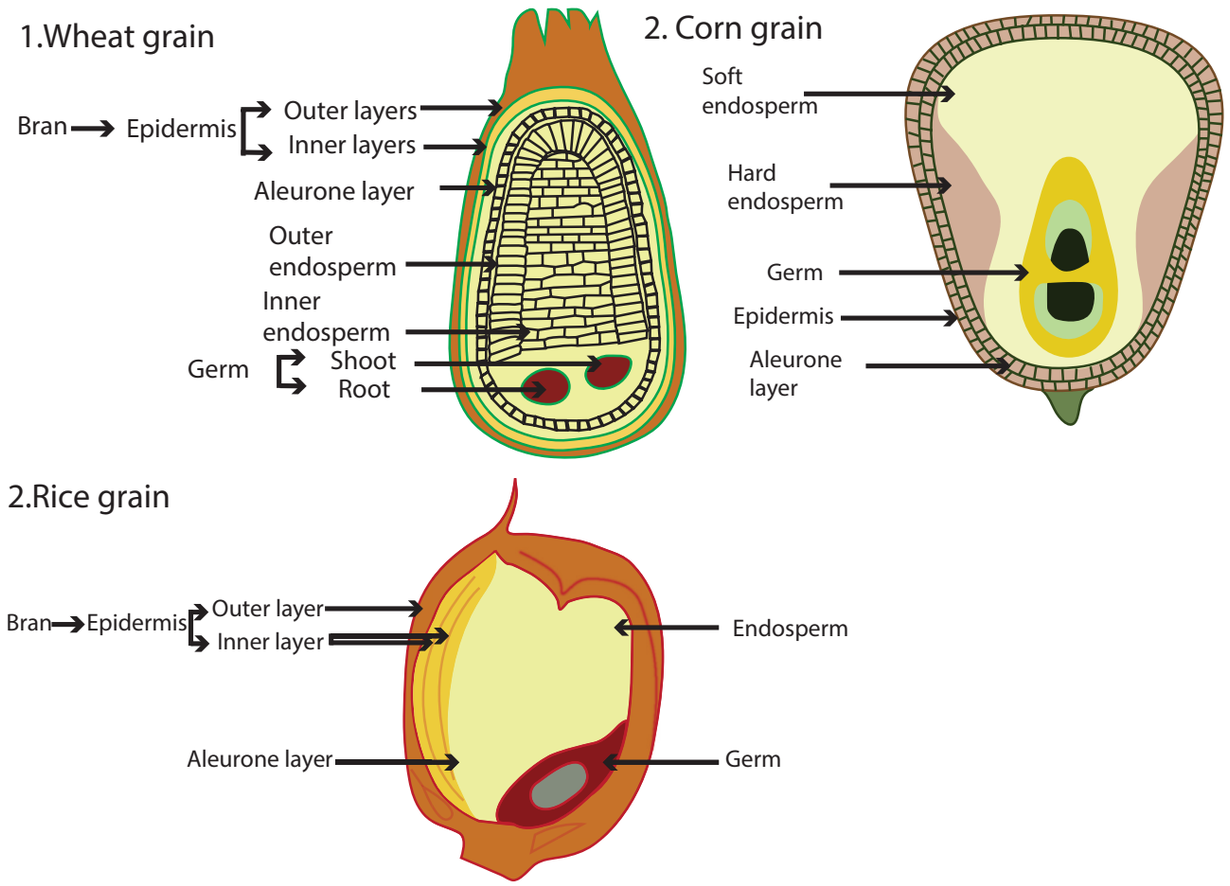

Fig 2.1: Structure of cereal grains

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ACTIVITY - 1

Identify and know the nutritive value of different cereals and millets available in the market.

energy requirement. Eighty percent of dry matter of cereals is carbohydrates. The two form of carbohydrates present are insoluble fibre (cellulose) and soluble carbohydrate. Cereals contain 6-12 percent protein, which are deficient in lysine. Among cereals, protein is of better quality than others. Fats are present to the extent of 1-2 percent in wheat and rice and 3 percent in maize. Cereals are poor source of calcium and iron, except ragi, which is a good source of calcium and iron. Whole grain cereals are important source of B vitamins in the diet.

2.3. Specific cereals and millets

Common cereals and millets are

2.3.1. Rice

The major carbohydrate of rice is starch which is 72-75 percent. Protein content of rice is 7 percent.

Fig 2.2: Rice

Types of rice

The different types of rice are:

Fig 2.3: Types of rice

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- **Long-Grain Rice:** These grains of rice are about 4-5 times longer than their width, and don't tend to clump together when cooked.
- **Medium-Grain Rice:** About 2-3 times longer than their width, these types of rice can be chewy and tender, and often clump together.
- **Short-Grain Rice:** Often mistaken for medium-grain rice, this variety is slightly longer than its width, and clumps together easily.
- **Parboiled Rice:** This is a type of rice prepared in a unique way; rather than removing the outer hull to cook brown rice, the outer shell is left on while this rice is steamed and dried. Then the outer shell is taken off for a less clumpy and more nutrient-dense variety of rice.
- **Polished rice:** Polished rice is rice that has been milled, which effectively strips away much of the protein and vitamin content. Traditional white rice is considered has polished rice and therefore less nutrient-dense than other varieties.
- **Brown rice:** Brown rice is rice in which the inner husk is not removed meaning that it hasn't been milled and thus provides a much higher content of fiber and nutrients. It is unpolished whole grain which contains 100 percent bran, germ and endosperm constituents. Brown rice is nutritionally superior to hand pounded rice, under milled and polished rice because it has higher amounts of protein, dietary fibre, vitamins and minerals.
- **Black rice:** It has a very high concentration of anthocyanins, which gives it the black color. It is high in nutrients and relatively rare, this rice variety is slowly becoming popular in our Indian cuisine.
- **Basmati rice:** Traditionally grown, found and used in India, for making biriyanis and pulaos. Basmati rice is a long-grain variety with a very delicate texture.
- **Sticky Rice:** This is a rice variety primarily grown in Asia, also known as glutinous rice.
- **Red rice:** Red rice is similar to black rice in that it is colored due to its unique anthocyanin content. This provides the red color to the husk, which can either be partially or fully removed before preparing this type of rice.

Different rice products

- **Rice flour:** Rice starch granules are quite small and are embedded in a protein matrix. It is used in puddings, ice creams and custard powder.
- **Rice bran:** Bran includes several sublayers within the pericarp and the aleurone layer. Bran is a good source of antioxidants. Oil is taken from rice bran.
- **Broken rice:** It is mainly used in making upma.
- **Parched rice products:** This includes parched rice, puffed rice and flaked

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rice. They are easily digestible and hence good for children and old people. It adds variety in the diet. Rice flakes are a good source of iron.

2.3.2. Wheat

Wheat grains are ovoid in shape rounded in both ends. Wheat proteins are rich in glutamic acid and low in tryptophan. Whole wheat is a good source of thiamin, riboflavin, niacin, folic acid, calcium, phosphorus, zinc, copper and iron. Wheat is also a good source of fibre. Wheat is consumed mostly in the form of flour obtained by milling the grain while a small quantity is converted into breakfast foods such as wheat flakes and puffed wheat.

Wheat is milled to produce flour which is used to make a variety of products including bread across the world. Wheat contains a protein called gluten which is necessary for the basic structure in forming the dough system for bread, rolls and other baked goods. Many of the foods we consume on a daily basis such as bread, cookies, cakes, pies, pastries, cereals, crackers, pasta, flour tortillas and noodles are all made from wheat flour.

Fig 2.4: Wheat

Products of wheat

Whole wheat flour: It contains the finely ground bran, germ and endosperm of the whole kernel. It is used in making chapathis, puris, whole wheat bread, etc.

DO YOU KNOW...?

Some interesting Facts about wheat

- Malted wheat is used in health drinks and in alcoholic drinks after distillation.
- Wheat is used for cattle, poultry, and other livestock feed.
- Young wheatgrass is becoming increasingly popular as a nutritional supplement offering vitamin A, B-complex, C, E, and K.
- Some strains of wheat are grown to produce starch in South Asia used in textile manufacturing.
- In many countries, rural houses still use wheat straw to thatch their houses as well as mattresses and pillows.
- Wheat is also being used for plastics manufacturing and aquaculture feed purposes for both fish and shrimp.

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Wheat bran: Wheat Bran is a concentrated source of insoluble fibre and provides health benefits.

Wheat germ: It is a great source of vegetable protein, along with fiber and healthy fats. It is also a good source of vitamin E, magnesium, thiamine, folate, potassium and phosphorus.

Wheat rava: Broken wheat or wheat rava is used in the making of upma, Bisi bela bath, pongal, etc.

Wheat flakes: They are used as breakfast cereals. They are packed with dietary fibre and most varieties are fortified with numerous essential vitamins and minerals.

Maida: It is also known as refined flour. The bran and germ are separated in making white flour or maida. Maida bakes uniformly into a loaf of greater volume and it is more bland in taste and more easily digested. The more the refinement, the lesser the nutritional quality.

Semolina: It is coarsely ground endosperm and its chemical composition is similar to that of white flour.

Macaroni products: These products are also called pasta. These products include macaroni, spaghetti, vermicelli and noodles.

Fig 2.5: Macaroni

2.3.3.Oats

Oats are whole grains. Neither the bran nor germ is removed in different forms of oats and hence all forms like oat meal, oat flakes and oat bran are nutritious. In oats there are significant amounts of beta glucans, soluble fibre which reduces serum cholesterol.

2.3.4.Barley

Barley malt is used in bakery, processed foods and, in vinegar and syrup making.

2.3.5. Millets

The major millet crops of India are:

- **Pearl Millet / Bajra /Kambu:** India is the largest producer of Pearl millet. This millet is an excellent source of phosphorus which is essential for the structure of body cells. It has the same quantity of protein as wheat.
- **Finger Millet / Nachani / Kezhvaragu:** It is also known as finger millet, ragi and red millet. It is well known in Southern India. This millet is rich in protein. The major proteins of ragi are prolamins and glutelins and they appear to be adequate in all essential amino acids. Ragi is rich in minerals especially calcium with good source of iron. The malted ragi flour can be used along with germinated green gram flour to formulate a high calorie-dense weaning food having excellent nutritional qualities. Ragi flour can be used with milk beverages.
- **Foxtail Millet /Kangni / Thinai:** Foxtail millets are rich in iron and pest-free. Foxtail acts as anti pest

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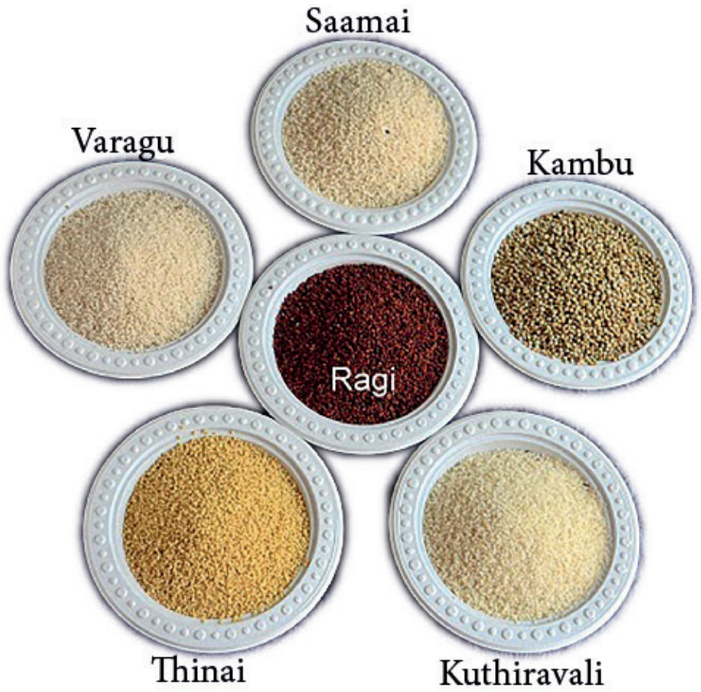

Fig 2.6: Types of Millets

agents which helps to store the delicate pulses like green gram.

- **Kodo millet/Kodra/Varagu:** Kodo millet contains high amount of polyphenols which acts as an antioxidants. It is rich in fiber and low on fat.
- **Little Millet / Kutki / Saamai:** The seeds are smaller in comparison to other millet such as foxtail millet. Little millet has high amount of iron content and fiber like Kodo.
- **Barnyard Millet / Jhangora / Kuthiravali:** Barnyard millets are good source of fiber, phosphorous as well as calcium.
- **Sorghum /Jowar /Cholam:** Sorghum is mostly cultivated due to its high fodder value. Sorghum is rich in nutrients with high amount of protein, unsaturated fats, fiber and minerals such as phosphorus, calcium, potassium and iron.

2.3.5a. Health benefits of millets

The various health benefits of millets are:

1. **Healthy heart:** Millets are rich in magnesium which helps to lower the blood pressure and also decreases the chances of strokes, heart attacks and atherosclerosis.
2. **Balance cholesterol level:** The high amount of fiber found in Millet helps to lower the cholesterol.
3. **Prevent diabetes:** It helps to reduce the risk of Type 2 diabetes as it possesses an adequate amount of magnesium.
4. **Assist digestion:** Since millets are rich in fibre, it helps to enhance the gastrointestinal health and eradicate the ailments such as excess gas, constipation, cramping and bloating.

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Fig 2.7: Sweets and savouries - Millets

5. **Prevent cancer:** Research shows that fibre is the simplest way to prevent the outbreak of breast cancer in women. Since millets are rich in fiber, it can prevent occurance of breast cancer.
6. **Detoxification:** Millet contains antioxidants, which help to neutralize the free radicals that can lead to cancer and also clears up the toxins from the liver and kidney.
7. **Respiratory health:** Research shows that Millet helps to improve the respiratory health and also prevent asthma.

2.4. How can millets be used in the daily diet?

- One of the most common ways to eat millets is as breakfast cereal or porridge.
- Replace rice or wheat with millets in preparations such as:
  - ❖Sambar rice
  - ❖Curd rice
  - ❖Upma
  - ❖Kozhukattai
  - ❖Pongal
  - ❖Idli
  - ❖Dosai
  - ❖Adai

DO YOU KNOW...?

Colours of unpolished millets

- Varagu is dark brown
- Thinai is dark yellow
- Saamai and kudiravaali are light grey
- Panivaragu is creamy yellow
- Kambu has a greenish tinge.

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- Snacks such as murukku, thattai and seedai and sweets such as ladoo can be made from ragi.
- Thinai is best suited for making adhirasam. It can also be used to make halwa, ven pongal, sweet pongal or curd rice.
- For pulav or biriyani, go for parboiled samai, kudthiravali or varagu.

2.5. Processing of cereals

1. Primary processing of cereals

The main purpose of primary processing of whole cereal grains is to separate the outer layers of the grain from the inner section. When the grain is milled to produce white flour, the germ and the bran are discarded. The milling process grinds and pounds the grains. The process used for milling each grain type is slightly different.

After milling of the grain, the products can be described in the following ways:

- **Wholegrain or wholemeal** products means the whole of the grain has been used that is the bran germ and endosperm. Because the oil component in the germ can go rancid after a time, wholemeal products can develop off flavours.
- **Refined** products refer to products made only from the endosperm (starch). The bran and germ are removed. Refined products have a longer shelf life but are nutritionally poor because they contain mostly carbohydrate.
- **Enriched** products have vitamins and minerals added, usually to give them similar nutritive properties to wholemeal products, but without the fibre content.
- **Flour** is the powdered form of the grain after grinding or milling.
- **Meal** is a more coarsely ground product than flour.
- ***Instant or quick-cook*** products have been cooked, or partially cooked, then dehydrated. When reconstituted they require very little preparation time. Examples include instant porridge, quick-cook rice and instant Asian style noodles.

2. Secondary processing of cereals

Secondary processing of cereals results in a variety of products. The main products are as follows:

- Breakfast cereal production may involve other processes such as rolling and baking to make flakes. Eg. Wheat flakes.
- Bread and other bakery items such as savoury crispbreads, sweet biscuits, cakes and pastries require the additional processes of sifting, mixing, kneading, proving and baking. Some breads and cakes are leavened with raising agents such as yeast and baking powder.
- Extruded snack foods — commercially produced using a dough or batter that is extruded and cooked into novelty shapes. Eg. macaroni.
- Pasta is formed from flour-based dough and formed into shapes by hand or machine.

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- Noodles and dumplings are manufactured from flour-based doughs and shaped, then simmered or poached in liquid.

2.5.1. Milling

Cereal processing is complex. The principal procedure is milling, i.e., the grinding of the grain so that it can be easily cooked and rendered into attractive foodstuff. The steps involved in the process of milling are:

- Rice is passed through two stone rubber discs rotating at different speeds and by shearing action on the grain, the hull is pulled away.
- This is then milled in a machine called pearlor to remove coarse outer layers of bran and germ by the process of rubbing, resulting in unpolished milled rice.
- Unpolished rice is liable to develop rancidity and so it is next polished in a brush machine which removes the aleurone layer and yields polished rice.
- Sometimes the polished rice is further treated in a device known as trumbol to give a coating of sugar and talc to produce a brighter shine on the rice.

The percentage of losses of different nutrients during milling are: Protein 15 percent, Fat 82 percent, Thiamine 85 percent, Riboflavin 70 percent and Pyridoxine 50 percent. The degree of milling determines the amount of nutrients removed.

2.5.2. Parboiling

Parboiling is a process in which rice has been partially boiled in the husk. This makes rice easier to process by hand, boost its nutritional profile and change its texture.

1. Conventional process: This consists of the following steps:

- Steeping paddy in cold for 2 or 3 days in large cement tanks.
- Steaming of the soaked paddy for 5-10 minutes
- Drying in the sun.

2. Hot soaking process: This consists of the following steps:

- Soaking of paddy in water at 65-70° C for 3-4 hours.
- Draining of water and steaming of soaked paddy in the same vessel for 5-10 minutes
- Drying of the paddy in the sun or in mechanical driers.

Advantages of parboiling

- Dehusking of parboiled rice is easy.
- Milled parboiled rice has greater resistance to insects and fungus.
- Loss of nutrients due to the removal of husk and bran in milling are decreased.
- Loss of water soluble nutrients due to washing of rice is less in parboiled rice compared to raw rice.
- Parboiling improves digestability.

2.5.3. Malting of cereals

Malting is a controlled germination process, which activates the enzymes of the resting grain resulting in the conversion of cereal proteins and other macromolecules.

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Generally barley is used in the production of malt. Other grains used in the preparation of malt includes wheat, jowar and ragi.

The process of malting of cereal grains consists of the following steps:

1. Selection of grain and cleaning.

2. Steeping in cold water for 36 hours with 2 to 3 changes in water.

3. Germination: The grains are spread on wire mesh trays and kept for 3 days. Water is sprinkled over each of these trays.

4. Kilning: The germinated grains are dried at slow rate on kilns.

Amylase rich food (ARF) is germinated cereal flours which are extremely rich in the enzyme alpha-amylase. ARF are excellent weaning foods because they reduce the bulk of weaning foods and are energy dense. Malt is used in commercial proprietary foods, breakfast cereals, malted milk confectionaries, infant foods, bakery products and in brewing.

2.6. Cereal cookery

2.6.1. Gelatinisation

Starch granules do not dissolve readily in cold water but they will form a temporary suspension with the starch tending to settle out as soon as the mixture is allowed to stand. When heated with water, the grains absorb water and swell. This process is called as gelatinisation.

2.6.2. Gluten formation

Although all cereals are more or less similar in protein content, the unique presence of glutelin and gliadin in the wheat makes it suitable for certain recipes. Glutenin or glutelin is the protein which gives toughness and rubberiness to gluten. Gliadin gives elasticity. Due to its elastic properties, the dough can be rolled to prepare chapathi or poori.

Fig 2.8: Gluten formation (Chapathi and Poori)

2.6.3. Dextrinisation

Dry heat also brings changes to starch granules through a process known as dextrinisation. If a starch product is subjected to dry heat, carbohydrate compounds called dextrins are formed. When these are dissolved in water they have a sweet taste. Colour and flavor changes also occur. Extensive dextrinisation reduces the thickening power of starches. Eg. Toasted bread.

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2.7. Fermented cereal products

The term fermentation refers to the breakdown of carbohydrates into simpler substances. The advantages of fermentation are:

- Flavour and texture of the product are improved.
- Vitamin B and C content is increased.
- The product is easily digestible.
- Acid by- products formed during fermentation inhibits the growth of harmful microorganisms.
- It provides variety in the diet.

Some of the fermented cereal products are:

- Idli
- Dosai
- Dhokla
- Appam
- Bread

Fig 2.9: Fermented cereal products (Idly and Dosai)

Some fascinating facts about cereals

- The first cereal grains were domesticated by early primitive humans, about 8,000 years ago.
- The cereal industry uses 816 million pounds of sugar per year in the making of bread, biscuits and pastries.

2.8. Role of cereals in cookery

Role of cereals in cookery

1. Cereals are used as thickening agent, eg. corn flour in custard, corn flour in white sauce and macaroni in soups.
2. Cereals are used as coating agent, eg. maida paste in cutlets or bread crumbs in cutlets.
3. Cereals are used in sweet preparations, eg. rice payasam and wheat halwa.
4. Malted cereals are used in the preparation of beverages and weaning mixes.
5. Cereal products like corn flakes and rice flakes are used as ready to use foods.
6. Fermented foods made from cereals are used as breakfast foods or snacks, eg. idli, dhokla.

2.9 Health benefits of cereals

- **Source of Energy:** Cereals are the major energy provider in the diet.
- **High Mineral Content:** Ragi, millets, jowar, and bajra have high amounts of minerals and fiber.
- **Prevent Cancer:** Whole wheat products reduce the chances of breast cancer.
- **Prevent Constipation:** Cereals have both insoluble and soluble fibers like cellulose, pectin, and hemicellulose. This prevents constipation.

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- **Maintain Blood Sugar Level:** The fiber content in cereals decreases the speed of glucose secretion from the food, thereby maintaining sugar levels in the blood.
- **Provide Protein:** Cereals usually have 6-12% protein.
- **Source of Vitamins:** Cereals are a good source of vitamins B.

2.10 Pulses

Pulses are edible fruits or seeds of pod bearing plants. Pulses are the edible seeds of plants in the legume family. Pulses grow in pods and come in a variety of shapes, sizes and colors. Different varieties of pulses are grown around the globe. The major pulses or dhals which find important place in Indian diet are red gram dhal, Bengal gram dhal, black gram dhal and green gram dhal. Some pulses like Bengal gram, green gram, rajmah, soya bean dry peas are used as whole grams. A legume is a plant or its fruit or seed. Well known legumes include chickpeas, channa and soyabean.

ACTIVITY - 2

List any five recipes that can be made out of:
(a) Rice (b) Wheat (c) Ragi (d) Semolina (e) Millets and their preparation.

The word pulse originates directly from the Latin *puls* meaning "thick gruel or porridge".

2.10. 1 Nutritive value of pulses

Pulses give 340 calories per 100 grams which is almost similar to cereal calorie value. Pulses contain 55 to 60 percent starch. In a vegetarian diet, pulses are important sources of protein. They give about 20-25 percent protein that is double the amount of protein compared to cereals. The proteins present in pulses are not of good quality as they are deficient in aminoacids. Pulses contain 1.5 percent fats. They contain calcium, magnesium, zinc, iron, potassium

Pulses

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and phosphorus. They are excellent sources of B complex vitamins particularly, thiamine, folic acid and pantothenic acid. Like cereals, they do not contain any vitamin A or vitamin C, but germinated pulses contain vitamin C.

Pulses are considered as super food because they are:

- Good source of protein
- Rich in minerals and B vitamins
- Low in fat
- Gluten free
- Source of dietary fibre

2.10.2 Germination

Whole pulses are soaked overnight, water should be drained away and the seeds should be tied in a loosely woven cloth and hung. Water should be sprinkled twice or thrice in a day. In a day or two, germination takes place.

Fig 2.10: Germination

DO YOU KNOW...?

Pulses have been essential part of our diet for centuries. Agricultural production of pulses dates back to 7000-8000 BC.

ACTIVITY - 3

Germinate pulses and prepare any two products from them.

Advantages of germination

- Nutritive value is improved during sprouting. During sprouting, minerals like calcium, zinc and iron are released from bound form. Vitamin C is synthesized during germination.
- Sprouting decreases cooking time.
- Thickening power of starch is reduced due to conversion of starch to sugars.
- Germination improves taste and texture.
- Germinated pulses add variety to the diet.

2.10.3 Toxic constituents in pulses

Some pulses contain chemical constituents that have toxic properties.

1. **Trypsin inhibitors:** They are present in red gram, Bengal gram, cowpea, double bean, soyabean and dry peas. Trypsin inhibitors are proteins that inhibit the activity of trypsin in the gut and interfere with digestibility of dietary proteins and reduce their utilisation.
2. **Lathyrogens:** Lathyrism is a nervous disease that cripples man. It is known to result from an excessive consumption of the pulse kesari dhal (Lathyrissativus). The symptoms of lathyrism are muscular rigidity, weakness and paralysis of the leg muscle.

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3. **Haemagglutinins:** These are proteins in nature and they occur widely in leguminous seeds. Haemagglutinins reduce the food intake resulting in poor growth.
4. **Saponins:** These are present in soyabeans. Saponins cause nausea and vomiting. These toxins can be eliminated by soaking prior to cooking.
5. **Goitrogens:** These substances interfere with iodine uptake by thyroid gland. They are present in soyabean and groundnuts. Excessive intake of these foods may lead to precipitation of goitre.
6. **Tannins:** They have high amount of seed coat in most legumes. Tannins bind with iron irreversibly and interfere with iron absorption. Tannins also bind proteins and reduce their availability.

These toxic constituents can be removed during processing and cooking.

2.10.4. Forms of pulses

Pulses are used in different forms such as:

- Whole legumes
- Decuticled split legumes with and without skin
- Germinated or fermented pulses
- Flour of pulses and
- Parched pulses like Bengal gram and peas.

DO YOU KNOW...?

In December 2013, the United Nations General Assembly (UN) voted unanimously to declare 2016 the International Year of Pulses (IYP). Throughout 2016 the Global Pulse Confederation (GPC) celebrated, raise awareness and promote consumption of pulses at events around the globe.

2.10.5. Soyabean

Soyabean with its high protein contents is considered as a substitute for meat protein which is expensive. Soyabean has 42 grams of protein per 100 grams of the product.

Soyabean can be processed to obtain the following products:

1. **Soya flour:** Soya flour is used in combination with wheat flour in preparation of chapathis. It can also be incorporated in the batter used in the preparation of bajji, vadai and pakoda.

Fig 2.11: Soya

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2. **Soya milk:** The milk is prepared by grinding soaked beans with water. It is then passed through a mill in a stream of water. The emulsion that is obtained is filtered and transferred to a boiler and mixed with vitaminised margarine to which sugar, salt, calcium and malt are added. The mixture is cooked for 20 minutes, emulsified and then dried.
3. **Tofu:** It can be used like paneer in various preparations.
4. **Textured vegetable protein (TVP):** It is prepared using defatted soya flour from which most of the oil and carbohydrates are removed. It is quick to cook with a protein content compared to certain meats.
5. **Soya protein isolates:** Soya protein isolates are protein granules, isolated by processing. It is fortified with vitamins and minerals and used as a complementary food.
6. **Soya Grits:** Soya grits are made from lightly toasted soya beans that have been ground into coarse pieces. The toasting brings out their pleasant, nutty flavor.

DO YOU KNOW...?

Other uses of pulses

- **Part of the vital web of biodiversity.**
- **Foster sustainable agriculture and soil protection.**
- **Unexpected ally against climate change.**

2.10.6 Role of pulses in cookery

Role of pulses in cookery

1. Pulses are rich in proteins and B - vitamins and improve the quality of cereal proteins.
2. Pulses give satiety due to high protein and fibre content.
3. Pulses improve flavor and consistency of dhal sambhar and rasam.
4. They contribute to fermentation in Idli and Dosa batter.
5. They are used in snacks like sundal, bajji, etc.
6. They are used in salads, eg. sprouted gram.
7. They are used in desserts like dhal payasam and sweets like mysorepak and ladoos.
8. They are used as thickening agents, eg. Bengal gram flour in gravies.
9. Roasted pulses are used in chutneys and chutney powders.
10. They are used as seasonings and curries.

2.10.7 Health benefits of pulses

- **Good for Your Heart:** Pulses are high in fiber and potassium which is useful in lowering blood pressure and reducing the risk of heart diseases.

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- **Lower Risk of Diabetes:** Pulses are a low-glycemic index food. Including pulses in the diet can make it easier to manage the blood sugar levels.
- **High in Protein:** Pulses also make a healthy and inexpensive source of protein.
- **Good Source of Folate:** Pulses also are a good source of folic acid, a B vitamin needed to produce and maintain new cells.
- **Pulses can help maintain and lose weight:** The fibre in pulses increase the satiety value and helps in reducing and maintaining weight.

Summary

- A cereal is any grass cultivated for the edible components of its grain (botanically, a type of fruit called a caryopsis), composed of the endosperm, germ and bran.
- Cereals are the main source of energy, contributing 70-80 percent of the requirement.
- Cereals contain 6-12 percent protein, which are deficient in lysine.
- Cereals are used in food preparation and processing in a variety of ways. The whole grain can be used in porridge, soups, salads and main dishes.
- Secondary processing of cereals results in a variety of products like bread, flakes, pasta, etc.
- Pulses are the edible seeds of plants in the legume family.
- Pulses give 340 calories per 100 grams which is almost similar to cereal calorie value.
- Soyabean with its high protein contents is considered as a substitute for meat protein which is expensive. Soyabean has 42 grams of protein per 100 grams of the product.

Glossary

Terms	Meaning
ARF	Amylase Rich Food. Amylase Rich Food is germinated cereal flours which are extremely rich in the enzyme alpha amylase. They are excellent weaning foods because they reduce the bulk of the weaning foods and are energy dense.
Bran	It is the hard outer layer of the cereal grain which is rich in fibre.
Dextrinisation	It is the process involving the browning of starch foods when subjected to dry heat. The starch is broken down to dextrins.
Distillation	It is the action of purifying a liquid by a process of heating and cooling.
Gelatinisation	It is the process of breaking down the intermolecular bonds of starch molecules in the presence of water and heat, allowing the hydrogen bonding sites to engage more water.

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Germination	It is the process by which an organism grows from a seed or a similar structure. The most common example of germination is the sprouting of the seedling from a seed of an angiosperm or gymnosperm.
Gluten	It is a composite of storage proteins termed as prolanins and glutelins and stored together with starch in the endosperm of various cereal grains. It is found in wheat, barley, rye, oats, etc.
Kilns	It is a furnace or oven for baking or drying something.
Macaroni products	They are the class of food each of which is prepared by drying formed units of dough made from semolina, durum flour or any combination of two.
Malting	It is a controlled germination process which activates the enzymes of the resting grains resulting in the conversion of cereal proteins and other macromolecules. Generally Barley is used in the production of malt.

Questions

Part A:

Choose the correct answer (1 mark)

1. _____ is the outer layer of the kernel.

   (a) Bran

   (b) endosperm

   (c) germ

   (d) Epidermis

2. Cereals are deficient in amino acid _____.

   (a) lysine (b) methionine

   (c) cysteine (d) germ

3. Parboiling reduces the loss of vitamin _____.

   (a) A (b) B (c) C (d) D

4. The process of removing bran and germ is called as _____.

   (a) milling (b) parboiling

   (c) malting (d) boiling

5. If a starch product is subject to dry heat, it is called as

   (a) gelatinisation

   (b) gluten formation

   (c) dextrinisation

   (d) gluten

6. Pulses give _____ calories per 100 grams.

   (a) 340 (b) 250 (c) 175 (d) 179

7. Soyabean contains about _____ percent proteins.

   (a) 22 (b)32 (c) 42 (d) 52

8. Pulse protein is deficient in _____ aminoacids.

   (a) Arginine

   (b) methionine

   (c) lysine

   (d) germination

9. Germination increases the vitamin _____ content of pulses.

   (a) A (b) D (c) C (d) V

10. _____ is prepared using defatted soya flour from which most of the oil and carbohydrates are removed.

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(a) Tofu (b) TVP

(c) Soya milk (d) Milk

Part B:

Write short asnwer (2 marks)

1. List any two products of wheat.
2. List any two rice products.
3. What are the nutrients present in ragi?
4. What is bran?
5. What are the uses of malted foods?
6. What is fermentation?
7. What is dextrinisation?
8. Write a note on ragi.
9. List the food products that can be made with ragi.
10. List any two millets available.
11. Write on TVP.
12. Write on the uses of soya flour.
13. What is germination?
14. Write on soya protein isolate.
15. What is Tofu?

Part C:

Answer in brief (3 marks)

1. Draw the structure of rice and name its parts.
2. Explain the nutritive value of cereals.
3. How is milling done?
4. Write on the steps in parboiling.
5. Explain the malting process.
6. What are the advantages of fermentation?
7. List the different fermented cereal products.
8. Explain gelatinisation.
9. How can millets be incorporated in the diet?
10. Discuss the nutrient content of pulses.
11. Write on the different forms of pulses.
12. What are the advantages of germination?

Part D:

Answer in detailed (5 marks)

1. Explain parboiling. What are its advantages?
2. Draw and explain the structure of wheat grain.
3. Explain the role of cereals in cookery.
4. What is fermentation? What are the cereal products prepared by fermentation?
5. Explain on the different rice products.
6. Explain the different wheat products.
7. Write on gluten formation.
8. What are the benefits of using millets?
9. How cereals are used in Indian cookery?
10. Explain the health benefits of cereals.
11. Write on the toxic constituents in pulses.
12. Write on the different soya products.
13. Discuss the role of pulses in cookery.
14. How pulses are used in Indian cookery?
15. What are the health benefits of pulses?

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Unit 3

VEGETABLES AND FRUITS

Vegetables and fruits are nature's marvellous gift to the humankind. Vegetables and fruits are very important commodities in our daily diet. They are life-enhancing medicines packed with vitamins, minerals, antioxidants and many phytonutrients (Plant-derived micronutrients). Vegetables and fruits are available throughout the year and they can be consumed fresh and eaten raw. They are an absolute feast to our sight because of their colour and have a unique nutrient profile that helps the human body to be fit, rejuvenate, and free of diseases.

In this lesson, the students will be able to:

- recognise and classify the various types of vegetables and fruits.
- be familiar with the composition and nutritive value of Vegetables and fruits

GI4XF

- understand the causes and ways to prevent browning in vegetables and fruits
- know how to conserve nutrients while cooking vegetables
- understand the importance of eating vegetables and fruits every day
- learn exciting ways to add more vegetables and fruits to their daily diet

All vegetables and fruits are plants or parts of plants that are used as food. Different parts of plants are consumed.

Vegetables and fruits

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3.1 Composition of vegetables and fruits

Vegetables contain a high amount of water. They also contain carbohydrates, dietary fibre, protein, vitamins and other nutrients that are important for human health.

Lettuce, cucumbers and leafy vegetables contain about 95% water, therefore only 5% of their mass is dry matter. Hard vegetables like carrot and pumpkin have around 12-15% dry matter.

Carbohydrates are the main components of vegetables and fruit. They represent more than 90% of their dry matter. Carbohydrates are present as starch, sugars and dietary fibre. Starch is mainly found in root vegetables, such as potatoes and sweet potatoes.

The main sugars that are present in vegetables and fruits are glucose, sucrose and fructose. Although more usually associated with fruit, sugars are an important component of flavour in vegetables such as carrots, sweet corn and peas.

Dietary fibre compounds like cellulose, lignin, pectins and other substances are also found in vegetables and fruits. Dietary fibre in vegetables and fruits have several health benefits like lowering blood sugar and cholesterol levels.

3.2 Classification of Vegetables

Vegetables are classified according to the part of the plant consumed, colour of the vegetable or according to the nutritive value.

3.3 Nutritive value of vegetables

- Roots and tubers like carrots, potatoes and sweet potatoes contain a large amount of starch (carbohydrates), hence they contribute to energy value of the food.

Table 3.1 Classification of vegetables based on parts of plants consumed

Parts of plants	Examples
Roots	Carrot, beet root, radish, turnip, colocasia
Tubers	Potatoes, sweet potatoes, tapioca
Bulb	Onion, garlic, leeks
Leaves	Cabbage, lettuce, spinach, amaranth, fenugreek leaves, coriander leaves, mint leaves, greens
Flowers	Plantain flower, cauliflower, broccoli
Fruits	Tomatoes, brinjal, lady's finger, pumpkin, cucumber, gourds (ash gourd, bottle gourd), capsicum, drumstick, plantain
Legumes (pods and seeds)	Peas, beans, chowli, broad beans, French beans, double beans, Bengal gram tender, red gram tender.
Stems	Plantain stem, ginger, amaranth stem, celery stem, lotus stem and greens

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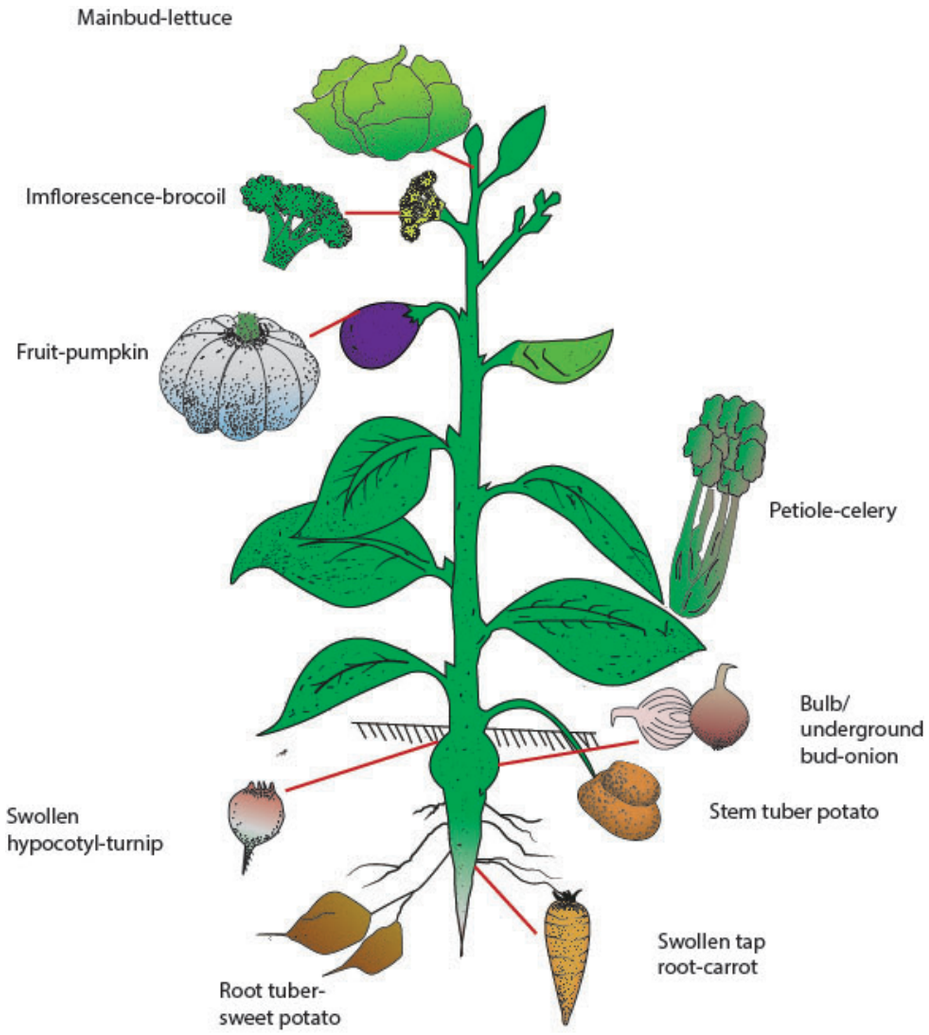

Fig 3.1: Origin of vegetables from different plant parts

- Carrots contain a large amount of Beta carotene (Vitamin A). Potatoes and sweet potatoes are rich in Vitamin B_6, Vitamin C, Potassium and Iron.
- Green leafy vegetables are good sources of phosphorus, calcium and iron. They are excellent sources of carotene (Vitamin A) which are also good antioxidants.
- Greens are good sources of vitamin-B particularly riboflavin and folic acid. But drying and withering reduce vitamin-B.
- Green leafy vegetables also contain vitamin-C eg., Agathi, drumstick leaves and coriander leaves.
- Green leafy vegetables are rich in iron. Eg., Mint leaves, drumstick leaves, paruppukeerai.
- Agathi, colocasia leaves, drumstick leaves and fenugreek leaves contribute to calcium in our diet.
- Greens are good sources of fibre which help in preventing degenerative diseases.

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- Beans and peas are high in fibre. Fiber increases stool bulk and prevents constipation.
- Beans, peas, and lentils are also rich sources of some vitamins and minerals, such as folate, iron, potassium and magnesium. Folate and iron are important for preventing anaemia, as well as maintaining normal metabolic functions. Potassium and magnesium are important for muscle and nerve function.

DO YOU KNOW...?

Spinach is the leaf, cauliflower is the flower and cucumber is the fruit. Some plants have medicinal value.

3.4 Purchase of vegetables and fruits

Most fresh vegetables and fruits retain their freshness for a short time under ideal conditions of storage. They belong to the category of perishables (green leafy vegetables) and semi - perishables (garlic, onion, roots and tubers) In general, freshness, uniformity of size, colour, degree of ripeness and being free from defects are the qualities most sought after while purchasing vegetables and fruits.

When purchasing, select fresh vegetables which are firm, crisp, bright in colour with no visible bruises or signs of decay and wilting.

Select clean leafy vegetables which are fresh,tender, crisp, brightly coloured and free from flowers, insects, mud and spots or holes in the leaves.

While selecting roots and tubers ensure that they are heavy, firm, free from sprouts, heavy in relation to size, with shallow eyes and without green discolouration.

At the peak of season, each vegetable and fruit has the highest nutrient content, flavour and is available at a reasonable price. It is therefore, advisable to buy vegetables and fruits which are in season, as the quality is good and the price is low.

ACTIVITY - 1

Visit a local market and indicate how you will purchase any five vegetables and fruits

_____

_____

3.5 Vegetable Cookery

Vegetables are cooked to improve the colour, flavour and texture by which overall palatability is improved. Digestibility is also improved. The fibre becomes softened, starch gets gelatinised and protein gets coagulated. Cooking vegetables adds variety to the diet. Cooking also destroys micro-organisms.

While cooking vegetables, water-soluble nutrients like thiamine, riboflavin, nicotinic acid, pantothenic acid, pyridoxine, folic acid and vitamin C may be dissolved in the cooking water and the nutrients may be lost.

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3.5.1 Methods to reduce loss of nutrient while cooking vegetables

Table 3.2 Methods to reduce loss of nutrients while cooking vegetables.

Action	Reason
Cut the vegetable into bigger pieces.	Exposure of the vitamins to water is less.
Cut the vegetables and use it immediately.	Vitamin C is lost on exposure to air.
Soaking or washing time should be reduced. Wash the vegetable with the skin and later should be peeled and cut.	Enough time is not given for the water soluble nutrients to get dissolved in water.
Vegetables should be cooked in minimum amount of water. Any liquid remaining after cooking the vegetable should be used in a gravy or soup.	Water soluble nutrients are lost in the cooking liquid.
Cook vegetables wherever possible with the skin.	Leaching of vitamins into the water would be less.
Cook the vegetables by steaming and pressure cooking.	No additional water is added.
Do not add sodium bicarbonate while cooking	Nutrients are destroyed in an alkaline medium.
Cook for a minimum time, using a tight fitting lid.	Prolonged heating increases vitamin loss.
Green leafy vegetables should be washed well and then cut.	Water soluble nutrients are lost if the the vegetables are washed after cutting them
Greens should be cooked in open pans.	Greens when cooked in closed pans lose the natural green colour.

3.5.2 Role of vegetables in cookery

Vegetables are used universally in all recipes. They are used

- in curries, salads and in sambar
- as garnishing agents eg. shredded carrot and coriander leaves
- as stuffing in samosa and parathas
- as thickening agents in gravies and soups
- in chutneys (onion) and pickles (tomato, onion)
- as part of recipes like pulao, avial and non-vegetarian dishes
- as preserved foods like vathal in the dehydrated form.

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ACTIVITY - 2

- Make a chart to show the availability of seasonal fruits in your area.

3.6 Fruits

Fruits are formed from flowers and they are the ripened ovary or ovaries of a flowering plant together with the adjacent tissues. Most fruits are fleshy and pulpy or juicy and are pleasantly sweet and have a distinct appealing flavour when ripe. Fruits provide several health benefits and eating the recommended amount of fruit every day can reduce the risk of chronic diseases.

3.6.1 Nutritive value of fruits

Fruits contain high amount of moisture, hence they are highly perishable. They are also good sources of fibre. Apples, pears, cherries, grapes and citrus fruits contain flavonoids which act as antioxidants.

Fruits particularly citrus varieties and guava are a good source of vitamin C. Gooseberry is the richest source of vitamin C.

Yellow fruits like mango and papaya contain β carotene. Banana is a good source of carbohydrate and energy. Fruits are a poor source of protein and fat with the exception of avocado.

Fruits also contain fibre and minerals such as sodium, potassium and magnesium. They are not a good source of calcium. Dry fruits and Seetha phal (custard apple) contribute appreciable amounts of iron.

3.6.2 Classification of fruits

Fruits can be classified as:

Berries: Strawberries, gooseberries, blackberries, raspberries, blueberries, cranberries

Citrus fruits: Sweet limes, oranges, tangerines, sour oranges, lime, lemon, grape fruit.

Drupes: Apricot, sweet cherry, peach, plums

Grapes: Green grapes, black grapes, seedless grapes

Melons: Musk melon, water melon

Pomes: Apples, pears

Tropical and Subtropical fruits: Gooseberry, avacado, banana, dates, guava, jack fruit, mango, jambu fruit, papaya, passion fruit, pineapple, pomegranate, sapota, Seetha phal (custard apple).

3.7 Pigments in vegetables and fruits

Vegetables and fruits are appealing because of their bright and variable colours which are due to pigments present in the plastids of plant cells. The chief pigments of vegetables and fruits can be classified as water soluble and fat soluble.

Fat soluble/ Lipophilic pigments	Water soluble/ Lipophobic pigments
Chlorophyll	Anthocyanin (red/ blue/purple)
Carotenoids (red, orange and yellow)	Flavones& flavanols (yellow) Flavanals etc.

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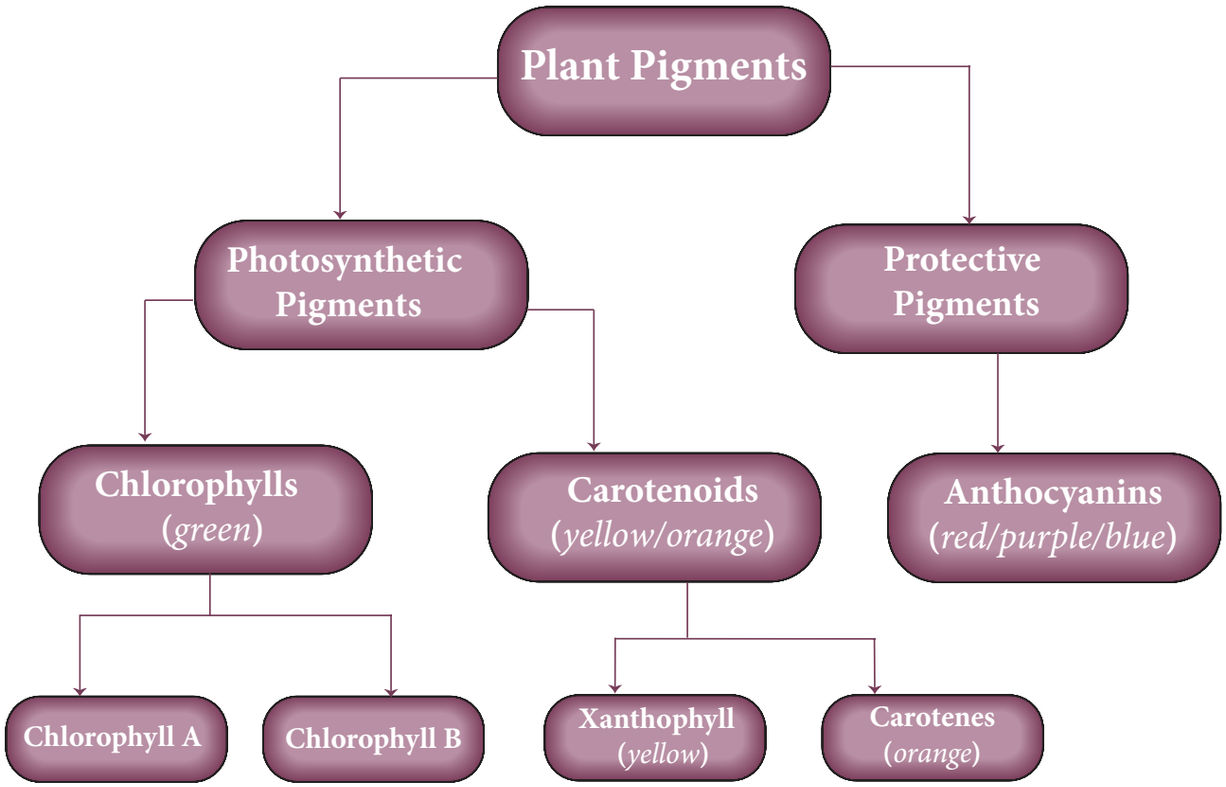

Fig 3.2: Classification of pigments in vegetables and fruits

ACTIVITY - 3

Cut pictures of vegetables and fruits from magazines and stick them on paper plates and highlight the nutrients present in each fruit and vegetable

Chlorophyll

Chlorophyll is the green pigment of leafy vegetables and other green coloured vegetables like capsicum, beans, peas and chillies. It is mostly insoluble in water. Two cholorophylls have been isolated. Cholorophyll-a is intense blue green in colour and cholorophyll- b is dull yellow green in colour.

Carotenoids

Carotenoids are the yellow, orange, red fat soluble pigments distributed in nature. They are divided into three groups viz. carotenes present in carrot, green leafy vegetables and other fruits, lycopenes present in tomatoes and xanthophylls present in yellow fruits.

Pigments that contain the phenolic group include anthocyanin, anthoxanthin, leuco anthoxanthin, catechin,quinones and betalins. The first four groups are collectively known as "Flavanoids".

Anthocyanin

They are a group of reddish water-soluble pigments occurring in many vegetables and fruits. Cherries, red apples, pomegranates have their colour appeal due to anthocyanins.

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Anthoxanthins

They are colourless white to yellow pigments that give colour to cauliflower, onions, spinach or other leafy vegetables. In green leafy vegetables the colour is masked by chlorophyll.

3.8 Medicinal benefits of vegetables and fruits

Vegetables and fruits are an important component of our daily diet as man cannot live on cereals alone. Vegetables and fruits are essential for balanced diet and good health. They not only add colour and variety to the diet but also provide significant amounts of vitamins, minerals and carbohydrates including roughage (fibre). Vegetables and fruits also possess medicinal values.

The following list highlights some key nutritional benefits of vegetables and fruits:

- Vegetables and fruits are rich in fibre. Fibre gives satiety and thereby decreases food intake.
- Fibre is good for the heart and intestines. It helps in regulating bowel movement and helps to maintain a healthy digestive system and lowers the risk of bowel cancer.
- It reduces blood cholesterol levels and thereby helps in the prevention of cardio vascular diseases and lowers the risk of stroke.
- Folate in spinach, beans, melons and orange prevents neural tube problem at birth.
- Potassium in fruits and vegetables like sweet potatoes, tomato paste, tomato puree, beet greens, white potatoes, white beans, lima beans, cooked greens, carrot juice, and prune juice regulate blood pressure.
- Vitamin A keeps eyes and skin healthy and helps to protect against infections. Excellent fruit and vegetable sources of vitamin A are sweet potatoes, pumpkin, carrots, spinach, turnip greens, mustard greens, kale, collard greens, winter squash, cantaloupe and red peppers.
- Vitamin C helps to heal cuts and wounds, keeps teeth and gums healthy. Excellent fruit and vegetable sources of vitamin C are red and green peppers, kiwi, strawberries, sweet potatoes, kale, cantaloupe, broccoli, pineapple, Brussels sprouts, oranges and mangoes.
- Vegetables and fruits (with the exception of olives, avocados, and coconut) are naturally low in fat. Substituting vegetables and fruits for higher calorie foods should be a part of any weight loss program and healthy diet.
- Every fruit and vegetable offers different nutrients, taste and texture. For the best overall nutrition we have to choose a variety of vegetables and fruits.

3.8.1 Tips to increase the amount of vegetables and fruits in your diet

- Keep cleaned vegetables and fruits in the refrigerator so they are easy to grab as a quick snack
- Add vegetables to curries, stews and soups.

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- Drink 100% fruit juice instead of fruit-flavoured drinks which contain added sugar.
- Have fruit for dessert.
- Keep a bowl of apples, bananas and/or oranges on the table for a quick snack.
- Choose a salad made with a variety of vegetables and fruits instead of junk foods like French fries.
- While baking cakes use raisins, dates or prunes. This helps to increase fibre.
- Add lettuce, onions, capsicum and/or tomatoes to sandwiches.
- Enjoy fruit smoothies or milk shakes for breakfast or snacks.
- Pack fresh or dried fruit for healthy snacks to school.

ACTIVITY - 3

Consider one type of fruit. Compare quality and price of fruit available in

a) Small greengrocery shop,
b) Supermarket, c) Wholesale market

3.8.2 Role of fruits in cookery

- Raw, whole or cut fruits can be served as an appetiser, as a salad or for dessert.
- Fruits can be served in the form of juices or milk shakes.
- Apples are served as stewed apples.
- Fresh fruits can be preserved as jams, marmalades, preserves and dried fruits

ACTIVITY - 4

Make a healthy raw snack with vegetables and fruits

3.9 Browning in vegetables and fruits

You might have seen apples, pears, potatoes and brinjal that turn brown in color when peeled or cut open. Have you ever thought about it? What is the reason behind this color change? That's because of a naturally occurring process called "Oxidation".

Enzymatic browning is an oxidative reaction responsible for browning in vegetables and fruits. When the skin of vegetables and fruits are either cut or broken, cell wall gets ruptured and an enzyme called polyphenol oxidase is released and reacts with the oxygen in the air. As a result vegetables and fruits turn brown or dark leading to changes in flavour and nutritional values.

Fig 3.4: Browning on cut surface of apple

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5 a day

Eating a good variety of fruit and vegetables is an important element of healthy eating. The World Health Organisation (WHO) advises that we eat a minimum of 400g of fruit and veg every day, equating to five portions. This recommended daily amount is thought to help reduce risk of serious health conditions including stroke, heart disease, obesity and type 2 diabetes.

The 5 a day message looks to encourage people to enjoy a variety of different vegetables and fruits as part of a healthy balanced diet.

3.9.1 Measures to prevent enzymatic browning

There are ways to prevent fruits and vegetable from getting oxidized. Here are a few methods :

- Squeeze lime juice on fruits such as banana, apples, avocado, pears and vegetables like potatoes, sweet potatoes to prevent oxidative browning. The juice of other citrus fruits such as oranges and grape fruits can also be used.
- Soak the cut fruits or vegetables in plain water which helps to slow down the oxidation process.
- Blanching fruits or vegetables also prevents browning.
- Wrapping in a cling wrap tightly is also a good way to prevent browning.
- Most importantly, do not use a rusty knife as the iron in it will increase the rate of browning.

Summary

- Vegetables and fruits are essential for balanced diet and good health.
- They not only add colour and variety to the diet but also provide significant amounts of vitamins, minerals and carbohydrates including roughage (fibre).
- When purchasing, select fresh vegetables and fruits which are firm, crisp, bright in colour with no visible bruises or signs of decay and wilting.
- While cooking vegetables, water-soluble nutrients like thiamine, riboflavin, nicotinic acid, pantothenic acid, pyridoxine, folic acid and vitamin C may be dissolved in the cooking water and the nutrients may be lost. Hence care must be taken to adopt proper cooking techniques to prevent loss of nutrients.
- Vegetables and fruits are appealing because of their bright and variable colours which are due to pigments present in the plastids of plant cells.
- The chief pigments of vegetables and fruits are cholorophyll, anthocyanins, anthoxanthins and carotenoids.
- The cut surface of certain vegetables and fruits turn brown or dark due to enzymatic browning which can be prevented by blanching or by using lemon juice.

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➢ Eating a variety of vegetables and fruits is an important element of healthy eating and helps to reduce the risk of heart diseases and diabetes.

Glossary

Terms	Meaning
Cling wrap	A thin plastic film typically used for sealing food items in containers to keep them fresh over a longer period of time.
Pectin	Pectin is a soluble gelatinous polysaccharide which is present in ripe fruits and is used as a setting agent in jams and jellies.
Antioxidants	An antioxidant is a substance, such as vitamin E, vitamin C, or beta-carotene, thought to protect body cells from the damaging effects of oxidation
Phytonutrients	Phytonutrients are natural compounds found in plant foods such as vegetables, fruits, whole grain products and legumes. These plant compounds have beneficial effects working with other essential nutrients to promote good health
Brassica vegetables	Any plant belonging to the genus **Brassica**, of the mustard family. Examples include cabbage, kale, broccoli, cauliflower, turnip, and mustard
Dietary fibre	Also known as roughage. It is a portion of the plant that cannot be digested by the digestive enzymes.
Blanching	This refers to a cooking technique in which food is briefly immersed in boiling water. Blanching brings out the colour in vegetables and helps to maintain their nutritional value, which can be lost with overcooking.
Flavanoids	A large group of water-soluble plant pigments that are beneficial to health. Flavonoids are polyphenols and have antioxidant, anti-inflammatory, and antiviral properties.
Satiety	Satiety is a state of being completely full, more commonly used to describe someone who has eaten enough.

Questions

Part- A

Choose the correct answer (1 mark)

1. Green leafy vegetables are excellent sources of _____.

   a) protein

   b) vitamin and minerals

   c) fat

   d) Lactose

2. The pigment present in beet root is _____.

   a) betalain

   b) allin

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c) curcumin

d) carotenoids

3. The enzyme responsible for browning is _____.

a) polyphenol oxidase

b) thiaminase

c) oxygenase

d) protein

4. Sweet lime and oranges are examples of _____ fruits.

a) allium

b) cruciferae

c) citrus

d) curcumin

5. Guavas and amla are good sources of _____.

a) vitamin D

b) riboflavin

c) vitamin C

d) vitamin A

6. The pigment present in tomatoes is

a) lycopene

b) anthoxanthin

c) anthocyanin

d) thaiaminase

Part - B

Write short answers (2 marks)

1. Give examples of vegetables and fruits that are good sources of vitamin A and C
2. List any two health benefits of fibre in vegetables and fruits.
3. What are anthocyanins?
4. Give two examples for drupes and berries.
5. Explian the carbohydrate composition of vegetables and fruits.

Part - C

Answer in brief (3 marks)

1. How should greens be cooked to prevent loss of colour and nutrients?
2. List any two selection criteria while purchasing vegetables and fruits.
3. List the role of vegetables in cookery.
4. How are fruits classified?
5. Explain the nutritive value of green leafy vegetables.

Part - D

Answer in detailed (5 marks)

1. Classify vegetables based on part of plant consumed, giving one suitable example for each.
2. Briefly explain the nutritive value of vegetables and fruits.
3. Suggest some tips to increase the consumption of vegetables and fruits in the diet?
4. Classify the pigments present in vegetables and fruits. Write a short note on each pigment.
5. What are the nutritional benefits of eating vegetables and fruits?
6. What happens when cut vegetables and fruits are exposed to air? Explain the ways in which you can prevent this.
7. Explain how losses of nutrients can be prevented while cooking vegetables.

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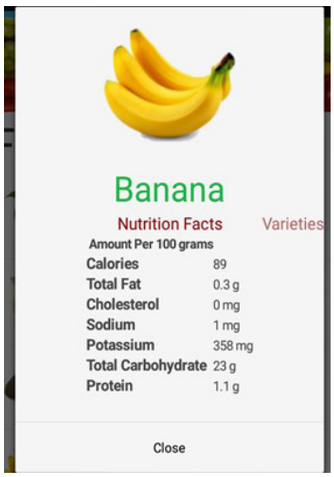
ICT CORNER

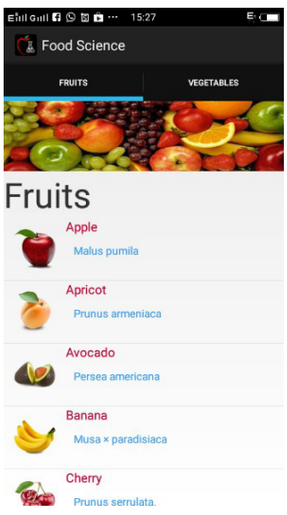
NUTRITION AND DIETETICS (FRUITS AND VEGETABLES)

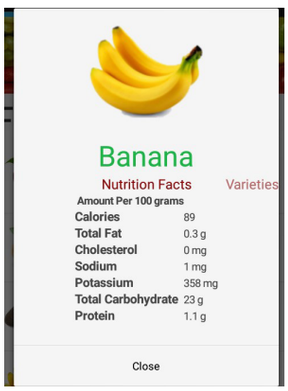
Fruits and Vegetables play very important role in the building and functioning of our body.
This app helps to find the nutrition facts in 100gms of fruits or vegetables (Total 28 fruits and 50 vegetables are given in this app)

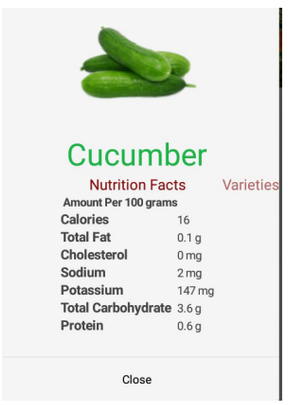


STEPS:

1. Scan the QR code from your mobile. **'Food Science'** page will open with two options.
2. You can select either fruits or vegetables. When we touch fruits or vegetables, the name of the fruits or vegetables will appear on the screen.
3. Touch any fruits or vegetables it will open with all the health benefits of that particular fruits or vegetables.







DOWNLOADING

To go inside the app directly you can either use **QR code** or the **given link.**

https://play.google.com/store/apps/details?id=com.dhiraj.foodscience&hl=en

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Unit 4

NS278

FLESH FOODS, MILK AND MILK PRODUCTS

Flesh foods are consumed since prehistoric times. Meat, poultry and fish are known as flesh foods. Flesh foods like meat, poultry, pork and fish provide the body with essential nutrients, minerals and vitamins for it to remain healthy. These foods contain good quality proteins with high biological value. Egg, milk and milk products are also good sources of animal proteins providing the body with essential amino acids which help to promote growth and maintenance of the human body.

In this lesson the students will be able to:

- learn the different types of meat and fish
- understand the nutritional significance of meat, fish, milk and eggs.
- understand the selection criteria of meat, fish and eggs.
- compare the characteristics of fresh and deteriorated egg

Flesh foods, milk and milk products

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- learn the importance of pasteurization
- understand the role of milk and eggs in cookery

4.1 Meat

Meat refers to muscle of warm blooded four-legged animals. Meat is defined as skeletal muscle with naturally attached tissue. Red meat consists of mutton, pork, beef and rabbit meat (Fig.4.1). The flesh of birds (poultry), fish, crustaceans, flesh of salmon and lobsters are light coloured and are referred to as white meat.

4.1.1 Classes of meat and related products

1. **Veal:** It is the meat from cattle slaughtered 3 to 4 weeks after birth.
2. **Beef:** Meat of cattle over 1 year old.
3. **Mutton:** Flesh of young ovine animals of both sexes whose age is 12 months or under.
4. **Yearling Mutton:** Carcasses of young sheep usually from 12 to about 20 months old are termed yearling mutton.
5. **Mature mutton:** Flesh of both the male and female of ovine species that are 20 months in age at the time of slaughter.
6. **Pork:** It is the meat of swine. Good quality pork is obtained from animals between the age of 3-12 months before the amount of fat becomes excessive.
7. **Organ meats:** Liver, kidney, heart, thymus, pancreas and brain.
8. **Sausages:** Made of ground or minced meat and are enclosed in casings.

Catttle(beef)

Pigs(pork)

Sheep(lamb)

Fig 4.1: Types of red meat

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Meat also includes the glands and organs of animals.

4.1.2 Structure of meat

Animal flesh consists of muscle tissue or fibres, connective tissue and fatty (adipose) tissue. Lean meat is the muscle tissue of animals.

Meat muscle is made up of bundles of muscle fibres held together by creamy white connective tissues. Tendons join muscles (made up of bundles of muscle fibres, surrounded by connective tissue) to the bones of animals.

Muscle cells comprises of

1. Water
2. Minerals
3. Fat
4. Proteins
5. Vitamins
6. The red pigment called myoglobin

Fat: Fat is distributed throughout meat in small particles or in large masses. The pattern formed by the uniform distribution of fat in small "lakes" throughout the muscle or lean flesh is called **"marbling"** and is considered an important factor in contributing tenderness and flavour to muscle tissue

The colour of meat

The colour of meat is due to the red pigment called **'myoglobin'**.

Fig 4.2: Marbling in meat

A large amount of the iron found in meat is in the liver, an organ constituting only a small portion of the carcass.

Offals (Organ meats)

Offal also called as organ meats, refers to the internal organs and entrails of a butchered animal. The name offal means "off fall", in other words, the bits which fall from an animal when it is butchered. The term offals generally covers organs such as the heart, liver and lungs (collectively known as the pluck) and other organs like the kidneys, brains, head, feet, tongue, intestines and tails. Offal from birds is generally referred to as giblets.

Offals are a highly nutritious food and an excellent source of protein. The liver, kidney and heart are a good source of iron and vitamins A, and D.

Fig 4.3: Organ meats- Liver, Brain, Heart and Kidney

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Table 4.1 Nutritive value of meat (per 100 g)					
Flesh food	**Energy (Kcal)**	**Protein (g)**	**Fat (g)**	**Calcium (mg)**	**Iron (mg)**
Beef	86	19.4	0.9	3	-
Mutton	194	18.5	13.3	150	2.5

4.1.3 Composition and Nutritive value of meat

Meat has an outstanding nutritive value, contributing substantial amount of high quality proteins and essential minerals and vitamins to the diet. Meat contains 15-20 percent protein of high biological value. The proteins of meat are well utilized by the body, thus ensuring a supply of essential amino acids necessary for growth and maintenance. Meat contains enough iron, phosphorus, zinc and copper to rate as an important source of these minerals.

As far as vitamins are concerned, vitamin A, thiamine and riboflavin are present in liver, kidneys, heart and sweetbreads (the pancreas or the thymus). All lean meats contain thiamine, riboflavin and niacin. Meat is also relatively high in energy value. Meat fats are rich in saturated fatty acids.

4.1.4 Post mortem changes in meat

The changes taking place in meat after slaughter may be grouped under two heads:

1) Onset of rigor mortis
2) Development of tenderness in muscles

Onset of rigor mortis:

After slaughtering, the lean tissues undergo a series of complex physical and chemical changes. As a result, muscles lose their soft pliable nature and become rigid, stiff and inflexible. This is termed as **"rigor mortis".**

Stiff muscle starts to soften and becomes tender when it is held in a cold room temperature between 0°C to 20°C for 1–4 weeks. This is known as **"ripening"** or **"ageing".** During ageing the humidity of the room is to be controlled.

Development of tenderness:

Meat can be made tender by using mechanical methods like pounding, cutting and grinding which break muscle fibre. Addition of salt, vinegar, lime juice and enzymes like papain (raw papaya), bromelin (pineapple) and ficin (figs) also help in tenderizing meat.

4.1.5 Meat Cookery

In the process of cooking, many chemical changes occur affecting the appearance, taste and texture of meat. Cooking meat-

- Develops or improve flavour, colour, aroma.

Fig 4.4: Cooked and raw meat

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- Makes it delicious and appetizing to eat.
- Makes it more tender.
- Makes it easier to digest.
- Makes it safe to eat - kill any harmful bacteria it may have picked up during handling.

4.1.6 Changes that occur during cooking:

- On cooking, the red pigment of meat turns brown due to the denaturation of protein pigment.
- Cooking (heat treatment) also brings about inactivation of enzymes and denaturation of proteins, which makes the meat tougher
- When meat is cooked volatile compounds from both fat and lean meat are released which contributes to the flavour and taste of cooked meat.
- Cooking melts the meat fat which increases palatability of meat when eaten hot.
- There is loss of water on cooking meat which does not change the nutritive value but may affect the juiciness and brings about shrinkage in volume and weight.

4.2 Poultry

The term poultry is applied to all domesticated birds used as food and includes chicken, ducks, geese, turkeys and pigeons. Of these, chicken and turkey are most commonly used for their meat.

Fig 4.5: Broiler chicken

4.2.1Classification

Poultry is classified based on age. Age influences tenderness and fat content of the poultry. According to Indian standards, the classification is as follows:

Broiler or fryer: Chicken of 8 to 10 weeks of age either sex, having tender meat with soft, pliable smooth textured skin and flexible breastbone cartilage.

Roaster: A young chicken, usually 3 to 5 months of age, of either sex, having tender meat with soft, pliable smooth textured skin and breastbone cartilage that may be somewhat less flexible that of the broiler or fryer.

Stag: A male chicken, usually under 10 months of age with coarse skin, somewhat toughened and darkened flesh and a considerable hardening of the breastbone cartilage.

Stewing chicken or fowl: A mature chicken, usually more than 10 months of age, with meat less tender than that of a roaster and inflexible breastbone tip.

Cock: A mature male chicken, usually over 10 months of age, with coarse skin, toughened and darkened meat and hardened breastbone tip.

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4.2.2 Processing

Poultry is marketed in ready to cook form as dressed chicken after removing the head, feet and entrails. After the birds are killed, they are scalded, that is, dipped in hot water briefly. The temperature of the scald water may be 60 ^{0}C and the bird is kept in it for about 45 seconds or more. Scalding loosens the feathers on the chicken and thus helps defeathering.

Fig 4.6: Cuts of Chicken

After defeathering, evisceration of the bird takes place. The eviscerated birds are thoroughly washed and chilled. Chicken can be purchased whole, cut into parts or in packs of similar individual parts, such as breasts, drum sticks or thighs.

4.2.3 Composition and nutritive value

Poultry meat has high protein content (about 25 percent) and is comparable in quality and nutritive value to other meats. It contains all the essential amino acids required for building body tissues. There is a little fat on the meat of young birds, but the fat content is influenced by age and species of poultry.

ACTIVITY - 1

Conduct a 10-minute review relay. Divide the class into three or four teams of up to 10 students. Give each team a different coloured marker and ask them to name their team. One student at a time from each team must write one thing they have learned about meat and poultry. The student then returns to the team and hands the pen to another member. Each student must write something different than the previous learning facts. The winning team is the one with the most new facts.

Chicken fat is more unsaturated than the fat of red meat and this has nutritional advantage. Because of its high protein to fat ratio, poultry meat is advantageous to persons who must restrict the intake of fats. Like other animal tissues, poultry flesh is a good source of B Vitamins and minerals.

4.2.4 Selection of poultry

When purchasing fresh poultry, look for firm birds with plump flesh the skin should not look wrinkled. If buying frozen chicken, check that the package is well sealed.

4.3 Fish

India has a coast line of 5,100 km. Over 200 edible fish varieties are known to be commercially important. Marine fishes are sardines, mackerel, tuna, catfish, brown duck, ribbon fish, prawns and cuttle. Fresh

Table 4.2 Nutritive value of Poultry (per 100 g)

Food	Energy (Kcal)	Protein (g)	Fat (g)	Calcium (mg)	Iron (mg)
Chicken	109	25.9	0.6	25	-

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water fish are carps, catla, rohu, murrels and hilsa. Fish contains complete proteins and can be an alternative for meat in the diet, but unfortunately fish consumption per capita is far lower than that of meat.

4.3.1 Classification of Fish

Edible fish are categorized as either fin fish of shell fish. The term fin fish refers to the fishes that have bony skeleton. Shell fish is used to designate both mollusks and crustaceans. Shellfish are highly perishable.

Crustaceans have legs with partly joined outer shells. They include crabs, lobsters, prawns and shrimps. Molluscs have harder outer shells and no legs. They have hinged shells like oysters, scallops and mussels.

4.3.2 Composition and nutritive value

Commonly consumed fish are carp, rohu, sardine, mackerel pomfrets, seer fish, prawns, ribbons fish, sole, Bombay duck, catfish and crab.

The composition of fish varies. Fish are not good source of energy because they are not good sources of carbohydrate and fat.

Carbohydrate: The shell fish has less fat and more carbohydrate than fin fish. Like meat, fish contain some glycogen in muscle tissues. In the live fish, glycogen is the source of stored energy. Oysters are notable for their high content of glycogen.

Protein : Fish is an excellent source of protein due to its quality and quantity. They contain around 20 percent protein. The biological value of fish protein is 80. Fish is rich in lysine and methionine hence it has supplementary value with cereals and pulses.

Fat : Fish contains less amount of fat compared to meat and poultry. Fresh

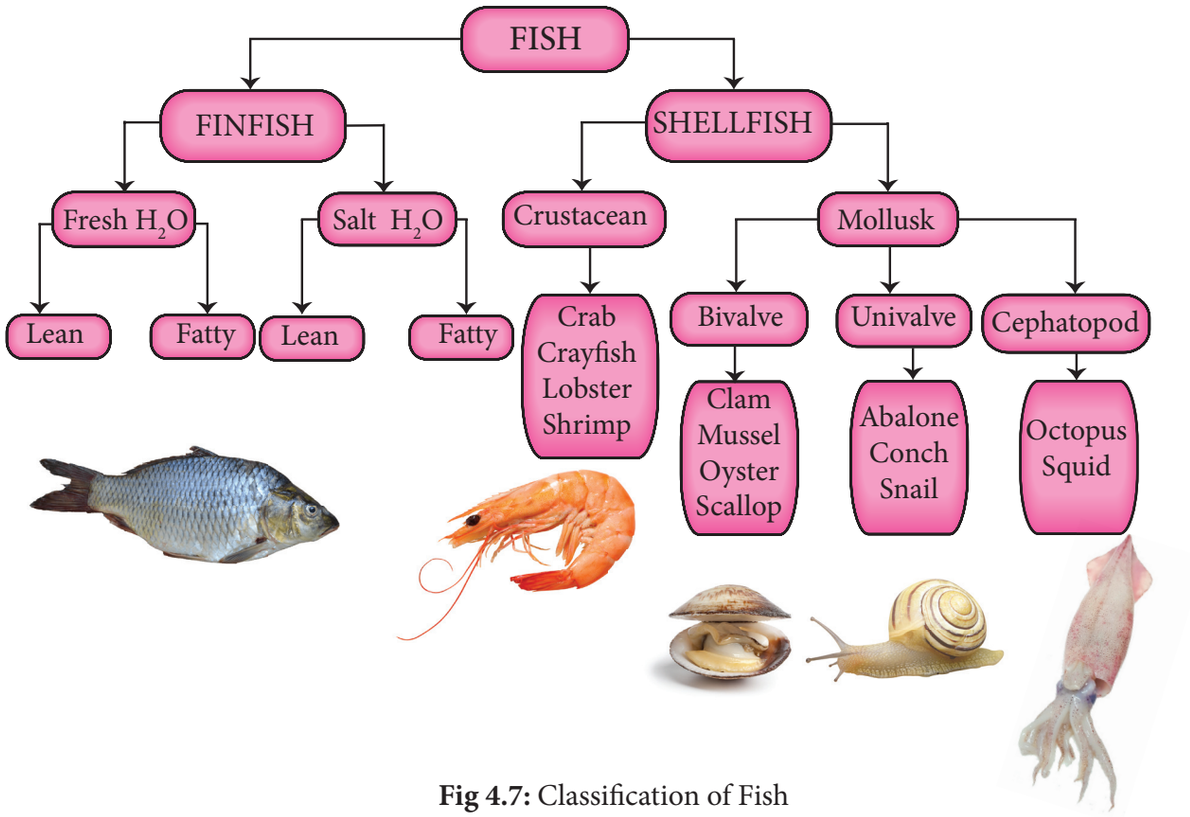

Fig 4.7: Classification of Fish

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Table 4.3 Nutritive value of Fish (per 100 g)					
Food item	**Energy (Kcal)**	**Protein (g)**	**Fat (g)**	**Calcium (mg)**	**Iron (mg)**
Pomfret -black (Vavalu)	111	20.3	2.6	286	2.3
Prawn (Yera)	89	19.1	1.0	323	5.3
Sardine (Mathi)	101	21.0	1.9	90	2.5
Seer (Vanjaram)	126	22.5	4.0	71	5.4

water fish contains eicosapentaenoic acid and docosahexaenoic acid which are ω-3 polyunsaturated fatty acids.

Minerals: Fish is rich in calcium particularly small fish when eaten with bones. Marine fishes are good sources of iodine, selenium and fluoride. Selenium is a powerful antioxidant. Oysters are good source of copper and iron. Sodium content of freshwater fish is slightly less than meat. Shell fish such as oysters are nature's richest source of zinc. The bioavailability of iron and zinc is higher in fish than plant foods.

Vitamins: Sea foods contain significant amount of vitamin B_{12} especially shell fishes. Fish liver oils are excellent source of fat-soluble vitamins. Shark liver oil contains 10,000-24,000 IU of vitamin A per gram of oil. Rohu contains vitamin C. Fishes are good source of niacin and vitamin D. Sea foods contain significant amounts of vitamin B_{12} especially shell fishes.

Fish and health

Eskimos living in Greenland and the fishing community in Japan, enjoy complete freedom from cardiovascular diseases. Their

Table 4.4 Selection of Fish		
Characteristics	**Fresh fish**	**Stale fish**
Skin	Bright, moist and shiny	Skin shows signs of wrinkling and shrinking away from the flesh
Scales	Firmly attached to the skin	Falls off easily
Eyes	Eyes should be convex, the pupil black and the cornea translucent. The eyes should be bright, clear and bulging.	Sunken eyes
Bones	Bones stick firmly to the flesh	The bone separates easily from the flesh
Flesh	Firm to touch	Should not leave a depression when touched
Gills	Bright red in colour	Brown

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daily consumption of fish is 250-400 g. The beneficial effect of dietary fish is attributed to the fatty acid composition of the fish.

4.3.3 Selection of Fish

Fish that are fresh can be easily identified by the following qualities:

Prawns : Fresh and firm, strong colour, no unpleasant smell.

Scallops : Pinkish white or pale yellow, feel firm, give-off clear liquid.

Clams, oysters and mussels : Tightly closed and heavy for their size, shells should not be cracked.

ω-3 fatty acids protect against cardiovascular disease and are essential for the development and function of brain and prevent inflammation and pain of arthritis.

ACTIVITY - 2

Make a list of the ways in which fish can be used in the menu.

4.4 EGG

4.4.1 Structure and composition of egg

An egg is designed to give protection and food for a developing chick. It is therefore a very nutritious food. There are three main parts: the shell, the white and the yolk.

The shell consists of two parts

1. An outer shell composed mainly of calcium carbonate
2. Two thin inner membranes composed mainly of phosphates

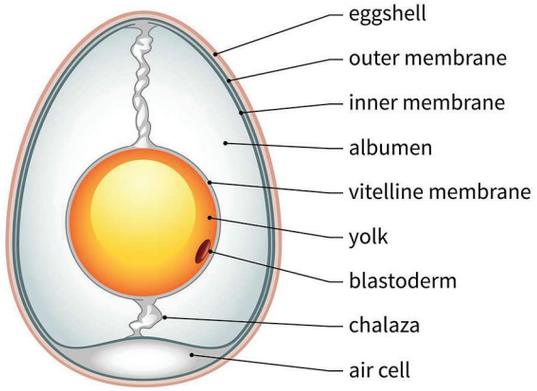

Fig 4.8: Structure of an Egg

The outer shell protects the egg, or the developing chick in a fertilized egg. The shell is porous and contains numerous tiny holes, which enables a chick to breathe. The colour of the shell varies from white to deep brown depending on the breed of the hen.

The two inner membranes lining the shell act as chemical filters to obstruct bacteria which may enter through the porous shell. The two membranes separate to form a small air pocket between them at the rounded end.

The egg white has two distinctly visible layers. The egg white immediately surrounding the yolk is thick and viscous. This is surrounded by a thinner more transparent white.

The egg yolk is anchored to the membranes inside the egg shell by two rope-like structures known as the **chalazae**. These hold the yolk centrally in position. The yolk is separated from the white by a membrane known as the **vitelline membrane**.

The white of the egg (albumin) consists of largely water with no fat or carbohydrate but contains 8-12 percent protein. Different types of proteins are present in egg white

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like ovalbumin, conalbumin, ovamucoid, ovomucin and avidin. The protein ovomucin is responsible for the jelly-like character of egg white and thickness of the albumin. Avidin binds with biotin and makes the vitamin unavailable. But avidin is denatured by heat and thus cooked egg does not affect the availability of biotin.

Egg yolk comprises mostly 25-33 percent of fat and 15-17 percent protein and the remaining water. The major proteins in egg yolk are lipoproteins which include lipovitellins and lipovitellinin. These lipoproteins are responsible for the excellent emulsifying properties of egg yolk, when it is used in products such as mayonnaise.

4.4.2 The value of eggs in the diet

Eggs are an excellent and relatively cheap source of high biological value protein. Egg proteins have an excellent supplementary value to all other plant protein foods. Hence a combination of eggs with any of the cereal or cereal pulse mixture will enhance the protein quality of food. They also provide vitamins A, D, E and riboflavin. Egg yolk is a good source of carotene and iron. Egg is one of the richest sources of lecithin- a phospholipid which forms a part of the structure of every cell wall in the body. Egg also provides essential fatty acids like linoleic acid and arachidonic acid.

4.4.3 Evaluation of egg quality

Egg is an excellent food and hence its quality is of very great importance. Fresh eggs have the best quality. Quality of eggs can be determined by candling where the egg is held against a source of strong light. Candling will reveal

a) a crack in the shell.

b) the size of the air cell.

c) the firmness of the white.

d) the position of the yolk.

e) the presence of foreign substances.

Table 4.5 Nutritive value of Egg (per 100 g)

Food	Energy (Kcal)	Protein (g)	Fat (g)	Calcium (mg)	Iron (mg)
Egg (hen)	173	13.3	13.3	60	2.1

Table 4.6 Characteristics of fresh and deteriorated eggs

Characteristics	Fresh egg	Deteriorated egg
Consistency of Egg white	Firm and viscous	Thin and runny
Position of the yolk	Centre of the white	Yolk moves toward the shell
Air cell	Small	large
Chalazae	Strong	weakens
Vitelline membrane	Intact and strong	Weak, Ruptures- white mixes with the yolk

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ACTIVITY - 3

To compare quality characteristics of fresh and deteriorated raw eggs

Materials Needed:

1 fresh egg

2 deteriorated egg (held at room temperature for at least two weeks)

Procedure

1. Break one fresh egg out of the shell onto a flat plate. Be careful not to damage the egg.
2. Keep the shell. Inspect the air cell in the large blunt end of the egg shell.
3. Observe the thick and thin egg white: the height, diameter, and the color of the yolk; the position of the yolk in the white; the chalazae and record the observations.
4. Repeat steps 1-3 using a deteriorated egg.

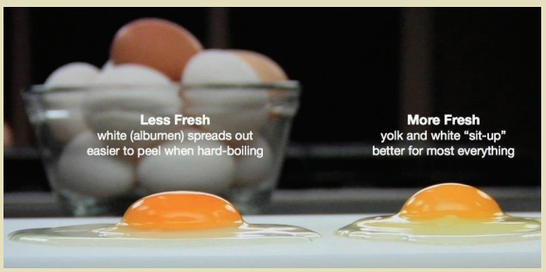
4.4.4 The properties of egg

There are three main properties of proteins in eggs which enable them to be used in so many different ways in cookery.

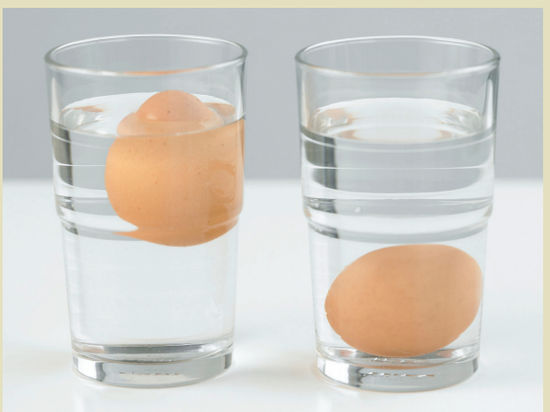
1. Egg proteins coagulate on heating.
2. Egg proteins stretch when beaten and hold air in the structure.
3. Egg yolk proteins are good emulsifying agents.

4.4.5 Uses of egg in cookery

Eggs can be used in many ways in cookery. Eggs when used alone or in combination with other foods they become the major protein source of a meal. Eggs can be used as boiled, scrambled, fried (omelettes) or poached for table use. Eggs are used as :



In a good quality egg the white is thick and stands high. Yolk is firm, round and high.
In a poor quality egg the yolk is somewhat flattened and enlarged. The white appears watery.



When the egg sinks in water it is considered as fresh.

Poor quality eggs float due to increase in size of the air cell and due to loss of moisture.

- **Thickening Agent:** Egg proteins coagulate on heating. Therefore, eggs can be used as thickening agents for making stirred and baked custards, soups and puddings.
- **Binding Agent:** Egg proteins coagulate between 65 and 70°C and

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ACTIVITY - 4

Students brainstorm a list of 10 foods that use eggs. Ideas can be recorded on the "How Do We Use Eggs" worksheet.

help to hold shape of the products in which it is used. They can be used for making cutlets, French toast or Bombay toast and banana fritters.

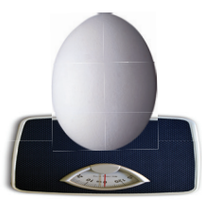
- **Leavening Agent:** Eggs when beaten, form elastic films which can trap air. This air expands during baking and gives a fluffy spongy product. Thus they can be used in cakes, foamy omelette, souffles and meringue.
- **An Emulsifying Agent:** Besides protein, egg contains phospholids such as lecithin which are known for their emulsifying quality. Hence egg can be used an excellent emulsifying agent in products such as mayonnaise as it is able to stabilise the oil in water dispersion.
- **As a Flavouring and Colouring Agent:** Egg is used in food mixtures to contribute flavour and colour to products such as cakes and puddings.
- **As a Clarifying Agent:** Egg helps in the preparation of clear soups. When a small amount of egg white is added to the liquid soup and heated, the egg albumin coagulates and carries along with it suspended particles. On allowing it to settle, a clear soup is obtained.

DO YOU KNOW...?

Egg contain the hightest quality protein you can buy

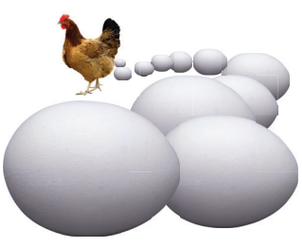
To tell if an egg is raw or hard cooked, spin it! If the egg spins easily, it is hard -cooked but if it wobbles, it is raw.

Egg yolks are one of the few foods that are a naturally good sources of vitamin D



A large egg contains only 70 calories and 5 grams of fat

Egg protein has just the right mix of essential amino acids needed by humans to build tissues. It is second only to mother's milk for human nutrition.



An average hen lays 300 to 325 eggs a year

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- **As a Garnishing Agent:** Hard boiled eggs are diced and are used to garnish dishes like biryani.
- **As an Enriching Agent:** Eggs are used to enhance the nutritive value of various preparations.

4.5 Milk And Milk Products

The story of milk goes back to the beginning of civilization itself. Cattle were domesticated even in prehistoric times and milk was one of the most essential of all foods. Milk is one of the most complete single food available in nature for health and promotion of growth.

Milk is the normal secretion of mammary gland of mammals. Its purpose in nature is to provide good nourishment to the young of the species producing it. Man has learnt the art of using milk and milk products as a part of food for his well being. Man has increased the milk producing function of the animals best adapted as a source of milk for him. The cow is the principle source of milk for human consumption in many parts of the world; Other animals as a source of milk for human beings are the buffalo, goat, sheep, camel and mare. In India, more milk is obtained from the buffalo than the cow. Some amount of goat milk is also consumed.

4.5.1 Nutritive value of milk

Milk is a complex fluid containing protein, fat, carbohydrates, vitamins and minerals. The main protein in milk is casein and it constitutes 3.0-3.5 percent of milk. The fat content of milk varies from 3.5 percent in cow's milk to about 8.0 percent in buffalo's milk. Fat is present in the form of fine globules varying in diameter from 1 to 10μm(micrometers).Milk also contains phospholipids and cholesterol.

ACTIVITY - 5

- Learn how milk gets from the farm to fork
- Design a poster about the importance of drinking milk

Lactose is the sugar present in milk. The important minerals in milk are calcium, phosphorus, sodium and potassium. Milk is an excellent source of riboflavin and a good source of Vitamin A. However, milk is a poor source of iron and ascorbic acid. The small amount of iron present is bio available.

4.5.2 Types of processed milk

Raw milk is processed into the following types of milk.

1. Skimmed Milk

Skimmed milk is whole milk from which fat is removed by a cream separator. The quantity of fat is usually 0.05 to 0.1 percent. It contains all other milk nutrients, except Vitamin A and D but can be fortified by the addition of these vitamins.

2.Toned Milk

Toned milk is prepared by using milk reconstituted from skimmed milk powder. Skimmed milk is prepared by removing fat from milk in a cream separator. Skimmed milk is then mechanically dried to give skimmed milk powder. It is mixed with buffalo milk containing 7 percent fat. The fat content of toned milk should be around 3 percent.

3.Standardised Milk

In standardised milk, the fat content is maintained at 4.5 percent and solids non -fat

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Table 4.7 Nutritive value of milk and milk products (per 100 g)					
Food	**Energy (Kcal)**	**Protein (g)**	**Fat (g)**	**Calcium (mg)**	**Iron (mg)**
Cow's milk	67	3.2	4.1	120	0.2
Buffalo's milk	117	43	6.5	210	0.2
Curd	60	3.1	4.0	149	0.2
Paneer	265	18.3	20.8	208	-

is 8.5 percent. It is prepared from a mixture of buffalo milk and skimmed milk.

4. Homogenised Milk

Homogenisation is a mechanical process that reduces the size of fat globules by forcing milk through small apertures under pressure and velocity. When milk is homogenised, the average size of the globule will be 2 micrometers. The decrease in the size of fat globules increases their numbers and surface area. The newly formed fat droplets brings about stabilization of the milk emulsion and thus prevents rising of the cream. Homogenised milk has a creamier texture, bland flavour and whiter appearance.

5.Evaporated Milk

It is made by evaporating more than half the water from milk under vacuum, at a temperature of 74°C- 77°C. It is then fortified with vitamin D, homogenized and filled into cans.

4.5.3 Pasteurisation of milk

Milk is a favourable medium for bacterial growth. Pasteurisation destroys all pathogenic bacteria, including those causing typhoid, tuberculosis, diphtheria as well as yeasts and moulds. Pasteurization is a process which consists of heating milk to a certain temperature for a definite time to ensure destruction of harmful bacteria. There are three methods of pasteurisation.

a) **Holding method or Batch process :** In this method, milk is held at 62.8°C for 30 minutes.

b) **High temperature short time method or continuous process (HTST):** Milk is heated to 71.7°C for not less than 15 seconds.

c) **Ultra High temperature method :** Milk is heated to a temperature of 93.4°C for 3 seconds.

Milk should be then rapidly cooled to prevent multiplication of surviving bacteria, after heat treatment. During pasteurization the nutritive value of milk is not altered. It does not produce an unpleasant cooked flavour. Harmful pathogens especially TB bacteria are destroyed. Shelf life of milk is increased due to a marked decrease in the total bacterial count.

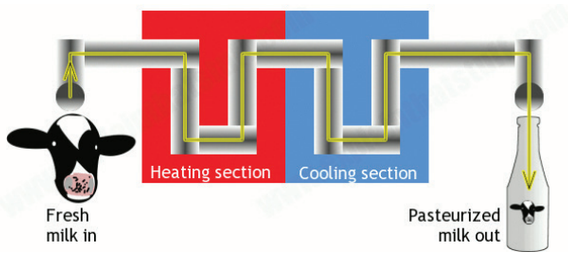

Fig 4.9: Pasteurisation of milk

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4.5.4 Milk products

Khoa

Khoa is prepared by evaporating whole milk in an open cast iron pan with continuous stirring until it is semi-solid. It is used extensively in the preparation of Indian sweets.

Cream

Cream is the fat of milk and is used in the preparation of sweets. It is made by simmering large quantities of milk until a thick layer of milk fat and coagulated protein form on the surface. It can be consumed with or without the addition of sugar.

Butter

Butter is obtained from cream by churning. When cream is churned, the fat globules are destabilised and coalesce until the milk separates into two phases– viz., the butter and the aqueous phase. Butter is removed and washed.

Butter is used as a cooking medium in many Indian recipes. It is one of the main ingredients in cakes, biscuits, icing and bread.

Ghee

Ghee is butter oil. It is prepared by melting butter and separating the moisture from butter by heating. It is used in preparing Indian sweets, savouries, curries and variety rice like pulav and biriyani.

Paneer

Paneer is a soft cheese prepared by addition of lemon juice or citric acid to hot milk and precipitating the casein. The liquid released in this process is known as **"whey"** and the resultant curd is tied in a muslin cloth and hung for a day to squeeze any liquid present in it. The soft cheese (paneer) that is obtained is used in Indian gravies and pulavs. It is a very good source of protein

Fig 4.10: Milk products

Cheese

It involves the curdling of milk with enzyme rennet under microbially controlled conditions. Milk is held at about 27°C in vats and a lactic acid culture is added. When the milk gets acidic, rennet is added to it and the milk is allowed to coagulate. The curd formed is cut and heated to about 37°C with constant stirring to remove the whey. Whey is drained. Salt is mixed with the curd and it is pressed to remove further amount of whey. The cheese formed is coated with paraffin to prevent loss of moisture. The paraffined cheese is allowed to ripen for three to six months at temperatures between 45°C to 60°C. Cheese is a concentrated source of protein.

Curd

Curd is prepared by heating milk to about 50°C. A teaspoon of curd (starter)

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from an earlier batch of curd is added and is mixed thoroughly. The lactic acid bacteria present in the starter curdles the milk. The bacteria breaks down lactose to lactic acid thereby increasing the acidity of milk. When the pH reaches 4.6, the milk protein casein coagulates as curd. The optimum temperature for the formation of curd is 35°C - 40°C and the time needed for curd formation is 8–12 hours depending on the atmospheric temperature. Curd is used as a dressing on salads made from fresh vegetables and combines well with plain cooked rice.

Yoghurt

This is a coagulated milk product with curd like consistency. It is made from partially skimmed or whole milk and it has a slightly acidic flavour. In the production of yoghurt, a mixed culture of Lactobacillus bulgaricus, Streptococcus thermophilus and Lactobacillus acidophilus is added to pasteurised milk and incubated at 42°C to 46°C.

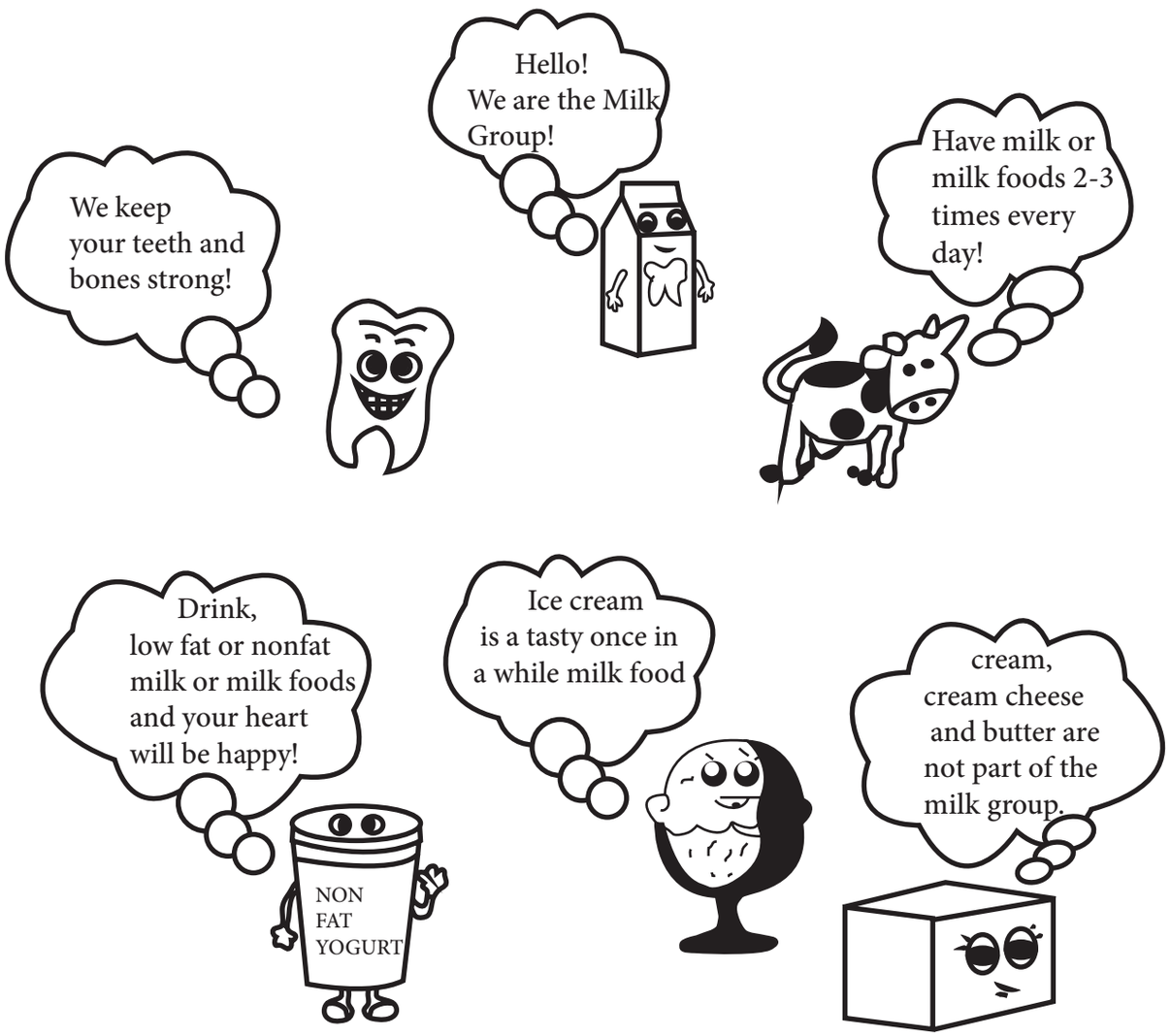

Fig 4.11: Role of Milk

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4.5. 5 Role of milk and milk products in cookery

Role of milk and milk products in cookery

1. It contributes to the nutritive value of the diet, eg. milkshakes, plain milk, flavoured milk, cheese toast.
2. Milk adds taste and flavour to the product eg. payasam,tea, coffee.
3. It acts as a thickening agent along with starch eg. whitesauce or cream soups.
4. Milk is also used in desserts, eg. ice-cream, puddings
5. Curd or buttermilk is used as a leavening agent and to improve texture, eg. dhokla.
6. Curd is used as a marinating agent, eg. marinating chicken and meat.
7. Curd is used as a souring agent, eg. ravadosa, dry curd chillies.
8. Khoa is used as a binding agent, eg. carrot halwa.
9. Cheese is used as garnishing agent.
10. Salted butter milk is used for quenching thirst.

Summary

- Meat, poultry and fish are known as flesh foods and they provide the body with essential nutrients, minerals and vitamins.
- Meat also includes the glands and organs of animals.
- Marbling is an important factor in contributing to tenderness and flavor to muscle tissue
- In the process of cooking many chemical changes occur, affecting the appearance, taste and texture of meat.
- The term poultry is applied to all domesticated birds used as food and includes chickens, ducks, geese, turkeys and pigeons.
- Poultry meat has high protein content and contains all the essential amino acids required for building body tissues.
- Edible fish are categorized as either fin fish of shell fish .
- Fish has ω-3 fatty acids, which protect against cardiovascular disease and are essential for the development and function of brain and prevent inflammation and pain of arthritis.
- Egg is a very nutritious food and has three main parts: the shell, the white and the yolk.
- The different types of processed milk are skim milk, toned milk, standardised milk, homogenised milk and evaporated milk.
- Pasteurisation of mik destroys all pathogenic bacteria and increases the self life of milk.

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Glossary

Terms	Meaning
Biological Value	A measure of the efficiency of the protein in a foodstuff.
Sweet breads	A culinary term referring to the thymus gland.
Scalding	Immerse (something) briefly in boiling water for various purposes, such as to facilitate the removal of skin from fruit or to preserve meat.
Eicosapentaenoic acid	A polyunsaturated fatty acid found especially in fish oils
Souffle	A **souffle** is a baked egg-based dish.
Meringue	Meringue is a type of dessert.

Questions

Part-A

Choose the correct answer (1 mark)

1. _____ is prepared by evaporating whole milk in an open cast iron pan with continuous stirring until it is semi-solid.
   a) Khoa
   b) Paneer
   c) Cheese
   d) Ghee

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2. Egg yolk proteins are good _____ agents
   a) Oxidizing
   b) Emulsifying
   c) Colouring
   d) Flouring
3. Organ meats are called as _____
   a) Offals
   b) Beef
   c) Poultry
   d) Chicken
4. _____ is the meat from cattle slaughtered 3 to 4 weeks after birth
   a) Beef
   b) Veal
   c) Poultry
   d) Chicken
5. _____protect against cardiovascular disease
   a) ω-3 fatty acids
   b) Saturated fatty acids
   c) Trans fatty acids
   d) UnSaturated fatty acids

Part - B

Write short answer (2 marks)

1. Name the proteins present in egg.
2. Explain any one method of evaluating egg quality
3. What is rigor mortis?
4. What is the fat content of toned milk?
5. Which is the pigment that gives red colour to meat?

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6. What is rennet?

7. What is homogenization?

8. What is ageing of meat?

9. How can meat be tenderized?

10. Give any two uses of eggs in cookery.

Part - C

Answer in brief (3 marks)

1. Draw the structure of an egg and name the parts

2. Compare the characteristics of fresh and deteriorated eggs

3. Explain post mortem changes in meat.

4. Explain how fish is classified.

5. Write short notes on nutritive value of milk.

Part - D

Answers in detailed (5 marks)

1. Explain the nutritional importance of fish and meat in the diet.

2. Discuss selection of fish.

3. What is pasteurization? Explain the different methods of pasteurizing milk.

4. Describe the different kinds of milk.

5. Explain the role of eggs and milk in cookery.

6. List the objectives of cooking meat. What are the changes that take place when meat is cooked?

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Unit 5

NUTS OIL SEEDS AND SUGAR

5.1 Nuts

Nuts are very important in our diet. They are a concentrated source of energy. They give us great energy boosts and provide our body with plenty of antioxidants, vitamins and minerals. Most of the fats contained in nuts are healthy fats like Omega 3 and other monosaturated and polyunsaturated fats (MUFA and PUFA). Groundnut, cashew nut, coconut and almonds are the nuts commonly used in India.

A wide variety of nuts are available throughout the year. They can also be stored for a long period of time. Certain nuts like almonds, pistachio, walnuts and cashew nuts are used in sweets and desserts while groundnuts and coconuts are used as oil source.

M6SRE

Sugar is a concentrated source of energy like fat. Sugar, jaggery and honey are used for confectionery. Jaggery and honey have more medicinal value than sugar.

In this lesson, the students will be able to:

- understand the major contribution of nuts and oil seeds in food preparation.

Nuts oil seeds and sugar

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- learn about fatty acid composition of different oils seeds.
- gain knowledge about the role of fats in cooking.
- role of sugar and jaggery in confectionary.
- learn about nutritive value of sugar, jaggery and honey.

5.1.1 Groundnuts

Groundnuts are a very rich source of protein and fat. They are exceptionally rich in ***Niacin,*** a B- complex vitamin. Groundnut is called the '***king***' of oilseeds. It is one of the most important food item and cash crop of our country. Besides being a valuable source of all the nutrients, it is a low priced commodity. Groundnut is also called as "***wonder nut***" and poor man's "***cashew nut***".

Importance of groundnut

- Groundnut is particularly valued for its protein content .
- Groundnuts contain more protein than meat and two and a half times more than in eggs.
- In addition to protein, groundnuts are a good source of calcium, phosphorus, iron and zinc.

Fig 5.1: Groundnut

- Groundnuts also contain vitamin 'E' and less amounts of vitamin 'B' complex.
- Being an oil seed crop, it contains 40 to 49% of oil.
- Groundnut oil is extremely high in mono-unsaturated (MUFA) and polyunsaturated (PUFA), which help in lowering low-density lipoprotein (LDL) cholesterol.

Role of groundnut in cookery

1. It is also called peanut.
2. Groundnuts are boiled or roasted and consumed.
3. It is also used in the preparation of peanut butter.
4. The chief product is the oil which can be used for cooking.
5. The cake left after the oil is extracted , purified and used as a supplementary mix.
6. It is also used to make various food preparations like butter, traditional candies (peanut candy) and chocolate, chutney, laddu, barfi , etc.

5.1.2 Cashew nuts

1. Cashew nuts are rich source of protein, fat and some amount of iron.
2. One ounze of cashewnut contains 5 grams of protein and high levels of essential minerals such as iron, magnesium, phosphorus, zinc, copper and manganese, which are good for health.

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Fig 5.2: Cashew nuts

3. Cashew oil contains anti-bacterial properties that help our body to build up the immune system and fight against various infections and diseases.
4. It also enhances the eye sight alongside lessening irritation.

ACTIVITY - 1

Cashew fruits are commonly grown in _____ parts of India. The fruit is used to make wine.

Role of cashew nuts in cookery

1. Sweet can be made from cashew nuts.
2. Whether roasted, salted, sugared or covered in chocolate, cashew nuts are often used as a flavour complement to appetizers, main dishes and deserts.

5.1.3 Coconut

The coconut palm (Cocos nucifera) is one of the most useful palm in the world. Every part of the tree is useful for human for some purpose or the other. Therefore, the coconut palm is also called as 'Kalpavriksha' meaning "the tree of heaven".

The white kernel of coconut is rich in calories though not a very good source of protein. It is extensively used in cookery in Tamil Nadu and Kerala. The white kernel when dried is called **"copra"** and has a high content of oil.

Fig 5.3: Coconut

ACTIVITY - 2

Name some Major coconut growing states in India._____

_____

Role of coconut in cookery

1. Kernel is ground and are used as thickening agent. In the preparation of curries, chutneys, sweets and puddings.
2. Made into sweets.
3. Coconut dried and made into flour is used in bakeries.
4. Coconut oil is used as a medium of cooking.

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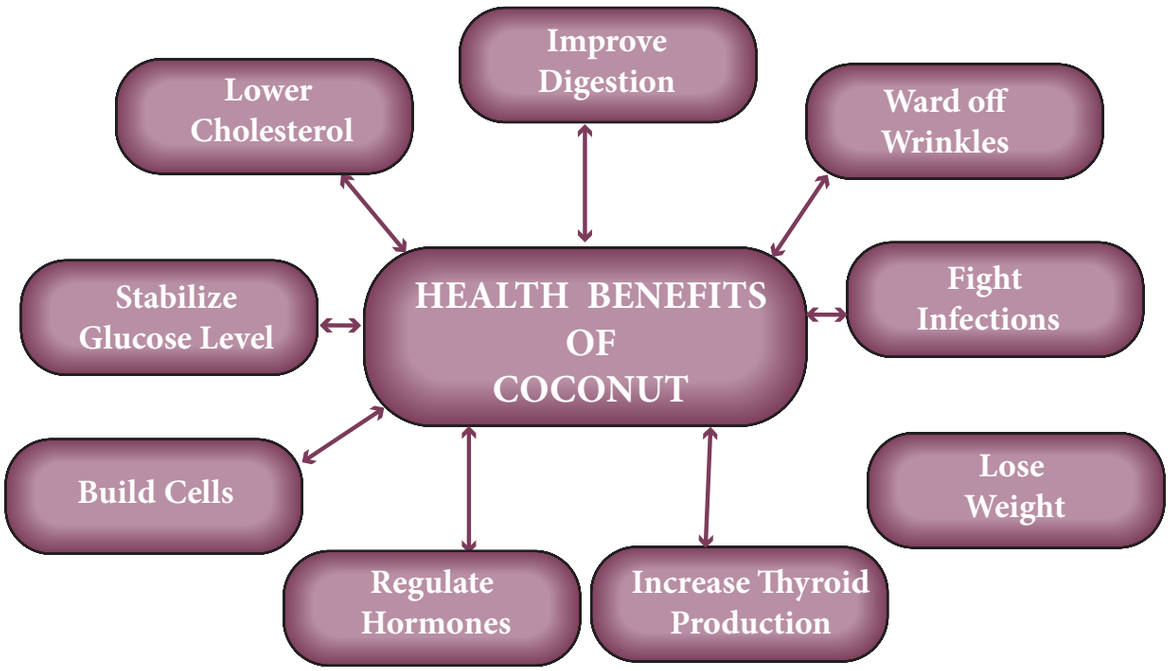

Fig 5.4: Health benefits of coconut

Coconut is used for its strong antioxidant properties and health benefits.

5.1.4 Almonds

Almonds or Badam are concentrated source of energy as they have 60 percent fat. Almonds have 20 percent protein like pulses. Like other nuts, carbohydrate content is low.

1. Almonds are used in the preparation of badam milk and sweets.
2. It is a rich source of protein that are not of high biological value.
3. Almonds are an excellent source of vitamin E, an antioxidant.
4. It reduces the heart disease by reducing **LDL (bad) cholesterol.**

Fig 5.5: Almonds

ACTIVITY - 3

List some commonly used nuts world wide.

1. _____ 2. _____
3. _____ 4. _____

Nuts and oilseeds as source of antioxidants

1. Groundnuts are rich in the antioxidant flavonol.
2. Sesame seeds contain sesamol which has superior oxidative stability.
3. Mustard possess strong antioxidant activity.

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5.2 Oil seeds and their importance

Oil is extracted from a range of oilseeds, fruits, nuts and seed kernels. However, not all oil bearing seeds and nuts contain edible oil. Some contain poisons or unpleasant flavours and are only used as thinner in paints.

A variety of vegetable oils are used for household cooking, and also as an ingredient for other food products such as baked items and snacks. Many oilseeds like mustard, corn, sunflower, sesame, palm and olive seeds are used everyday in various parts of our country for cooking purpose.

5.2.1 Mustard Seeds

- Mustard seeds are used for making mustard oil which is widely used for cooking in India.
- Mustard oil is a great oil substitute for traditional cooking oil as it is often used as a stimulant to help digestion and circulation.

Fig 5.6: Mustard

Due to its antibacterial properties, this oil can help protect the skin. It can also prevent cold, cough and skin problems.

5.2.2 Corn Oil

- Corn oil is a healthy edible oil.
- It is composed mainly of poly unsaturated fatty acids (PUFAs) and low on saturated fat.

5.2.3 Castor Seeds

- Castor seeds are used for making castor oil which is mostly used for beauty care purpose like hair care, skin care and other health benefits.
- Castor oil has a little higher viscosity so it is stickier than other types of oil.

Fig 5.7: Corn Oil

Fig 5.8: Castor Seeds

5.2.4 Sunflower Seeds

- Sunflower seeds are used for making sunflower oil which is widely used in cooking.
- It is low in carbohydrate and contains 40 percent fat and quality protein.
- Sunflower oil is a great option as it is a good source of vitamin E. It

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contains all the essential nutrients that are required for a healthy body.

- The Poly Unsaturated Fatty Acid (PUFA) helps in lowering cholesterol. It prevents colon cancer and is helpful in the repairing of the body, boosts the immune system and also promotes proper functioning of the nervous system.

5.2.5 Sesame Seeds

- Sesame oil is made from sesame seeds. It is used for cooking, body massage, ayurveda and also as alternative medicine.
- Sesame oil is one great choice as it has a few restorative properties. Sesame oil is beneficial for diabetics and also brings down the circulatory strain of the heart.
- It enhances oral cleanliness and dental well being of a person.

5.2.6 Palm Oil Seeds

- Palm oil seeds are largely obtained from tropical, subtropical and warm regions of the world.
- These seeds are used for making palm oil which has many benefits. Palm oil is a rich source of antioxidants, carotenes and Vitamin E.

5.2.7 Olive Oil Seeds

- Olive seeds are largely found in Mediterranean region in some parts of Asia and Africa.
- Olive oil is used in cooking, and it is also good for heart.

Fig 5.9: Sunflower Seeds

Fig 5.10: Sesame Seeds

Fig 5.11: Palm Oil Seeds

Fig 5.12: Palm Oil Seeds

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ACTIVITY - 4

List some recipes based on nuts and oils in our diet?

5. 3 Fats and oils

Fat is an important component of our diet and serves a number of functions in the body. Fat provides our body with energy. Although we can get energy from other nutrients in our diet, we need some fat as it provides essential fatty acids that our body cannot make. It is also a carrier of the fat-soluble vitamins and is necessary for their absorption. In general, no more than about one third of our energy intake should come from fat as too much fat can be associated with high energy intakes that can lead to weight gain.

5.3. 1.Nutritional significance

- A small amount of fat is an essential part of a healthy, balanced diet.

Role of fats in cooking

- They have high energy value.
- Impart palatability to diet.
- Add flavour and texture to the food.
- Improve taste and blends well with the food.
- Makes the food crispy.

In common usage, it is classified as fats and oils. Fats are solid at room temperature where as oils are liquid at room temperature.

DO YOU KNOW...?

1. Saturated eg. Butter, coconut oil
2. Mono unsaturated eg., olive oil
3. Poly unsaturated eg. Vegetable seed oil (soya been , corn, cotton seed)

Table 5.1 fatty acid composition of oil

Oil / Fats	Total Saturated	Total mono unsaturated	Total poly unsaturated
Groundnut oil	20.9	49.3	29.9
Coconut oil	89.5	7.8	2.0
Mustard oil	10.7	56.0	32.6
Sunflower	9.1	25.1	66.2
Sesame	13.7	41.3	44.5
Palm Oil	46.3	43.7	10.0
Olive Oil	14.8	74.5	10.0
Corn oil	12.7	29.6	57.4

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- Fat helps the body to absorb vitamins A, D and E. These vitamins are fat-soluble, meaning they can only be absorbed with the help of fats.
- Any fat not used by body's cells or to create energy is converted into body fat. Likewise, unused carbohydrate and protein are also converted into body fat.
- All types of fat are high in energy. A gram of fat, whether saturated or unsaturated, provides 9kcal (37kJ) of energy compared with 4kcal (17kJ) for carbohydrate and protein. The fatty acid composition of oil is given in **table 5.1**.

5.3.2 Refined oils

Vegetable oils are produced from oil-containing seed, fruits or nuts by various pressing processes, by solvent extraction and also by combination of these. A seed cake that is relatively high in protein remains, after fat extraction is often used for animal feed.

5.3.3. Hydrogenation – vanaspathi and margarine

Hydrogenation

Plant oils contain a large percent of unsaturated fatty acids and hence have a tendency to become rancid. These unsaturated glycerides in oil can be converted to saturated glycerides by the addition of hydrogen. This process is known as **"hydrogenation"**.

Hydrogenated fat is manufactured from vegetable oils by the addition of molecular hydrogen to the double bonds in the unsaturated fatty acids in the presence of nickel.

Unsaturated Fatty Acids are of two types. There are

- MUFA – Mono Unsaturated Fatty Acids

PUFA – Poly Unsaturated Fatty Acids

DO YOU KNOW...?

As per the Heart Association of America, an individual should consume PUFA up to 10% and MUFA up to 15% of his/her total calories of the daily intake. MUFAs lower the level of bad cholesterol (LDL) in the blood and raise the good cholesterol (HDL). PUFAs reduce both the good and the bad cholesterol.

Vanaspathi

Hydrogenated oil in India is known as **"Vanaspathi"**. It is manufactured by hydrogenating refined groundnut oil or a mixture of groundnut oil with other edible vegetable oils. Good and Bad Fatty Acids are found in Vanaspathi.

DO YOU KNOW...?

According to Vanaspathi Control Order, the melting point of Vanaspathi should be between 31°C and 37° C and it should contain 5 percent sesame oil and should be fortified with vitamin A.

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Margarine

- Margarine is made from vegetable oils like cotton seed oil, soya bean oil, corn oil, groundnut oil, coconut oil and also meat fat.
- Margarine is made from one or more optional fat ingredients churned with cultured pasteurized skimmed milk or whey.
- Margarine is often used as a substitute for butter.

Fig 5.13: Margarine

5.4 Rancidity

Spoilage of fats may occur on storage, particularly if the fats are highly unsaturated and the conditions of storage are conducive to chemical change in the fats. It is called Rancidity. There are two types of rancidity.

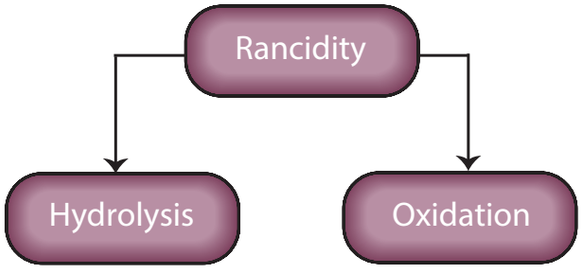

Fig 5.14: Types of rancidity

"Hydrolysis" is the decomposition of fats into free fatty acid and glycerol by enzymes in the presence of moisture. These free fatty acids released are responsible for the unpleasant flavour and odour.

During **"oxidation"** oxygen is added to the unsaturated linkage and this result in the formation of peroxides. These peroxides

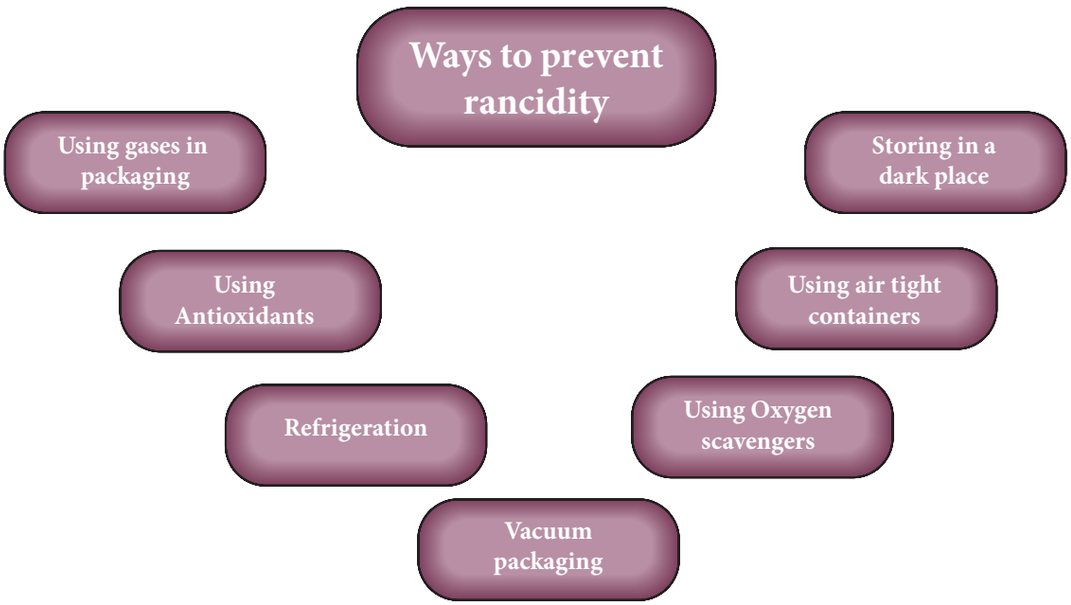

Fig 5.15: Ways to preventive measures

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decompose to yield aldehyde and ketones which are responsible for the pronounced flavour.

Rancidity may also be caused by the absorption of odour and action of micro organism and enzymes.

Preventive Measures :

1. Adding inert Gases : Inert gas can be added to the packet or the container like nitrogen, which does not react with oxygen. Example Chips packets are flushed with nitrogen gas, so they don't become rancid.

2.Adding Antioxidant : Antioxidant are added to some foods to slow down or eliminate oxidative deterioration.

3. Refrigeration reduce the temperature and hence don't allow the microbes to continue their processes.

4. Vacuum Packaging is done to keep oxygen out.

5. By using oxygen scavengers or oxygen absorbers are added to enclosed packaging to help remove or decrease the level of oxygen in the package. They are used to help maintain product safety and extend shelf life.

6. Keeping food in air tight containers Less air too prevents rancidity.

7. By storing food in dark place.

Examples of Antioxidant:

- BHA – Butylated Hydroxy Anisole.
- BHT - Butylated Hydroxy Toluene.

5.5 Sugar, jaggery and honey

Sugar, jaggery and honey are sweetening agents. They are added to beverages and foods to increase palatability. Sugar is made up of glucose and fructose. It is a source of energy providing 4 kilocalories per gram. Sugar provides only empty calories. Jaggery is made from sugar cane juice after processing it. Jaggery is a fair source of iron. Palmyra palm, date palm or coconut palm is used to make jaggery. Honey is the golden coloured syrup made by bees from the nectar of flowers. It is a mixture of glucose and fructose.

5.5.1 Sugar

Sugars are carbohydrates from the sugarcane plant and sugar beets. It is also present naturally in fruits, vegetables and dairy. Our body uses sugar to give energy to our cells by breaking it down to glucose.

5.5.2 Types of sugar

Regular or white granulated sugar: It is the most common sugar called for in recipes when cooking and baking.

Confectioneries or powdered sugar: Powdered sugar is simple granulated sugar ground to a smooth powder and then sifted. Commercially available powdered sugar is mixed with a small amount of corn starch (3%) to prevent caking. It is often used in icings, confectionaries and whipping cream.

Castor sugar (Super fine sugar): This sugar has the smallest crystal size of white granulated sugars. It is generally used in making delicate or smooth desserts such as puddings. Because the crystals are so fine, they dissolve easily, even in cold drinks.

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White granulated sugar

Palm sugar

Brown sugar

Beet sugar

Powder sugar

Fig 5.16: Types of sugar

Brown sugar: Brown sugar is made by mixing white sugar with various amount of molasses. Light brown sugar is often used in sauces and most baked goods.

Liquid sugar: Liquid sugar is white granulated sugar that has been dissolved in water. Liquid sugar is often used in drinks.

Palm sugar: It is a sweetener derived from any variety of palm tree. Palm sugar is an ingredient in both sweet and savoury dishes used throughout Asia, Middle East and North Africa.

Sugar and related products

1. Sucrose
2. D- Glucose
3. D- Fructose
4. Dextrose Syrup
5. Corn Syrup

Beet sugar: Sugar beet is a plant whose root contains a high concentration of sucrose and which is grown commercially for sugar production.

Function of sugar in foods

Sugars have a number of functions in the preparation of foods, such as improving taste and texture.

- Providing sweetness.
- Used as preservatives in jams and jellies.
- Increasing the boiling point or reduces the freezing point of foods.
- Allowing fermentation by yeast.

Health facts about sugar :

- Sweetened beverages such as colas, packaged fruit juices, aerated drinks should be avoided/limited as far as possible as the sugar in these products provide empty calories.

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➢ High amounts of fat and sugar are used to prepare confectionery (cakes, pastries) and sweets. These foods should be consumed sparingly.

Sugars have long been cited for contributing to obesity, high blood pressure and high cholesterol. Here are some of the effects that consumption of too much sugar on health:

ACTIVITY - 5

List the different types of traditional sweets prepared with sugar and jaggery.

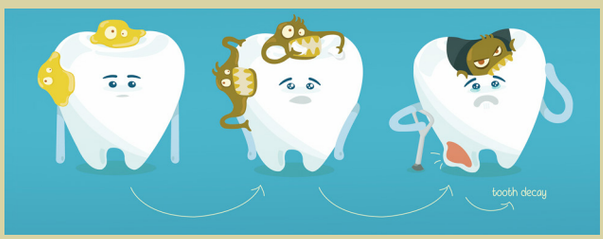
Too much sugar

- Cardiovascular Disease
- Dizziness
- Cholesterol
- Colon & Pancreatic Cancer
- Attention Deficit Disorder-ADD
  Attention Deficit Hyperactivity Disorder-ADHD
- Obesity
- Tooth decay
- Allergies
- Hypertension
- Type 2 Diabetes
- Metabolic Syndrome

Dizziness

Obesity

Allergies



Tooth decay

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Sugar as a source of energy

Sugar is an important source of energy. During digestion, all carbohydrates in food (starches and sugars) break down into simple sugars. These molecular sugars are absorbed from the intestine into the blood stream and travel to the cells, where they are used to provide energy for cellular functions. In parts of the world, where people suffer from energy malnutrition and are undernourished, sugar is valued as an inexpensive source of energy to support human activities.

5.5.3 Stages of sugar cookery

When sugar is boiled at different temperatures, various sweets can be made.

5.5.4 Jaggery

Jaggery is a concentrated product of cane juice and can vary from golden brown to dark brown in colour. It contains upto 50% sucrose, 20% invert sugars and 20% moisture. It is mostly produced in India and Africa. It is used to make several Indian desserts and is known as a healthy replacement of sugar, primarily because it is unprocessed.

Forms of Jaggery

- Jaggery square – Achu vellam
- Jaggery palm – *Karuppatti*
- Jaggery (paagu) – *Paagu vellam*

Jaggery can also provide therapeutic benefits, and hence used as various medicines in ayurveda and folk medicine.

Table 5.2 Stages of sugar cookery

Product	Temperature	Test	Description of
Syrup	110-112°C	Thread	When syrup is dropped from a spoon, syrup spins a 5cm thread
barfi, fondant,fudge	112-115°C	Soft ball	Froms a soft ball when syrup is dropped in cold water.
Caramels	118-120°C	Firm ball	Froms a firm ball when syrup is dropped in cold water, does not flatten on removal from water.
Divinity, laddu, marshmellow	120-130°C	Hard ball	Froms a ball hardenough to hold its shape when syrup is dropped in cold water.
Butterscotcht	132-143°C	Soft crack	Froms threads which are hard but not brittle when syrup is dropped in cold water.
Brittle	150-154°C	Hard crack	Froms threads which are brittle when syrup is dropped.
Caramel	170°C	brown liquid	Sugar melts and browns.

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Some medicinal uses of jaggery are given below:

a) Common cold

The simple use of jaggery helps to get remedy from common cold. It is taken with dried ginger and black pepper and has similar effects as conventional medications.

Jaggery	3 grams
Black pepper	250 mg
Dried ginger powder	500 mg
Honey	1 tsp

Crush jaggery crystal , mix it with other ingredients. Eat it after meal three times a day. It works immediately after eating first dose.

Benefits of honey:

1. Useful for Weight reduction
2. Used for healing wounds
3. Home remedy for cough
4. Acts as a natural sleeping aid
5. Natural home remedy for dandruff
6. Natural energy drink
7. Bleaches Face & Skin
8. Boosts memory
9. Boosts Immune System
10. Helps with herbs.

b)Chronic Cough

Jaggery also works as chronic cough remedy. It reduces throat irritation due to soothing and smoothening effects on soft tissues of throat. According to ayurveda, it produces warmth to the lungs and dilates the respiratory tract, so it helps in cough, asthma and breathing trouble.

QI4BZ

5.5.5 Honey

Honey is a sweet food made by bees from the flowers nectar or honeydew droplets. It is the only food that includes all the substances necessary to sustain life, including enzymes, vitamins, minerals, and water and even more.

Honey is one among the most popular and widely used sweeteners with enormous health benefits. The health benefits and advantages of honey have been valued since ages.

Summary

- Nuts are very important for our diet. They give us energy and provide our body with plenty of antioxidants, vitamins and minerals.
- Groundnuts are a very rich source of protein and fat. They are exceptionally rich in Niacin.
- Cashew oil contains anti-bacterial properties that help our body to build up the immune system and fight against various infections and diseases.
- Almonds are an excellent source of vitamin E an antioxidant.
- Hydrogenated fat is manufactured from vegetable oils by the addition of molecular hydrogen to the double bonds in the unsaturated fatty acids in the presence of nickel.

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- Margarine is made from vegetable oils. These types of fats help to reduce low-density lipoprotein (LDL), or bad, cholesterol when substituted for saturated fat.
- Vaccum packaging is done to keep oxygen out.
- Sugar, jaggery and honey are sweetening agents.
- Jaggery is a sweetener that is made from sugarcane.

Glossary

Terms	Meaning
MUFA	Mono Unsaturated Fatty Acid- fatty acids that have one double bond in the fatty acid chain with all of the remainder carbon atoms being single bonded
PUFA	Poly Unsaturated Fatty Acids- fatty acids that contain more than one double bond in the fatty acid chain.
Ounce	A unit of weight (one sixteenth of a pound approximately 28gms)
Kernel	A softer usually edible part of a nut, seed or fruit stone
HDL	High Density Lipoprotein called as good cholesterol
LDL	Low Density Lipoprotein called as bad cholesterol
Viscosity	State of being thick sticky and semifluid in consistency, due to internal friction
Free radicals	An uncharged molecule having an unpaired valency electron
Restorative	Having the ability to restore health strength or well being
Rancidity	Spoilage of oil foods
Oxidation	It is the chemical process by which an atom or group of atoms loses elctrons
Deterioration	The process of becoming progressively worse
Confectionery	collection of Sweets and chocolates
Chronic	Persisting for a long time or constantly recurring

Questions

Part- A

Choose the correct answer: (1 mark)

1. Nuts are a rich source of _____and _____

a) Protein, Fat

b) Calcium, Fat

c) Carotenoids, Fat

d) Carotenoids, Protein

2. Mustard oil contain _____ amount of total saturated fatty acid

a) 56.0

b) 20.9

c) 20.10

d) 20.11

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3. Hydrogenated oil in India is known as _____

a) Vanaspathi

b) Butter

c) Margarine.

d) Ghee.

4. Fat helps the body absorb vitamins ___, ___ and ___

a) A, D, E

b) A,C, E

c) A, D, K

d) A, D, B

Part- B

Write short answers (2 mark)

1. Write the importance of groundnut
2. List the uses of cashew nuts
3. Write three uses of coconut in cookery.
4. Write short notes on Hydrogenation
5. Define Rancidity.
6. Write short note on sugar?
7. What are the benefits of Honey?
8. Write short notes on Jaggery.

Part – C Brief Answers (3 mark)

1. Write on the uses of fats in cookery.
2. Write short note on sunflower seeds
3. What is Margarine?
4. Discuss about refined oils
5. What are the functions of sugar?
6. Write on the ill effects of sugar
7. What are the types of sugars available in the market?

Part- D

Answers in detailed (5 mark)

1. What are the oils commonly used in your home and add a note on their characteristics
2. Explain the role of nuts in cookery.
3. Explain the types of sugars.
4. Compare the nutritive value of sugar, jaggery and honey.
5. Discuss the role of fats in cooking.
6. Discuss the nutritional significance of fats and oils.

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Unit 6

QE1B0

SPICES, FOOD ADDITIVES AND FOOD ADULTERATION

Spices and aromatics are the very heart of Indian cooking. It has been used since ancient times and mentioned in Vedas, Egyptian Papyruses and the Old Testament. Food additives are substances added to food to preserve flavour or enhance its taste. It's been used for centuries. Due to increase in population and more demand for food the food adulteration is caused in today's world. An idea about spices, food additives and food adulteration helps us proper selection and usage.

In this lesson, the students will be able to:

- know the role of spices in Indian cookery.
- know the nutritive value, medicinal use and functional use of various spices in cookery.

Spices, food additives and food adulteration

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- acquire knowledge of using how to use food additives.
- detect food adulterants in the foods available at home.

6.1 Spices

A spice is a seed, fruit, root, bark or leaf of plant substance primarily used for flavouring, colouring and preserving food. Spices are distinguished from herbs while the herbs are the leaves, flowers or stems from plants used for flavouring or as a garnish. In the culinary arts, the word ***spice means "Any dried part of a plant, or bay leaf which is used as spice and it used for seasoning and flavouring a recipe, but not used as the main ingredient".***

6.1.1 Role of spices in Indian cookery

- Spices add flavour to food, make the food palatable and add variety in the daily diet.
- Spices stimulate salivation, acid secretion and digestive enzymes.
- Spices like turmeric, pepper have medicinal values such as anti-inflammatory, anti-bacterial, stimulant and antioxidant properties.
- Spices help in improving the impaired blood glucose levels in the body and control diabetes.
- Spices reduce cholesterol levels and useful in preventing heart diseases.
- Spices act as preservatives, thus prolongs the shelf life of foods.

ACTIVITY - 1

Does the spice available in your home fulfill the following? Please tick ☑ or ☒

1. Increases food quantity: ☐
2. Adds flavour to food: ☐
3. Gives colour to food: ☐
4. Enrich taste of food: ☐
5. Increase nutrient value: ☐

6.1.2 Nutritional Value of Spices

Spices are usually used in small quantities to flavour a dish. They add few calories to meal and cause a less impact on the nutritive value of foods. Spices add calories to food in negligible amount, even though many spices made from seeds contain high portions of fat, protein and carbohydrate when used in larger quantities.

DO YOU KNOW...?

Food Fact: India is the major producer, consumer and exporter, of spices in the world. India produces about 60 lakh MT of spices which 6.9 lakh MT(11%) is been exported to 150 countries. (*Source: Ministry of Spice Board of India)MT-Metric tone

DO YOU KNOW...?

India is said to be the home of Spices. World most expensive spice is saffron and second most expensive spice is cardamom. (*Source: Indian Spice Board. Com). In India Kerala produces 95% of total pepper output.

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6.1.3 List of Indian Spices and its uses

Table 6.1 List of Indian Spices and its uses

S.No.	Name of the Spices	Tamil name	Parts which is been used	Functional/Medicinal uses
1.	All spice	-	Seeds	Flavouring agent in cakes, breads and cookies.
2.	Asafoetida	Perunkayam	Resin from the tree	Helps in digestion, has Anti flatulence properties, good for bronchitis and whooping cough.
3.	Bay leaves	Brinji ilai	Dried leaves from bay tree	Flavouring agent in curry and rice preparation.
4.	Cardamom	Elakkai	Fruit pod	Helps in removing fat, cure for skin and urinary problems.
5.	Red chilli	Kaindha milagai	Seeds/Fruit	Rich in vitamin-A, used for spicy dishes
6.	Green Chilli	Paccha milagai	Fruit from plant	Rich in vitamin-A, used as flavouring agent in curries
7.	Fenugreek seeds	Vendhayam	Seeds from fenugreek plant	Used to reduce blood sugar level carminative, and relieves anorexia.
8.	Garlic	Poondu	Bulb from garlic plant	Helps in digestion, appetizer and stimulant. It has an antibiotic factor Allin in it which prevents cancer.
9.	Ginger	Inji	Stem of the plant	Helps in digestion, anthelmintic.

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10.	Clove	Krambu/ lavangam	Flower buds	Used as refrigerant, helps in digestion, stimulant, anti spasmodic, antibacterial. Relieves tooth ache.
11.	Cinnamon	Pattai	Bark of the tree	It is diuretic, given as tonic, analgesic and anti-inflammatory.
12.	Coriander Seed	Dhaniya/ kothumali vidhai	Seeds	Used as flavouring and thickening agent. Analgesic and anti-inflammatory.
13.	Cumin seed	Jeeragam	Seed	Used to cure constipation, acts as galactogogue, uterine and nerve stimulant.
14.	Aniseed	Sombu	Seed of ajwain family	Helps in relieving flatulence, induce perspiration, used in asthma medicine.
15.	Mustard	Kadugu	Seeds of mustard plant	Anti inflammatory cures skin disease, thermogenic.
16.	Pepper	Milagu	Dried fruit	Used to cure fever, asthma, cough, arthritis helps in digestion and flatulence.
17.	Poppy seeds	Kasakasa	Seed	Acts as skin moisturizer, used in internal haemorrhages, diarrhoea and dysentery.

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18.	Star anise	Annasi mogu	Seed	Used as Anti-influenza drug, deodorant, helps in digestion.
19.	Turmeric	Manjal	Stem	Anti septic, appetizer cures skin diseases, asthma, cough, bronchitis, inflammations, ulcers, intestinal worms and skin discolouration.
20.	Tamarind	Puli	Fruit pulp from tamarind tree	Used as flavouring and souring agent. Used as laxative, helps in gastropathy.
21.	Saffron	Kunguma poo	Stigma the plant	Used as colouring agent. acts as stimulant, helps in curring bronchitis, fever, epilepsy, skin diseases.
22.	Ajwain	Omum	Fruit	Helps in digestion and has anti flatulence properties.
23.	Nutmeg	Jathikai	Seed	Used as flavouring agent. has anti-bacterial, antiseptic and anti microbial properties.
24.	Mace	Jathi pathri	Dried aril of nutmeg(outer covering of nutmeg)	Used as flavouring agent. Has anti microbial property.
25.	Dill	Sadakuppi	Seeds and leaves are used	Used as flavouring and curing agent. Has anti pyretic property.

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26.	Fennel	Sombu	Bulb, foliage and seeds of anise were used	Used as flavouring agent. Similar to anise. Prevents cardiac problems.
27.	Vanilla	Vanilla beans	Seeds of vanillin plant	Used as flavouring agent. Cures stomach ailments.
28.	Curry leaf	karuvepillai	leaves	Used as flavouring agent and garnishing agent.

Garam masala used in all curry preparations in India is a mixture of eight spices- cloves, cinnamon, black pepper, mace, bay leaf, cardamom, cumin, coriander seeds

6.2 Food additives

According to Food Protection Committee of the Food & Nutrition Board, Food additives may be defined as "A substance or mixture of substances, other than a basic food stuff, which is present in a food as a result of any aspect of food production, processing, storage or packaging". The term does not include chance contaminants.

Food additives are substances which are added to food which either improve the flavour, texture, colour, chemical preservatives ,taste, appearance or function as processing aid.

6.2.1 Need for food additives

- It provides protection against food spoilage during storage, transportation, distribution and processing.
- It is included in the preparation of convenience foods like jams and jellies.
- To fortify or enrich the foods.
- It is used to add colour, flavour, firmness and retards or hastens chemical reaction in food.
- To maintain nutritional quality of food.
- Used as a preservative and colouring agent.

6.2.2 Classification of food additives

The food additives can be classified as following:

- Preservatives
- Colouring agents
- Anti oxidants
- Artificial sweeteners

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- Flavouring agent
- Emulsifiers, Stabilizers and Thickeners
- Flour improvers
- Humectants
- Curing agents
- Chelating agents
- Leavening agents

1. Preservatives

Preservatives are the compounds used to prevent and retard the microbial spoilage of food. They are classified in to

i. Class I and

ii. Class II preservatives.

Class I preservative: They are natural substances and addition of it in food is not restricted. Eg. Salt, sugar, honey, vegetable oil, spices etc.

Class II preservative: They are chemical substances which should be included in food in a restricted quantity. Eg. Benzoic acid, Sorbic acid etc.

2. Colouring agents

It is a dye, pigment or substance to impart colour in the food. It is classified into

i. Natural colours (Naturally available Eg. Turmeric)

ii. Synthetic colours (Synthesised from fruits, vegetables and chemicals Eg: Tartrazine, sunset yellow)

3. Artificial sweeteners

These are said to be sugar substitute which contains less energy, which are not produced naturally. Eg. Saccharin, Aspartame, Dulcin etc.

4. Anti Oxidants

Antioxidants are added to oils and fats to prevent oxidative rancidity Eg. Ethyl Propyl, Octyl Gallates etc

5. Flavouring agents

They form a divergent group of organic compounds both natural and synthetic in nature. Eg. Menthol, vanillin etc.

6. Emulsifiers, Stabilizers and Thickeners

A variety of organic compounds form the group of emulsifiers, stabilizers and thickening agents Eg. Guar gum, Gelatin, Agar-agar etc.

7. Humectants

These are moisture retention agents. It controls viscosity, texture, bulking, retention of moisture, reduction of water activity, control of crystallization and improvement of softness. Eg. poly hydroxyl alcohols.

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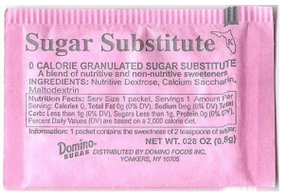
ACTIVITY - 2 and 3



Find the additive present in various food packets available in the market.

1. .....
2. .....
3. .....
4. .....
5. .....
6. .....

Is it healthy, delicious and can be taken regularly? If Yes/No. Give reasons?

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8. Flour improvers

These are bleaching and maturing agents used to bleach and mature the flour. Eg. Benzyl peroxide.

9. Curing agents

These are additives to preserve meat, give them desirable colour, flavour, and discourage microbial growth. Eg. Sodium nitrite

10. Chelating agents

These are anti oxidants. They serve as scavengers of metals which catalyze oxidation. Eg. Ethylene Diamide Tetraacetic Acid(EDTA)

11. Leavening agents

Leavening agent causes expansion of dough and batter by releasing gas and gives porous structure. Eg. Yeast , Baking powder and baking soda

6.2.3 Harmful effects of food additives

1. **Hydrogenated Fats—** It cause cardiovascular disease and obesity
2. **Artificial Food Colors—** It leads to allergies, asthma and carcinogenic
3. **Nitrites and Nitrates—** Carcinogenic
4. **Sulfites (sulfur dioxide, metabisulfites, and others)—** It leads to allergy and asthmatic reactions
5. **Sugar and Sweeteners—** It leads to obesity, dental cavities, Hypoglycemia and diabetes.
6. **Artificial Sweeteners** (Aspartame, Acesulfame K and Saccharin)—It cause behavioral problems, hyperactivity, allergies. T**he government has given statutory warning against the use of any artificial sweetener for children and pregnant women foods.**

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7. **Preservatives (BHA, BHT, EDTA, etc.)**— causes allergic reactions, hyperactivity, and liver problems
8. A**rtificial Flavours**— leads to allergic and behavioral problems
9. **Refined Flour**— low-nutrient calories, carbohydrate imbalances, altered insulin production
10. **Salt (excessive)**- Increase in blood pressure

6.3 Food Adulteration

Food is the basic necessity of life. The quality and safety aspects of food are paramount significance, but the major problem we face is Food ***Adulteration. Adulteration is defined as the process by which quality or the nature of a given substance is reduced through***

i. The addition of a foreign or an inferior substance

ii. The removal of a vital element.

The word adulterated implies on element of deceit. It means mixing the food with something inferior or spurious.

Adulterant is defined as any material which is employed or which could be employed for the purpose of adulteration.

ACTIVITY - 4

Mention the additives present in various food items?

S.No.	Name of the food item	Additive present
1.	Cake	
2.	Ice creams	
3.	Squash, jam and jellies	
4.	Bottle drinks	
5.	Maida	
6.	Pickles	
7.	Cookies	
8.	Kesari	
9.	Cooking oil	
10.	Pastries	
11.	Fastfoods	
12.	Noodles	
13.	Chocolates	
14.	Candy	
15.	Canned items/foods in tin	

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6.3.1 Types of Food Adulteration

Foods may be adulterated either intentional or incidental at all stages from production to selling.

1. Intentional Adulteration
2. Incidental adulteration

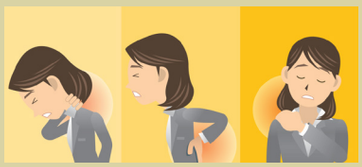
Intentional Adulteration

Adulterant is added knowingly to increase profit. This type of adulteration includes intentional addition, substitution or addition or removal of substances which adversely affects the quality of food. Eg. Sand, marble chips, Earth and other filth.

Incidental Adulteration

Incidental contamination is due to ignorance, negligence or lack of proper facilities. Eg. Toxic metals, presence of bacterial and fungal contaminants.

6.3.2 Flow chart depicting health problems of food adulteration



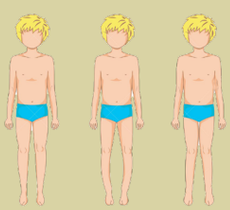
Nervous damage

Fever

Vomiting

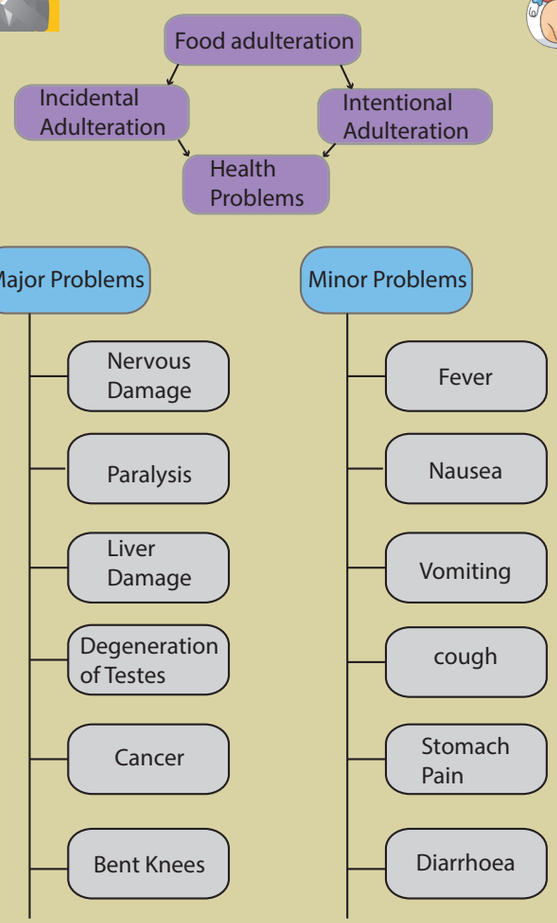
Paralysis

Cough



Bent kness

Diarrhoea



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6.3.3 Methods to detect Food Adulteration

There are two methods to detect food adulterants. They are

1. Physical test

2. Laboratory chemical test

1. Physical test

It is conducted by observation or visual examination using our senses like taste, smell, and vision and also using lactometer.

2. Laboratory chemical test

Swaminathan.M has devised an instructional manual to detect food adulterant harmful effects on health is given below.

Table 6.2 Food Adulterants and its harmful effects.

S.No.	Food group	Adulterant	Harmful effects on health
1.	Cereals, wheat and other food grains	Ergot	Nausea, vomiting, Gastric pain burning sensation in extremities
2.	Pulses and legumes Dhal	Kesari Dhal and toxic dyes	Leads to lathryism.
3.	Milk and milk products Milk, Khoa, Bura cheese	Starch	Diarrhoea and vomiting
4.	Sugar and Jaggery	Washing soda	Diarrhoea, vomiting
	Honey	Invert sugar	Nausea, vomiting
	Jaggery	Washing soda Chalk powder	Diarrhoea, vomiting
5.	Edible oils and fats	Argemone oil Mineral oil Karanja oil Castor oil	Gastric problems, carcinogenic, skin problems
	Ghee & butter	Vanaspati Mashed potatoes and starches	Flatulence, gastric problems
6.	Spices & condiments Turmeric powder	Yellow aniline dyes. Non permitted colorants like metanil yellow	Causes giddiness, weakness, cyanosis, vomiting and are carcinogenic
	Chilli powder	Brick powder	Leads to gastric pain, cholic pain and indigestion

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	Asafoetida(Devil's Dung)	Foreign resins galbanum and Colophony resin	Dysentry.
	Black pepper	Papaya seeds, rotten pepper and light berries	Stomach and liver problems.
7.	Beverages Coffee powder	Tamarind and date seed powder	Diarrhoea, stomach disorder.

Table 6.3 Test for determining common adulterants present in food at home level

S.no.	Food item	Adulterant	Test
1.	Asafoetiida	Resin or scented gum and coloured	Dissolve asafoetida in water. Pure asafoetida will form a milky white solution.Burn it on a spoon. Burning like camphor indicates pure asafoetida.
2.	Sugar	Chalk powder	Dissolve in a glass of water. Chalk will settle down at the bottom indicates adulterant present.
3.	Cardamom	Oil is removed and pods are coated with talcum powder	On rubbing talcum will stick to the fingers. On testing if there is hardly any aromatic flavour it indicates removal of essential oil.
4.	Chilli powder	Saw dust and colour	Sprinkle on the surface of water, saw dust floats. Added colour will make the water coloured.
5.	Coffee	Chicory	Shake a small portion in cold water. Coffee will float while chicory will sink making the water brown.
6.	Coriander powder	Powdered Horse dung	Soak in water. Horse dung will float which can be easily detected.
7.	Cloves	Oil may be removed	If so cloves may be shrunk in appearance
8.	Cumin seeds	Grass seeds coloured with charcoal dust	If rubbed in hand fingers will turn black
9.	Rava	Iron filling to add weight.	Pass magnet through the rawa. Iron fillings get attracted to magnet.

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10.	Betelnut powder	Saw dust and artificial colour.	Sprinkle in water saw dust will float and added colour will dissolve in water.
11.	Milk	water.	Pour few drops of milk on a polished surface. Pure milk leaves a white trail while flowing and the adulterated milk will flow without leaving a mark.
12.	Sago	Sand and talcum	Pure sago swells on burning and leaves hardly any ash.
13.	Honey	Sugar plus water	A cotton wick dipped in honey is burnt. If adulterated with water, cotton wick will not burn or burns with a cracking sound.
14.	Tea dust	Used tea leaves dried, powdered and artificially coloured	Sprinkle the dust on the wet white filter paper. Spots of yellow, pink and red appearing on the paper indicates that the tea is artificially coloured.
15.	Black pepper	Papaya seeds	Papaya seeds are shrunken and greenish brown in colour. It has repulsive flavour while black pepper has pungent and hot flavour.
16.	Coconut oil	Any other oil	Keep the bottle of coconut oil in refrigerator. It solidifies while the adulterant does not.
17.	Cinnamon	Coloured Cassia bark	Added colour comes off in water.
18.	Bajra	Ergot	Immerse in salt water. Fungus floats on top of water.
19.	Common salt	Chalk powder	Dissolve in water. The water turns white and indicates presence of chalk powder.
20.	Saffron	Maize fibres coloured and scented	Pure saffron is tough. Adulterated saffron is brittle and breaks easily.

6.4 Food laws in our country

The Indian parliament has passed the Food Safety and Standards Act, 2006 that overrides all other food related laws. Such as:

- Prevention of Food Adulteration Act, 1954
- Fruit Products Order, 1955

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- Meat Food Products Order, 1973
- Vegetable Oil Products (Control) Order, 1947
- Edible Oils Packaging (Regulation) Order 1988
- Solvent Extracted Oil, De-Oiled Meal and Edible Flour (Control) Order, 1967,
- Milk and milk Products Order, 1992 etc are repealed after commencement of FSS Act, 2006.

1. Agricultural Produce (Grading & Marketing) Act -1937

Regulation

- Grade and standards are prescribed for Agricultural & Allied Commodities grading, sorting as per quality attributes and inspection are included.

Special features

- Activity based on marketing and grading at producer's level. AGMARK certification.

2. Bureau of indian standards (bis)

Regulation

- Prescribing of grade standards, formulation of standards, specification of foods standards for limit of toxic compounds as applicable.
- Implementation of regulation by promotion through its voluntary and third party certification system, specifying of packaging and labeling requirements.

Special features

- General cover on hygienic conditions of manufacture, raw material quality & safety are given. Quality and safety oriented standards.

Natural + Medicine

All Natural

Natural + Chemicals

All Chemicals

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Summary

- Spice means "Any dried part of a plant, or bay leaf used as spice and used for seasoning and flavouring a recipe, but not used as the main ingredient".
- Spices can be utilized as thickening, souring, curing, leavening, flavouring and colouring agent.
- Food additive is "A substance or mixture of substances, other than a basic food stuff, which is present in a food as a result of any aspect of food production, processing, storage or packaging".
- Food additives can be classified as preservatives, colouring agents, antioxidants, artificial sweeteners, flavouring agent, emulisifiers, stabilizers, thickeners, flour improvers, humectants, curing agents and leavening agents.
- Adulterant is any material which is employed or which could be employed for the purpose of adulteration.
- Food adulteration is classified as incidental and intentional.

Glossary

Terms	Meaning
Aromatics	Having a pleasant and distinctive smell.
Flavouring agent	A substance used to give a different, stronger or more agreeable taste to food or drink.
Colouring agent	A substance added to food to give colour to make it more appealing.
Thickening agent	A substance added to food to give dense appearance.
Curing agent	A preservation method by adding salt to food or by smoking.
Souring agent	A substance added to food to give sour taste.
Stimulant	A substance that raises levels of physiological or nervous activity.
Anti flatulence	Removal of gas from the alimentary canal.
Carminative	A drug used to relieve flatulence.
Anorexia nervosa	Psychological disturbance resulting in a refusal to eat.
Antispasmodic	The nature of cough or nature of spasm is reduced or opposed.
Diuretic	A drug used to increase passing of urine.
Analgesic	A drug used to relieve pain.
Galactogogue	A substance that promotes lactation in human or animals.
Thermogenic	Relates to or involve in the production of heat.
Laxative	A drug tends to stimulate or facilitate evacuation of bowels.

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Anti pyretic	A drug against fever
Carcinogenic	Having the potential to cause cancer
Ergot	Fungus that grows on grasses and cereal grains
Lathyrism	Disease caused by excessive intake of chick pea
Lactometer	An instrument used to measure the density of milk
Flatulence	The accumulation of gas in alimentary canal
Gastropathy	It refers to changes in the mucosa of stomach in patients with portal hypertension

Questions

Part-A

Choose the correct answer (1 marks)

1. _____ are said to be the heart of cooking.
   a. spices
   b. meat
   c. milk
   d. pulses

2. _____ is the major producer of spices.
   a. china
   b. India
   c. Japan
   d. Delhi

3. Spices add few _____ to meal.
   a. calories
   b. taste
   c. flavour
   d. size

4. _____ is also known as "Devil's Dung".
   a. nutmeg
   b. mace
   c. asafoetida
   d. dill

5. _____ is a mixture of eight spices.
   a. coriander powder
   b. garam masala
   c. amchoor powder
   d. musted powder

6. _____ are substances which are added to food to improve the flavour, texture and colour.
   a. food adulteration
   b. food colour
   c. food additive
   d. food taste

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7. To _____ or _____ food, additives are included.

a. fortify, enrich

b. increase, decrease

c. taste, cook

d. smell, cook

8. _____ are said to be sugar substitute.

a. flavanoids

b. humectants

c. artificial sweeteners

d. sweets

9. Antioxidants are added to oils to prevent _____.

a. flavour

b. rancidity

c. smoking

d. colouring

10. The word _____ implies on element of deceit.

a. adulterated

b. additive

c. preserve

d. ranciduty

11. _____ is for willful profit.

a. incidental adulteration

b. intentional adulteration

c. situation adulteration

d. adulteration

12. _____ is due to ignorance, negligence or lack of proper facilities.

a. incidental adulteration

b. intentional adulteration

c. food additive

d. situation adulteration

13. Kesari dhal added in dhal leads to _____.

a. lathyrism

b. lead poison

c. diarrhoea

d. dieases

14. Metanil yellow dyes are _____.

a. putrified

b. carcinogenic

c. curative

d. colour

Part – B

write short answers (2 marks)

1. What are spices?
2. List three spices used daily in Indian cookery
3. Define food additive
4. List any three food additives
5. Classify the colouring agent
6. Define humectants
7. Give two examples for emulsifiers
8. What is a preservative
9. Define adulterant
10. Define adulteration

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Part – C

Answer in Brief (3 mark)

1. What is the role of spices in cookery
2. Explain five spices used in Indian cookery
3. Enlist the medicinal value of any five spices
4. Explain the need for food additives
5. Write short note on preservatives
6. Classify the types of adulteration
7. Write any five harmful effects of adulteration

Part-D

Answer in detailed (5 mark)

1. Explain the different types of spices and its uses in detail?
2. Classify the types of food additives. Explain any three in detail?
3. Illustrate the flow chart of food adulteration?
4. Explain any five methods to detect food adulteration of any four food groups?

ACTIVITY - 5

1. Identify the food adulterant present in the following food items

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Unit 7

RECENT CONCEPTS IN NUTRITION

Nutrition means to nourish and encompass the food people eat and how it enriches their lives physically, socially and personally. Food provides the nutrients that sustain life, but for most of us this is not the reason why we eat what we do. Researchers have found that various foods contain naturally occurring substances other than the nutrients that promote health. These foods are known as functional foods.

In this lesson, the students will be able to:

- understand the recent concepts in nutrition, such as Genetically Modified Foods, Nutraceuticals, Nutrigenetics and Nutrigenomics.
- acquire knowledge in the field of functional foods, prebiotics, probiotics and the importance of it in day to day life.
- give an idea on how to grow organic garden at home.
- acquire information on the medicinal and functional component of various fruits and vegetables

Recent concepts in nutrition

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7.1 Food biotechnology

Genetically modified food is synthesized using biotechnological tools. Modern Biotechnology is also called as genetic engineering, genetic modification or transgenic technology. Food bio technology is defined as ***"Application of technology to modify genes of animals, plants and micro organisms to create new species which have desired production, marketing, or nutrition related properties".*** In this technology, Nuclear DNA is modified through insertion of gene of interest (gene encoding desired trait). This modified DNA is called as recombinant DNA. When r**ecombinant DNA** expresses, it encodes desired product. This technology, when implemented enhance food qualities or yield is called as food bio technology

7.1.1 Recent Food Technology

Developments in food technology have contributed greatly to the food supply and have changed our world. Some of these developments are:

- **Pharma food :** food or nutrient that claims medical or health benefits.
- **Anti oxidants:** It is capable of stabilizing or deactivating free radical before they attack cells.
- **Chemoprevention:** It uses one or several compounds to prevent, strip or reverse the development of cancer.
- **Designer food :** Processed food that are supplemented with food ingredients naturally rich in disease preventing substances.
- **Functional food:** any modified food or food ingredient that may provide a health benefit beyond the nutrients it contains.

7.1.2 Genetically modified foods

Genetically modified organisms (GMOs) can be defined as "Organisms (i.e. plants, animals or microorganisms) in which the genetic material (DNA) has been altered in a way that does not occur naturally by mating and/or natural recombination". The technology is often called "modern biotechnology" or "gene technology", sometimes also called as *"recombinant DNA technology" or "genetic engineering"*. It allows selected individual genes to be transferred from one organism into another, also between nonrelated species. Foods produced from or using GM organisms are often referred to as GM foods.

7.2 Nutraceuticals

`The term Nutraceuticals is a hybrid or contraction of nutrition and pharmaceuticals. Nutraceuticals are products derived from food sources that are purported to provide additional health benefits, in addition to the basic nutritional value found in foods. It is classified into two:

1. Dietary supplements
2. Functional foods

DO YOU KNOW...?

The word Nutraceuticals was coined by Dr. Stephen L. Defelice founder and chairman of the foundation for Innovation in Mountain side.

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ACTIVITY - 1

1. Nutraceuticals = _____ + _____.

2. Synbiotic = _____ + _____.

7.2.1 Dietary supplements

A product intended to supplement the diet that bears or contains one or more of the following dietary ingredients:

- a vitamin
- a mineral
- an herb or other botanical
- an amino acid
- a dietary substance used by man to supplement the diet by increasing the total dietary intake or
- a concentrate, metabolite, constituent, extract, or combination of any ingredient described above.

Dietary supplements are further defined as products that are labeled as dietary supplements and are not represented for use as a conventional food or as a sole item of a meal or the diet. Supplements can be marketed for ingestion in a variety of dosage forms including capsule, powder, softgel, gelcap, tablet, liquid, or indeed, any other form. Eg. Multi-vitamin capsules.

7.2.2 Functional foods

Functional foods are fortified or enriched during processing and then marketed as providing some benefit to consumers. Sometimes, additional complementary nutrients are added, such as Vitamin D to milk. Functional foods are "***Ordinary food that has components or ingredients added to give it a specific medical or physiological benefit, other than a purely nutritional effect.***" All functional foods must meet three established requirements: Foods should be

(1) present in their naturally occurring form, rather than a capsule, tablet, or powder

(2) consumed in the diet as often as daily and

(3) should regulate a biological process in hopes of preventing or controlling disease.

7.3 Classification of functional foods

Functional foods are classified in to

a. Probiotic b. Prebiotic

c. Synbiotic d. Phyto chemicals

7.3.1 Probiotic

Probiotic is a greek word which means "for life" It was coined by Lilly and Stilwell in1965. Probiotics are living microorganisms which upon ingestion in sufficient numbers, exert health benefits beyond basic nutrition. Probiotics are a viable microbial dietary supplement which uplifts the health of the host.

7.3.2 Prebiotic

In 1995, Prebiotics was defined by Gibson and Roberfroid as non-digested food components that, through the stimulation of growth and/or activity of a single type or a limited amount of microorganisms residing in the gastrointestinal tract, improve the health condition of a host. Prebiotics may be used as an alternative to probiotics or as an additional support for them. Prebiotics have enormous potential for modifying the gut

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microbiota, but these modifications occur at the level of individual strains and species and are not easily predicted a prior.

7.3.3 Synbiotic

In 1995, Gibson and Roberfroid introduced the term "synbiotic" to describe a combination of synergistically acting probiotics and prebiotics. As the word "synbiotic" implies synergy, the term should be reserved for those products in which a prebiotic component selectively favours a probiotic microorganism. Synbiotics have both probiotic and prebiotic properties and were created in order to overcome some possible difficulties in the survival of probiotics in the gastrointestinal tract.

7.3.4 Phytochemicals

Phytochemicals are plant chemicals that differ from nutrients in some important ways. Phyto is a greek word for plants. Essential nutrient which include protein, fats, minerals, and vitamins are essential for life. Phytochemicals are not necessary for life but they help to promote optimal health by lowering risk for chronic diseases, such as cancer and heart disease. They are found only in plant foods. Fruits and vegetables are among the best sources of these compounds. Phytochemicals are believed to have many health benefits and prevent lifestyle diseases.. Some groups of phytochemicals have been linked to decreased cancer risk also. Following are examples of some phyto chemicals with nutritional importance.

7.3.4a Flavanoids

Flavanoids are a special class of phytochemicals that includes hundreds of different compounds. They are excellent antioxidants and some have hormonal properties. Among some of the most studied flavonoids are allicin, which is found in onions and garlic.

Benefits of Flavanoids

1. Longer life span
2. Prevents obesity and helps in weight management
3. Prevents cardio vascular disease, diabetes, cancer.
4. Prevents neuro generative disease
5. Slows down ageing process.

7.3.4b Carotenoids

Carotenoids are a group of phytochemicals that act as pigments, giving plants their bright green, orange, yellow, red, and blue colors.

Benefits of carotenoids

- Beta-carotene, found in carrots, sweet potatoes, green leafy vegetables, red peppers, and pumpkin. Beta-carotene from foods has been linked to a reduced risk for lung cancer.
- Lycopene, found in tomatoes and strongly linked to reduced risk for prostate cancer.
- Lutein, found in green leafy vegetables and linked to reduced risk for cancer and macular degeneration.

7.3.4c Antioxidants

Antioxidants are our first line of defense against free radical damage, and are critical for maintaining optimum health and wellbeing. Antioxidants are carotenoids, lycopene, vitamin C, vitamin A, vitamin E etc..

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Benefits of Antioxidants

- Slower signs of aging, including of the skin, eyes, tissue, joints, heart and brain
- Healthier, more youthful, glowing skin
- Reduced cancer risk
- Detoxification support
- Longer life span
- Protection against heart disease and stroke
- Less risk for cognitive problems, such as dementia
- Reduced risk for vision loss or disorders like macular degeneration and cataracts
- Antioxidants are also added to food or household products to prevent oxidation and spoilage

7.4 Nutrigenetics

The study of **Nutrigenetics** concentrates on how even slight variations in our genetic code, affect our nutrient needs, susceptibility to particular diseases and response to our environment.

7.5 Nutrigenomics

Nutrigenomics is a branch of nutritional genomics and it is the study of the effects of foods and food constituents on gene expression.

7.6 Functional components of Fruits and vegetables

7.6.1 Red Fruits and Vegetables

The phytochemicals present in red coloured fruits and vegetables are **carotenoids and anthocyanins.** One of the most abundant carotenoids present in fruits is Lycopene, which helps reduce damage from free radicals in our body and it prevents heart diseases, cancer, prostrate problems and reduces the skin damage from the sun. Red fruits and vegetables are also often very high in vitamin C, which helps in cellular renewal in the body.

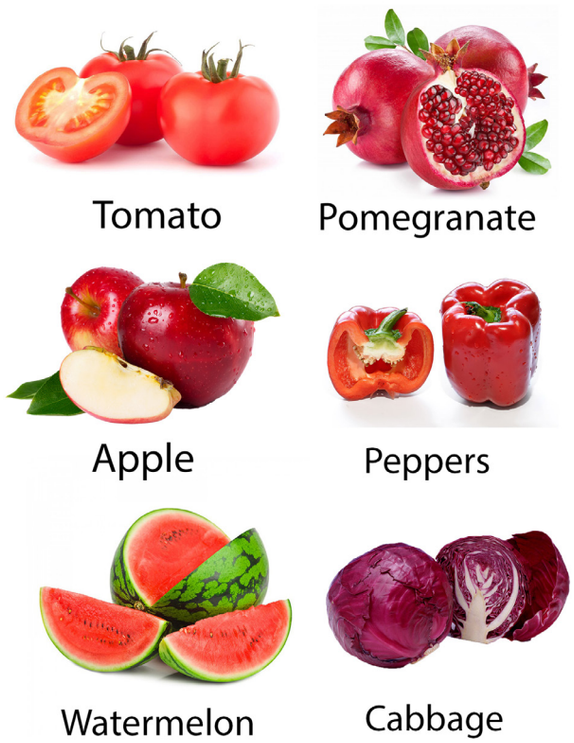

Fig 7.1: Red Fruits and Vegetables

7.6.2 Orange Fruits and Vegetables

Carotenoids are the powerful phytochemicals in orange coloured fruits and vegetables, and they give the fruits the bright color. Carotenoids repair DNA and help prevent cancer and heart disease, as well as strengthening our vision.

These orange foods also give the requited amount of potassium , vitamin A, B complex vitamin which keeps eyes and skin healthy and protects against infections.

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They also boost the immune system because of the high content of vitamin C.

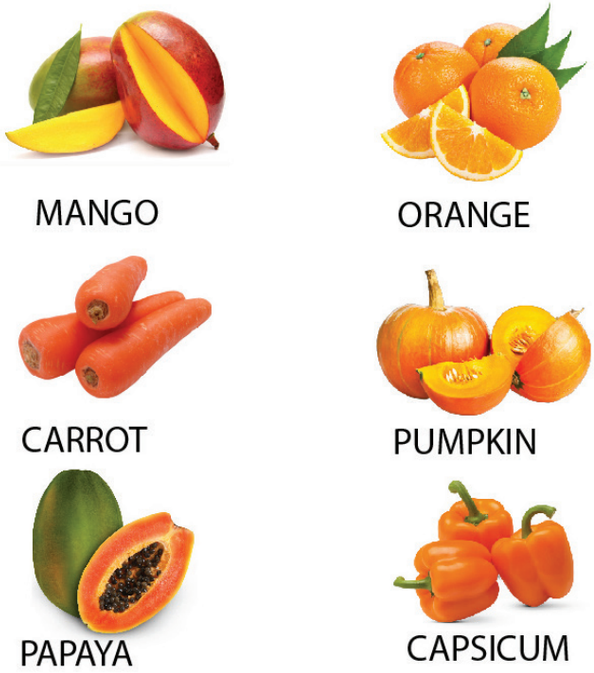

Fig 7.2: Orange Fruits and Vegetables

7.6.3 Yellow Fruits and Vegetables

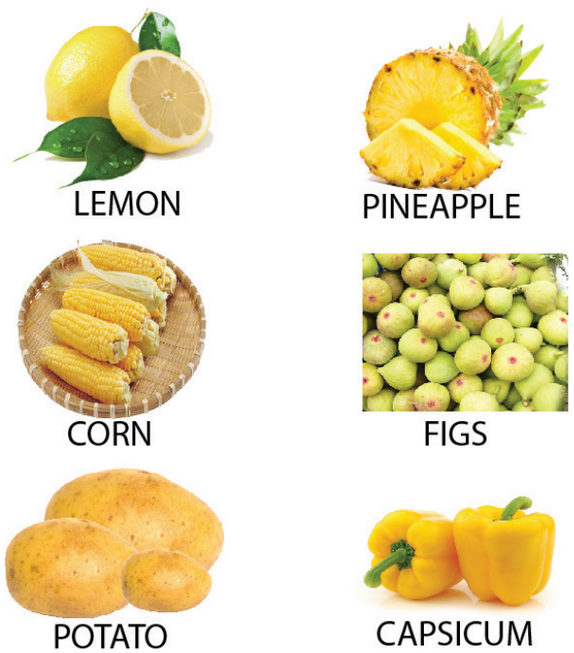

Fig 7.3: Yellow Fruits and Vegetables

Yellow foods are high in antioxidants like **vitamin C and phytosterols.** Vitamin C keeps our teeth and gums healthy, helps to heal cuts and wounds improves the mucus membranes (like when we have colds), helps to absorb iron, prevents inflammation, improves circulation, and therefore prevents heart disease.

7.6.4 Green Fruits and Vegetables

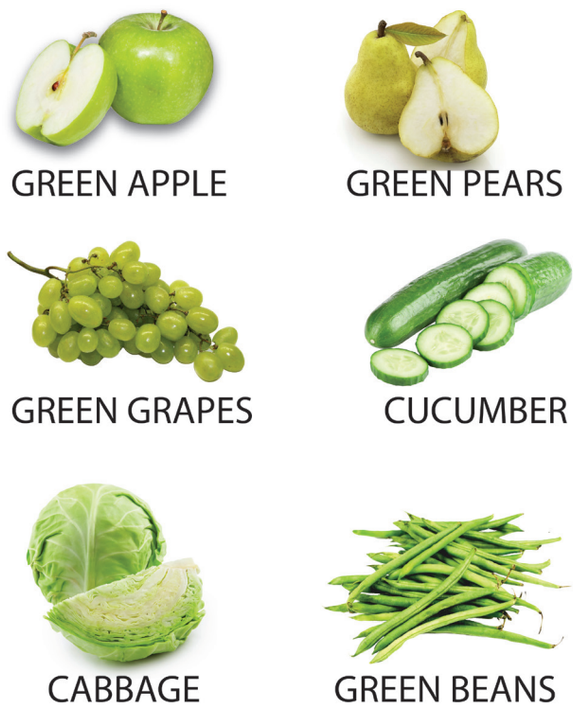

Fig 7.4: Green Fruits and Vegetables

These foods have the phytochemicals like **Terepenes, Sulforaphane and Indoles,** which both prevent cancer. They are also good for the circulatory system and are good sources vitamin B and minerals. Yellow green vegetables like figs, grapes, cucumber etc have carotenoids and lutein that help to prevent cataracts and eye disease, as well as osteoporosis.

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7.6.5 Greenish/White Fruits and Vegetables

The strong phytochemical in these whitish/greenish vegetables is called **allicin** and **allium**, which give an anti-bacterial, anti-fungal, and anti-viral chemical environment in the body. It also contains **Theols,** the sulphur containing class of phytonutirents. All phytochemicals in the greenish/white list of fruits and vegetables helps maintain low cholesterol levels in the body preventing heart diseases.

Fig 7.5: Greenish/White Fruits and Vegetables

7.6.6 Blue/Indigo/Violet Fruits and Vegetables

The blue, indigo, and violet coloured fruits and vegetables are known for their anti-aging properties. These foods are loaded with of antioxidants, specifically **anthocyanins and phenolics** which prevents free radical damage. Some blue and purple fruits and vegetables are also high in vitamin C.

Fig 7.6: Blue/Indigo/Violet Fruits and Vegetables

They improve memory function and urinary tract health.

7.7 Organic foods

Organic foods are environment friendly foods which are cultivated using animal manure and compost as natural fertilizer. Organic foods are which in the purest form, grown without the application of chemical fertilizer or pesticides and sold to the consumers without adding preservatives and synthetic food enhancers. To further enrich soil crop rotation system is followed

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7.7.1 Guidelines in Raising Organic Farms:

"Organic" technically refers to any material that is carbon-based. Organically raised food follows a set of prescribed practices that differ in a number of ways from industrialized agriculture. The farms must go through the certification process of the country or state which label their food organic. The process is expensive. Organic standards vary from country to country, and standards given below are followed in our country

- No use of synthetic chemicals
- No use of irradiation
- No use of sewage sludge (It gets used in other agriculture)
- No Genetically Modified Organisms (GMOs)
- Periodic on-site inspections

Fig 7.7: Organic foods

7.7.2 Tips to grow kitchen garden at home

1. Collect the pot materials,like sack made of jute or even synthetic sack or any reused tomato baskets, wooden baskets available from the market or unused buckets
2. Fill with good soil or compost materials (compost: you can prepare skin of vegetables, fruits and dump in a pit, spread in a layer alternatively with soil and along with earth worms for a longer period of time)
3. Purchase good variety of seeds of vegetables and fruits pertaining to the climate and season.
4. Plant it, keep it under the sun, water it regularly using water that has been used for washing vegetables, rice, dhal etc.
5. Remove the weeds regularly, don't over water it and maintain the plant by pruning the old leaves.
6. This will give you a good yield of vegetable and fruits grown from home
7. For example Brinjal, Ladies finger can be grown in all months, but tomatoes can be grown from the month April to August, and green leafy vegetables from the month of January to August

Fig 7.8: Tips to grow kitchen garden at home

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ACTIVITY - 2

Match the following

1. Cranberry	-	Carotene
2. Orange	-	Allin
3. Lemon	-	Anthocyanin
4. Broccoli	-	Phenolics
5. Purple cabbage	-	Indole
6. Garlic	-	Lycopene

ACTIVITY - 3

Do you think you can grow organic foods at home? If Yes how is it possible?

Summary

- Genetically modified technology also called as modern biotechnology or gene technology recombinant technology or genetic engineering.
- Nutraceuticals is the word which combines nutrition and pharmaceuticals.
- Dietary supplement is a product taken by mouth that contains a dietary ingredient.
- The study of Nutrigenetics concentrates on how even slight variations in our genetic code, affect our nutrient needs, susceptibility to particular diseases and response to our environment.
- World soil day-December 5th
- The phytochemicals in red foods are carotenoids and anthocyanins.
- Yellow fruits and vegetables are high in antioxidants like vitamin C and phytosterols.

Glossary

Terms	Meaning
Functional foods	Functional foods deliver additional or enhanced benefits over and above their basic nutritional value
DNA	Deoxyribonucleic acid, a nucleic acid found in chromosomes
Organic	Pertaining or relating to a compound containing carbon as an essential constituent.
Metabolites	A substance that takes part in a metabolic reaction, either as reactant or product
Fortify	Enrich with nutrients to food
Complementary nutrients	Additional nutrients
Phytochemicals	Phyto chemicals are plant chemicals
Cataracts	It is a disease in which an area of someone's eye becomes less clear
Degeneration	A term applied in biology to certain changes undergone by plant and animal life.

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Questions

Part-A Choose the correct answer(1 mark)

1. means to nourish.

   a. food

   b. nutrition

   c. calorie

   d. healtth

2. Modern bio technology is also called as _____.

   a. genetic engineering

   b. genetic modification

   c. both

   d. genetic

3. _____ is the word combines nutrition and pharmaceuticals.

   a. nutraceuticals

   b. nutigenetics

   c. nutrigenomics

   d. organic

4. _____ is the study to know how genetic code affects our nutrient needs.

   a. organic genetics

   b. nutrigenetics

   c. pharmagenetics

   d. nutrigenomics

5. _____ foods are environment friendly foods.

   a. antioxidants

   b. organic

   c. flesh foods

   d. nutrigenetics

6. _____ are said to be plant chemicals.

   a. Phytochemicals

   b. genome

   c. nutracitives

   d. nutrigenetics

Part-B

Short answers (2 marks)

1. What are functional foods?
2. Define Nutraceuticals
3. Enlist the uses of functional foods
4. Define Nutrigenetics
5. Define Nutrigenomics
6. What are pre-biotic and probiotics?
7. What is Synbiotic?

Part-C

Brief answer (3 mark)

1. Explain the classification of Nutraceuticals
2. Differentiate probiotic and prebiotic
3. Mention the Phytochemicals present in Red fruits and vegetables and its functions
4. Enlist the uses of flavanoids
5. Write short note on Nutrigenetics and Nutrigenomics

Part-D

Answer in detailed (5 marks)

1. Explain the importance of functional foods

2 What are the phytochemicals present in different colour foods? Explain any two

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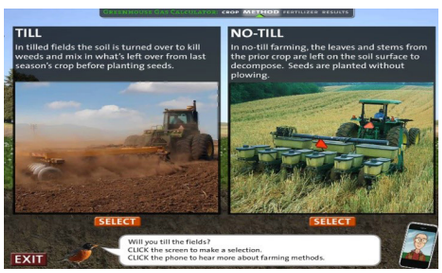
ICT CORNER

Farming

Through this activity you will learn to farm.

STEPS:

1. Use the URL to reach **'Interactive Farming'** page and click **'Start'** to play the game.
2. Select the crop you want to grow and observe how to plant them in the field.
3. Select the type of field you want to grow and till the land to observe the release of **'Green House Gas'** into the atmosphere.
4. Select the amount of fertilizer you want to utilize and get results of crop yield and greenhouse gas emission for your farming.



DOWNLOADING

Interactive Farming's URL:

http://forces.si.edu/soils/interactive/web/index.html

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Unit 8

Introduction to Nutrition Science

Food is the basic necessity of man. Besides satisfying hunger, food is a source of various other nutritional components that have to be present in a balanced proportion. Food provides energy for various activities, besides keeping healthy. The process of development continues from conception till the end of life. Therefore, nutrition is essential for a healthy life. To understand this we must know more about health, food and nutrition. Nutrition is the ultimate core of all the processes in which the animal or human system utilizes food for providing energy for growth, development and maintenance as per needs. A nutrient is the basic chemical component or substance that is present in the food and is needed by the body.

In this lesson, the students will be able to:

- understand the importance of food, nutrition and health.
- analyze the role of nutrition in relation to health.
- recognise the solution to overcome problems of malnutrition in the society.

Introduction to Nutrition Science

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8.1 The Origin of Nutrition

The desire to probe the mysteries of nourishment is an old one and the search has continued since time immemorial. In the first century BC(BCE)., it was a common belief in Egypt that the cause of many diseases is excessive eating. The Greek philosopher Hippocrates (460 – 359 BC(BCE)) observed and stated, "Growing bodies have the most innate heat, they require the most food other wise their bodies are wasted. In old people the heat is feeble and they require little fuel".

The science of nutrition has been developed by using the combined knowledge of the physical and biological sciences. A great number of important discoveries and developments in this field have enabled health care professionals to understand the nutrient needs of people and the means of supplying them. It is difficult to set a chronological order of events to show the development of nutrition. Many aspects developed simultaneously or overlapped each other.

Some progresses were stimulated by national emergencies. Others depended on technical development of the supporting sciences. Nutrition research in India, as Beri – Beri inquiry was started in 1918, under the guidance of Sir Mc Carrison at Coonoor in South India. It has blossomed into an important national institution, at Hyderabad called National Institute of Nutrition. It is currently engaged in carrying out basic as well as applied research work in nutrition. This national institute comes under the Indian Council of Medical Research (ICMR).

In the twentieth century a lot of knowledge has been gained about nutrition. The calorimetric studies carried out at the beginning of this century clearly established a relationship between energy and nutrition. Later experiments were able to correlate the nutritional functions of proteins and it was found that food proteins or their amino acids are the antecedents and precursors of many of the body's catalysts which are necessary for the chemical reactions involved in digestion and nutrition.

The health of the individual influenced by utilization of nutrients is called nutritional status of an individual. Medical check-up, dietary assessment and laboratory investigations can give an account on the nutritional status of a person. The purpose of nutrition is to support health by means of food that one eats.

8.2 Importance of Nutrients:

The word nutrition comes from the Latin root '**nutr**', which **means** to **nurture or nourish**. Right from the moment of conception till death, the body needs to carry many vital functions such as breathing,

Definition of Nutrients

A nutrient is a component in foods that an organism uses to survive and grow. A substance in suitable amount is essential for the growth, maintenance, function and reproduction of a cell or organism is called nutrients. Nutrients consist of carbohydrates, fats, proteins, vitamins and minerals.

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digestion, excretion and so on. Body needs energy to support all these diverse physiological fuctions.

Food is not only to be consumed, digested and absorbed but should be useful for various functioning of the body. Food and nutrition plays a prominent role in providing health. Food is essential because it contains substances which perform different important functions in our body. These essential substances derived from our food are called nutrients.

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

The human body requires 19 vitamins and 24 mineral elements for various day-to-day activities.

Definition of Nutrients

Nutrients are defined as the constituents of food which help us to maintain our body functions, to grow and to protect our organs.

Types of Nutrients:

Nutrients can be classified as macro nutrients and micro nutrients. Both are extremely important for our body as each nutrient has a specific role.

- Macro nutrients like carbohydrates, proteins and fats supply energy in large quantities to the body and building tissues.
- Micro Nutrients like vitamins and minerals are needed in small quantities but they play a crucial role to regulate and control body processes.

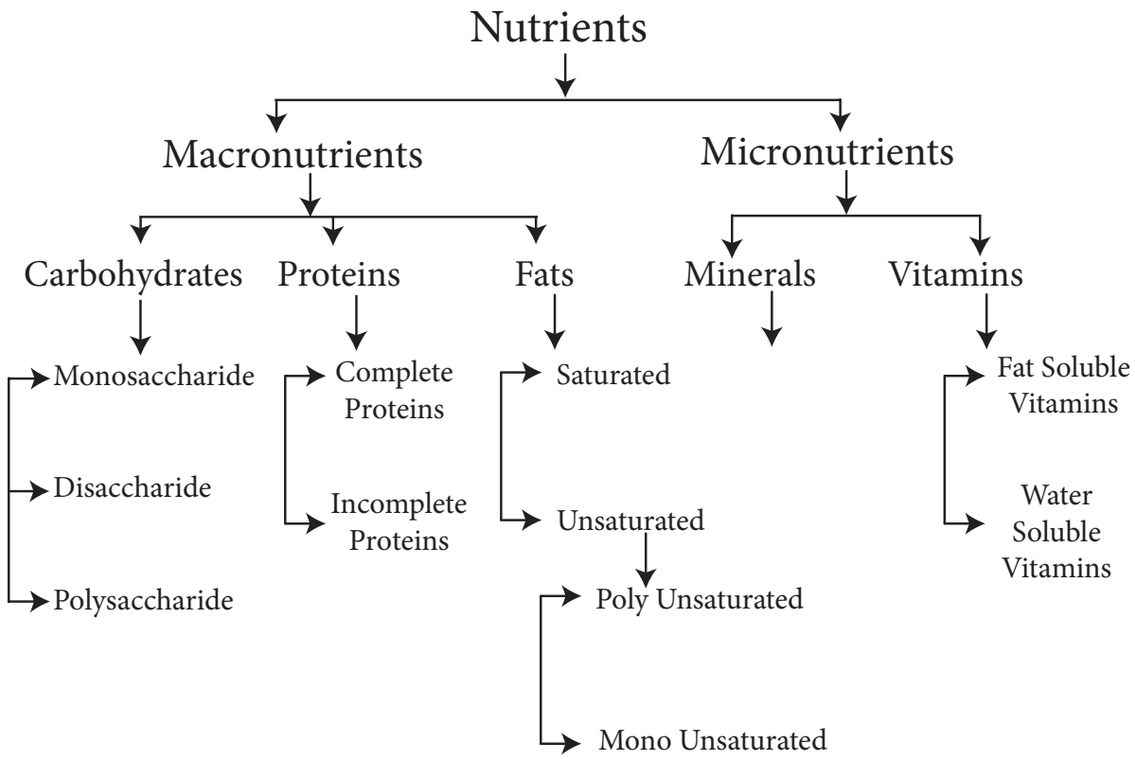

Fig 8.1: Types of Nutrients

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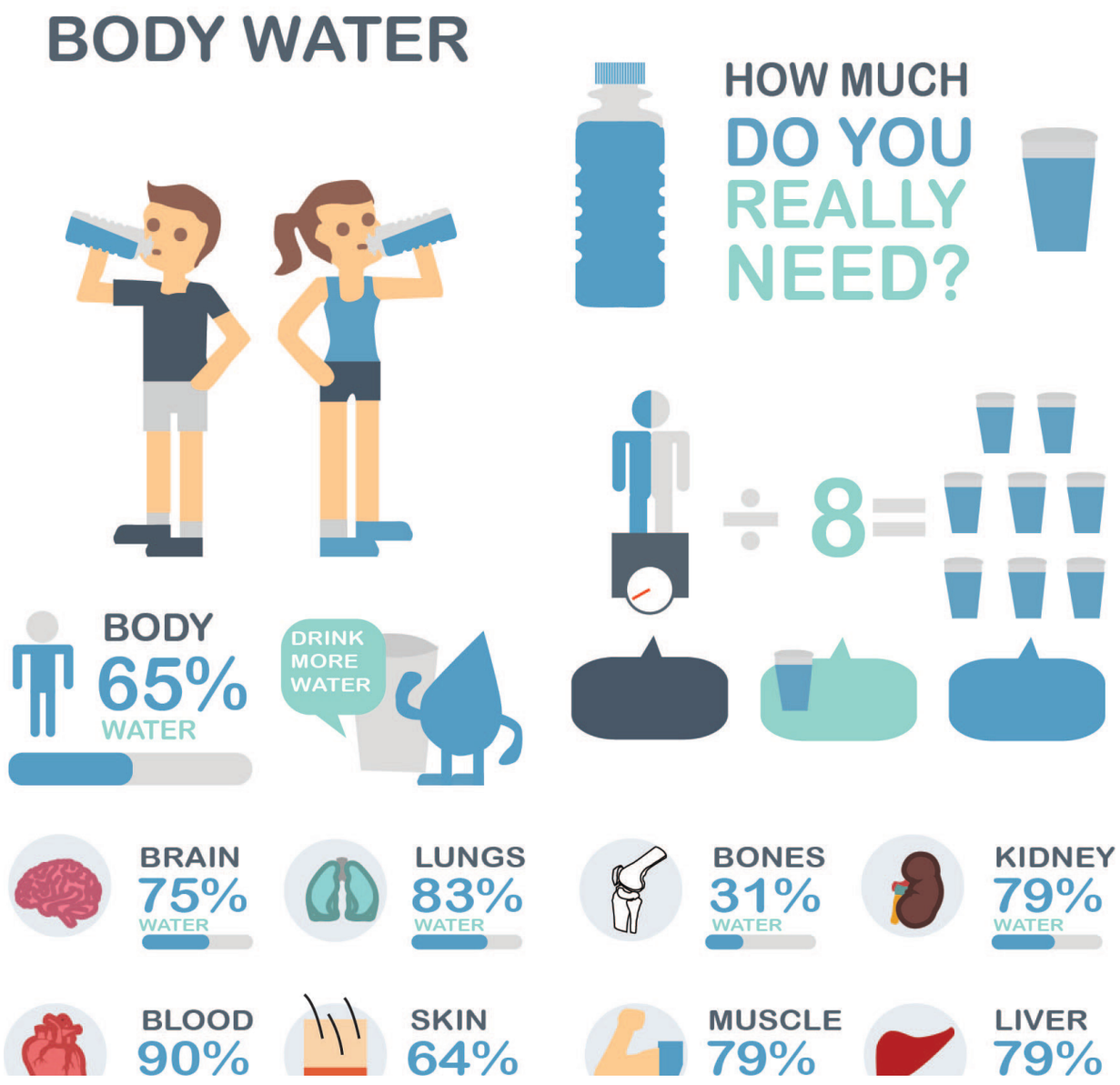

Fig 8.2: Importance of water

- Water is the overall vital nutrient that sustains all our life processes.

Nutrients provide nourishment to the body as such or after digestion. All these have a definite role and are obtained from different food products.

Nutrition is the quantitative science which deals with the accounts of nutrients contributed by different foods and action of each in the functioning of the body.

8.3 Importance of Nutrition

A living organism is the product of nutrition. A human being requires more than fifty different nutrients for its well-being. Food materials ingested by the body are digested, absorbed and metabolised. A number of foods have to be selected to get all the nutrients. The health of a person depends on the type and quantity of the foods that is choosen in his/her diet.

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Definition of Nutrition

Nutrition is the process of ingestion, digestion, absorption, transportation and utilization of nutrients for the well being of the body. It is the process of providing nourishment to the body for a healthy life.

DO YOU KNOW...?

Nutrition science is the area of knowledge regarding the role of food in maintenance of health.

Optimum nutrition is required to maintain good health. There are certain signs of good nutrition. In addition, nutrition is concerned with social, economic, cultural and psychological implications of food and eating.

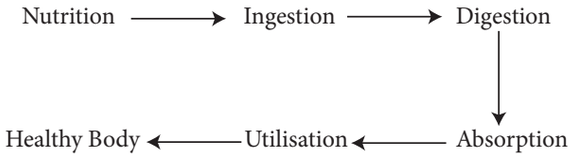

Fig 8.3: Nutrition and Health

Thus we understand that "Nutrition functionally means food at work".

Functions of Nutrition: The two main functions of nutrition are:

1. To provide material for growth and repair of tissues that eventually maintains the basic structure of our body.
2. To support the body with the energy required to perform all metabolic activities.

Nutritional Status

Nutrients are essential elements required for the normal functioning of our body. Nutrients when taken in excess or its deficiency results in over nutrition, malnutrition and under nutrition.

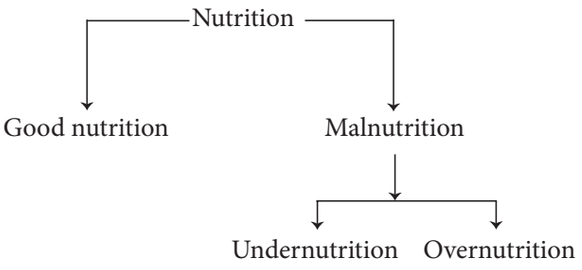

Fig 8.4: Nutritional Status

Good nutrition: "Good nutrition is the state in which a person gets all the nutrients required in correct amounts and proportion and some nutrients are stored in the body after meeting all the body requirements". This is known as optimum or adequate nutrition and it helps to maintain good health. Thus nutrients from food sources enable one to keep fit and maintain health. These substances include energy which gives the capacity to work, proteins which form our body muscles, bones, blood, organs, skin, hair and nervous tissues. Food supplies minerals and vitamins which protect our organs and regulate their functions and other physiological processes.

Malnutrition: Malnutrition is that state of ill-health which may be caused by the deficiency or excess of one or more essential nutrients in the body. Unhealthy environment also causes malnutrition. Physical, mental and intellectual well-being of a person is affected due to malnourishment.

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Fig 8.5: Malnourished child

A malnourished person is physically, mentally, socially and emotionally sick. It is of two types:

i. Under nutrition

ii. Over nutrition

8.4 Signs of Well Nourished Child

1. Skin is smooth and shiny with a healthy colour.
2. Bright and clear eyes and pink eye membranes.
3. Firm pink nails.
4. The hair is lustrous and firmly attached to the scalp.
5. Healthy gums and membranes of the mouth.
6. Reddish pink tongue. Not coated, pink lips.
7 Desirable height for age and desirable weight for height.
8. Good appetite and sound nutrition.
9. Normal body temperature, pulse rate and breathing rate.
10. Healthy children are alert.

8.5 Health

The word 'Health' refers to a particular state or condition of the body. According to this definition, a person may not suffer from any disease but still can be unhealthy, if he/she feels tired, lazy or cannot concentrate on

Table 8.1: Types of Malnutrition

Under nutrition	Over nutrition
1. Under nutrition is deficiency of one or more nutrients. 2. It is that state of nutrition in which the quality and quantity of food is not sufficient for the body and is deficient in one or more nutrients. 3. When almost all nutrients are below the requirement, the condition is known as under nourishment. 4. An undernourished person manifests symptoms of deficiencies and feels unwell. Poor body weight, poor resistance to infection, weakness and general ill-health are the symptoms of under nourishment.	1. Over nutrition is excess of one or more nutrients. 2. It is that state of nutrition in which the intake of nutrients is in excess of body needs quantitatively as well as qualitatively causing adverse effect on the body. 3. When almost all nutrients are high requirement, the condition is known as over nourishment. 4. The pathological state resulting from a disproportion of essential nutrients with or without the absolute deficiency of any nutrient as determined by the requirement of a balanced diet.

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his / her activities. But at other time the same person may feel fit and fine. This means the person is not absolutely healthy all the time. Still, we can call a person healthy who enjoys good health most of the time.

Definition of Health - According to World Health Organisation (WHO) "Health is a state of complete physical, mental, intellectual, social and spiritual well being and not merely an absence of a disease or ill-health".

8.5.1 Dimensions of health

A person who enjoys the four dimensions of health described above is in a complete or positive health state. A healthy person is an asset to his family, society and a nation whereas an unhealthy person is a burden. A new study has concluded that being a part of many different social groups can improve mental health and help a person cope with stressful events. And it also leads to better physical health, and enables to withstand and recover faster from—physical challenges.

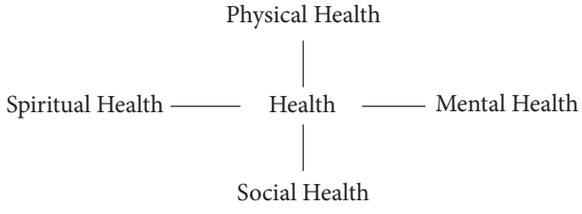

Fig 8.6: Dimensions of health

Physical health: A person who is active, alert and not suffering from any physical ailment is considered as physically healthy. Maintenance of the structural integrity and functional efficiency of body tissues is necessary for an active and productive life.

Table 8.2: Good physical health
Following are some of the features of good physical health:
a) Weight and height proportionate to age.
b) Strong and well developed muscles.
c) Normal growth and strong bones and clean teeth.
d) Smooth, shiny and good textured hair and skin.
e) Bright eyes.
f) Straight gait, no bulging belly.
g) Sound appetite and sleep.
h) Good immunity.
i) Active, energetic and enthusiastic.

Fig 8.7: Physical Activity

DO YOU KNOW...?

Do you watch TV more than 30 minutes per day? _____.

How long you are using mobile phones for Calling _____ Chatting _____ and Browsing internet.

Mental health: A healthy mind lives in a healthy body. It is evident that physical and mental health is directly related to each other. Mental illness can lead to physical ailment. For example, tension and worry leads to high blood pressure and

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Every kid loves watching television but if it exceeds than the allotted time, there is a need to look at it. Do you know how harmful is this? Is watching TV or Mobile from too close good for eyes?

heart problems. On the contrary, physical problems lead to mental problems. For example, polio affected individual develops inferiority complex in the society. This is a state of mental ill health.

Social health: Social well being is the ability to live in harmony with others. It is impossible to be socially healthy without enjoying good mental health.

A person who enjoys social well-being is one who:

For example, a tensed and worried person is incapable of helping others. Similarly, physical ailments make a person irritable, depressed and incapable of normal behaviour. This behaviour is unacceptable to

ACTIVITY - 1

Are you feeling Lonely? Yes _____ No _____.

Table 8.3: Good mental health
Following are some of the features of good mental health:
a) Free from tension and worry.
b) Mentally active and alert.
c) Sensitive towards others.
d) Free from internal conflicts and mental ailments.
e) Capable of adjusting with different people and in different environment.
f) Emotionally stable.
g) Good mental ability.
h) Good immunity.

Table 8.4: Good social health
a) Feels responsible towards others.
b) Have tolerance and cooperate with others.
c) Has cordial and pleasing behaviour.
d) Get along with other people.

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the society and hence they are called anti-social elements.

Spiritual health: Defining spiritual health is the most difficult task. A person who enjoys spiritual health follows moral values like:

Patience and inner peace are the hall-

Fig 8.8: Social health

marks, of spiritual health These can be inculcated by prayers, meditation etc., It should be emphasized that blindly following religious practices

Table 8.4: Spiritual health
a) Speaking the truth,
b) Helping others,
c) Dutiful,
d) Not hurting others,

and customs do not necessarily make a person spiritually healthy. One dimension which is also gaining prominence is spiritual health. In this modern age, importance of spiritual aspect cannot be neglected for our complete well being.

Summary

- Food is the basic necessity of man. Besides satisfying hunger, food is a source of various other nutritional components that have to be present in a balanced proportion.
- A nutrient is a component in foods that an organism uses to survive and grow.
- Macro Nutrients like carbohydrate, proteins, fats supply energy in large quantities to the body and build tissues.
- Nutrition is the process of ingestion, digestion, absorption, transportation and utilization of nutrients for the well being of the body. It is the process of providing nourishment to the body for a healthy life.
- Malnutrition is that state of ill-health which may be caused by the deficiency or excess of one or more essential nutrients in the body.
- Health is a state of complete physical, mental, intellectual, social and spiritual well being and not merely an absence of a disease or ill-health.

ACTIVITY - 2

Do you feel that going to devotional places alone is called spiritual health?

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Glossary

Terms	Meaning
Precursors	A substance from which another is formed, especially by metabolic reaction.
Catalysts	A substance that increases the rate of a chemical reaction without itself undergoing any permanent chemical change.
Nourishment	The food necessary for growth, health, and good condition.
Metabolism	The chemical processes that occur within a living organism in order to maintain life.
Conflict	A serious disagreement or argument.

Questions

Part – A

Choose the correct Answer:

1. _____ is the ultimate core of all the processes in animal or human system.

   a. Nutrients

   b. Nutrition

   c. Health

   d. Food

2. _____ are small chemical components of food that are needed by the body.

   a. Nutrients

   b. Water

   c. Fibre

   d. Health

3. _____ illness can lead to physical ailment.

   a. Physical

   b. mental

   c. Social

   d. Emotion

4. _____ well being is the ability to live in harmony with others.

   a. Physical

   b. mental

   c. Social

   d. Emotion

5. Patience and inner peace are the hall-marks of spiritual health.

   a. Spiritual

   b. mental

   c. Social

   d. Physical

Part - B

Write short Answer (2 Marks)

1. Define Health.
2. What is malnutrition?
3. What is under nutrition?
4. What is over nutrition?
5. What do you mean by good nutrition?

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Part - C

Answer in Brief (3 Marks)

1. Physical ill health leads to mental ill health. Give an example.
2. State any two conditions essential for good health.

Part - D

Answer in detailed (5 Marks)

1. Analyze the consequences of the excessive eating of unhealthy foods.
2. Identify the benefits of eating healthy foods and beverages.

Identify and tick major nutrients present in the following food items:

Food Items	Carbohydrates	Protein	Fat	Vitamins	Minerals	Fibre
Plant sources						
Rice						
Potatoes						
Jaggery						
Honey						
Milk						
Sugar						
Soyabean						
Peanuts						
Pulses						
Whole grain cereals						
French beans						
Green peas						
Almonds						
Flax seeds						
Cowpeas						
Butter						
Cheese						
Coconut oil						
Carrot						
Dates						
Mushroom						
Pumpkin						
Tomatoes						

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Food Items	Carbohydrates	Protein	Fat	Vitamins	Minerals	Fibre
Green Leafy Vegetables						
Spinach						
Drumstick						
Nuts						
Cauliflower						
Cabbage						
Broccoli						
Sprouts						
Onion						
Garlic						
Cumin						
Cinnamon						
Apple						
Orange						
Watermelon						
Papaya						
Mango						
Lemon						
Amla						
Strawberry						
Grapes						
Egg						
Chicken						
Meat						
Liver						
Fish						
Prawn						
Crab						
Oysters						

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ICT CORNER

HEALTH TRACK

A healthy Diet is one that helps to maintain or improve overall Health.
This activity shows to know about the keys to health.

STEPS:

1. Type the URL link given below in the browser or Scan the QR code with your mobile to access website.
2. On the “Game Zone” tab Click Play Now. You can find three options.
3. Now Click on the “Play Health Track”
4. Start playing the game by clicking the arrow.
5. Play the quiz to strengthen your knowledge on healthy food habits.

DOWNLOADING

Click the following link or scan the **QR code** to access the website.

http://www.healthtrek.org/

** Images are indicatives only.

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Unit 9

CARBOHYDRATES AND ENERGY

Carbohydrates are widely distributed in plants in which they are formed from Co_2 of the atmosphere by photosynthesis. Carbohydrates are the preferred source of energy for most of the body functions. As long as carbohydrates are available, the human brain depends exclusively on it as an energy source. They are the cheapest and most important source of energy for the vast majority of people in the tropics.

Our body needs energy to grow and repair themselves, keep warm and do physical activity. Energy comes from food and drink, in particular from carbohydrate, protein and fat (collectively known as macronutrients). The amount of each macronutrient in the food will determine its energy content.

In this lesson the students will be able to:

- understand the importance of carbohydrates as an economical source of energy
- know the significance of complex carbohydrates
- understand the importance of basal metabolism and basal metabolic rate
- create an awareness about the benefits of physical activity as part of a healthy lifestyle.

Carbohydrates and Energy

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9.1 Composition of carbohydrates

Carbohydrates are so called because they contain carbon with hydrogen and oxygen in the same proportion as in water (2:1). The general formula is $C_nH_{2n}O_n$

9.2 Classification of carbohydrates

Carbohydrates are classified according to the number of saccharide (sugar) groups present. They are broadly classified as simple carbohydrates and complex carbohydrates. The simple carbohydrates include monosaccharides(Single sugar) and disaccharides (Double sugars). Complex carbohydrates include starch, glycogen and fibers. The classification of carbohydrates is schematically represented below:

9.2.1 Simple Carbohydrates

A) Monosaccharides

They have one saccharide group and are the simplest form of carbohydrates. All carbohydrates are reduced to this state before absorption and utilization. They contain 3-6 carbon atoms and are accordingly termed triose, tetrose, pentose or hexose.

(i) **Biose:** $C_2H_4O_2$ (e.g.)Glycolic aldehyde

(ii) **Triose:** $C_3H_6O_3$ (e.g.)Glyceraldehyde and Dihydroxyacetone. They occur in plant and animal tissues in small amounts and are derived from the breakdown of glucose.

(iii) **Tetroses:** $C_4H_8O_4$ (e.g.) Erythrose, Threose

(iv) **Pentoses:** $C_5H_{10}O_5$(e.g.) Arabinose, Xylose, Ribose and Deoxyribose.

(v) **Hexoses:** $C_6H_{12}O_6$ .They are further sub-divided into 2 groups(i.e) Aldoses or sugars containing aldehyde group(e.g.) Glucose,

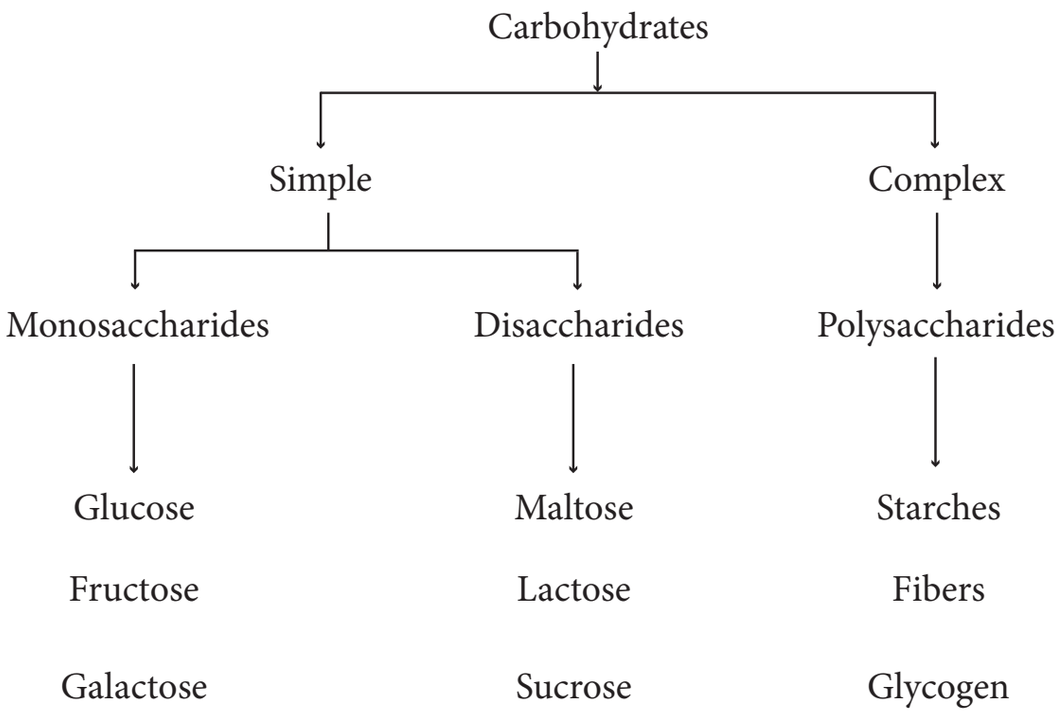

Fig 9.1: Classification of carbohydrates

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galactose and mannose as well as Ketoses or sugars containing ketone group(e.g.) Fructose.

Major monosaccharides

a) **Glucose** (Dextrose or grape sugar): It serves as the main source of energy in the body. It is abundantly found in nature. It is found in sweet fruits such as grapes, berries, oranges in vegetables like sweet corn and carrots. It is less sweet than cane sugar. It is the end product in the digestion of disaccharides and polysaccharides and is the form of carbohydrate circulating in the blood.

b) **Fructose**(Levulose or fruit sugar): It is much sweeter than cane sugar and is found in honey,ripe fruits and some vegetables.It is also a product of the hydrolysis of sucrose.

c) **Galactose:** It does not occur in the free state, but occurs as a constituent of lactose present in milk.

B) Disaccharides

They are formed by the combination of 2 monosaccharides. The disaccharides of nutritional importance are sucrose, maltose and lactose.

a) **Sucrose** (Cane sugar, beetsugar, table sugar): It occurs in sugarcane (10-12%) and beetroot(12-18%).In the intestine, sucrose is broken down into monosaccharides -glucose and fructose by the enzyme sucrase present in the intestinal juice and then absorbed.

Sucrose —(Hydrolysis)→ **Glucose+fructose**

b) **Lactose**(Milk sugar): It occurs in the milk of mammals. Cow's milk and buffalo's milk contain 4% of lactose, while human milk contains about 7% of lactose. Lactose is hydrolysed to glucose and galactose by the enzyme lactase present in the intestinal juice.

Lactose —(Hydrolysis)→ **Glucose+galactose**

c) **Maltose** (Malt sugar): It is found in all sprouted and malted products.It is an intermediate product formed in the process of conversion of starch into glucose. Maltose is hydrolysed to 2 molecules of glucose by the enzyme maltase present in the intestinal juice. Sprouted cereals and beer contain large amount of maltose.

Maltose —(Hydrolysis)→ **Glucose+glucose**

9.2.2 Complex Carbohydrates

These are complex compounds with high molecular weights. Their structural formula is $(C_6H_{10}O_5)n$, where n>2.They are formed by a combination of more than 2 molecules of a monosaccharide. Unlike the sugars,which contain 3 monosaccharides – Glucose, fructose and galactose in different combinations, the polysaccharides – Starch and Glycogen are composed entirely of glucose. They differ from each other only in the nature of the bonds that link the glucose units together.

1) **Starch :** It is a long, straight or branched chain of hundreds of glucose units linked together. The important sources of starch are

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cereals and millets(65-85%) and roots and tubers(19-35%). Starch is a polysaccharide formed in nature by the condensation of large number (4000-15000) of glucose molecules. It consists of a mixture of 2 components called amylose and amylopectin. It is the storage form of carbohydrate in the plant kingdom. Cooking facilitates the digestion of starch. Boiling causes swelling of the starch granules and rupture of the cell walls, allowing better digestion. The enzyme amylase present in the salivary and pancreatic juices, converts starch into maltose which is subsequently broken into glucose and absorbed.

2) **Dextrin :** It is not found in direct form in nature. They are polysaccharides formed by the partial hydrolysis of starch by acids or amylase. They are composed of large number of glucose molecules.

3) **Glycogen:** It is made up of chains of glucose,which are more highly branched than starch molecules.It is the storage form of carbohydrates in human beings and animals. It is formed by the condensation of large number (5000-10000) of glucose molecules.When required by the body, glycogen is converted to glucose to give energy.

ACTIVITY - 1

Match the right answer

a) Fruit sugar	-	Lactose
b) Grape sugar	-	Maltose
c) Milk	-	Starch
d) Malt sugar		Storage form of carbohydrate
e) Dextrin	-	Sucrose
f) Glycogen	-	Fructose
g) Cane sugar	-	Glucose

9.3 Functions of carbohydrates

The functions of carbohydrates in the body are as follows:

1) **Energy**: The principle function of carbohydrates is to serve as a major source of energy for the body. Each gram of carbohydrate yields 4kcal of energy regardless of its source.They provide an economical and quick source of energy. Excess carbohydrates in the body is stored as glycogen and can be converted to glucose for energy production when required .

2) **Protein Sparing Action:** Carbohydrates exert a protein sparing action. If sufficient amounts of carbohydrates are not available in the diet, the body will convert protein to glucose in order to supply energy. Hence, in order to spare proteins for tissue building and repair, carbohydrates must be supplied in optimum amounts in the diet. This is called the protein sparing action of carbohydrates.

3) **Fat Metabolism**: Adequate supply of carbohydrates determines the amount of fat to be metabolized for energy, which in turn affects the formation and disposal rate of ketones (intermediate products in fat metabolism). In the absence of adequate supply of carbohydrates, more fat is used because of which ketones accumulate in the body and this results in a disorder called Ketosis or Acidosis. This shows that carbohydrates have an anti-ketogenic effect which prevents harmful effect of ketone accumulation in the body.

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4) **Synthesis of Body Substances**: Carbohydrates aid in the synthesis of non-essential aminoacids, glycoproteins (which function as antibodies) and glycolipids (which form a part of cell membrane in body tissues especially brain and nervous system). Lactose encourages the growth of favourable intestinal bacteria.It has laxative properties and enhances the absorption of calcium.

5) **Detoxification:** Glucuronic acid, a metabolite of glucose serves as a detoxifying agent. It combines with harmful substances containing alcohol or phenolic group converting them to harmless compounds which are later excreted. Adequate hepatic(Liver) glycogen storage enhances normal liver detoxification ability.

6) **Roughage in the Diet**: Insoluble fibres (Cellulose) known as complex carbohydrates can absorb water and give bulk to the intestinal contents which aids in the elimination of waste products by stimulating peristaltic movements of the gastrointestinal tract.

7) **Central nervous system(CNS):** Glucose alone can work as a source of energy for the central nervous system. Prolonged deprivation of glucose to the CNS may cause irreversible damage to the brain.

9.4 Food sources of carbohydrates

The important sources of carbohydrates in the diets of children and adults are cereals, millets, root, tubers, pulses, sugar and jaggery, while milk and sugar are important sources in diets of infants.

The types and sources of Carbohydrates are given in **table 9.1**

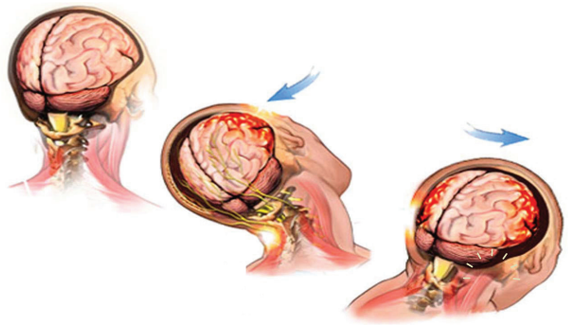
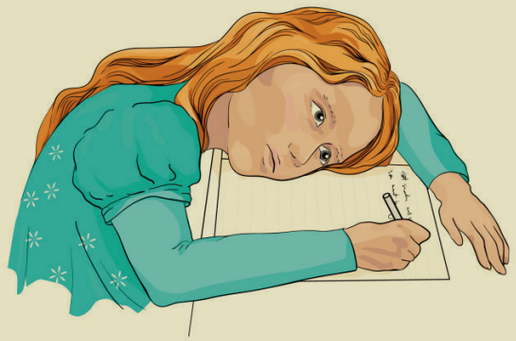


Fig 9.1: Central nervous system(CNS)

DO YOU KNOW...?

Why do pepole usually faint when they skip breakfast????



ACTIVITY - 2

Display any 5 foods sources of simple and complex carbohydrates

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Table 9.1 Types and Sources of Carbohydrates	
Type of Carbohydrates	**Food Sources**
1.Monosaccharides	
Glucose	Fruits, honey, corn-syrup.
Fructose	Fruits, honey.
Galactose	These do not occur in free form in foods.
2.Disaccharides	
Sucrose	Cane and beet sugar
Lactose	Milk and milk products.
Maltose	Malt and Cereal products.
3.Polysaccharides Digestible:	
Starch and Dextrin	Grains, vegetables especially roots& tubers, legumes, Meat products and sea foods
Glycogen	
Indigestible:	
Cellulose	Stalks and leaves of vegetables, outer coat of seeds
Pectins, Gums	Fruits, Plant secretions and seeds.

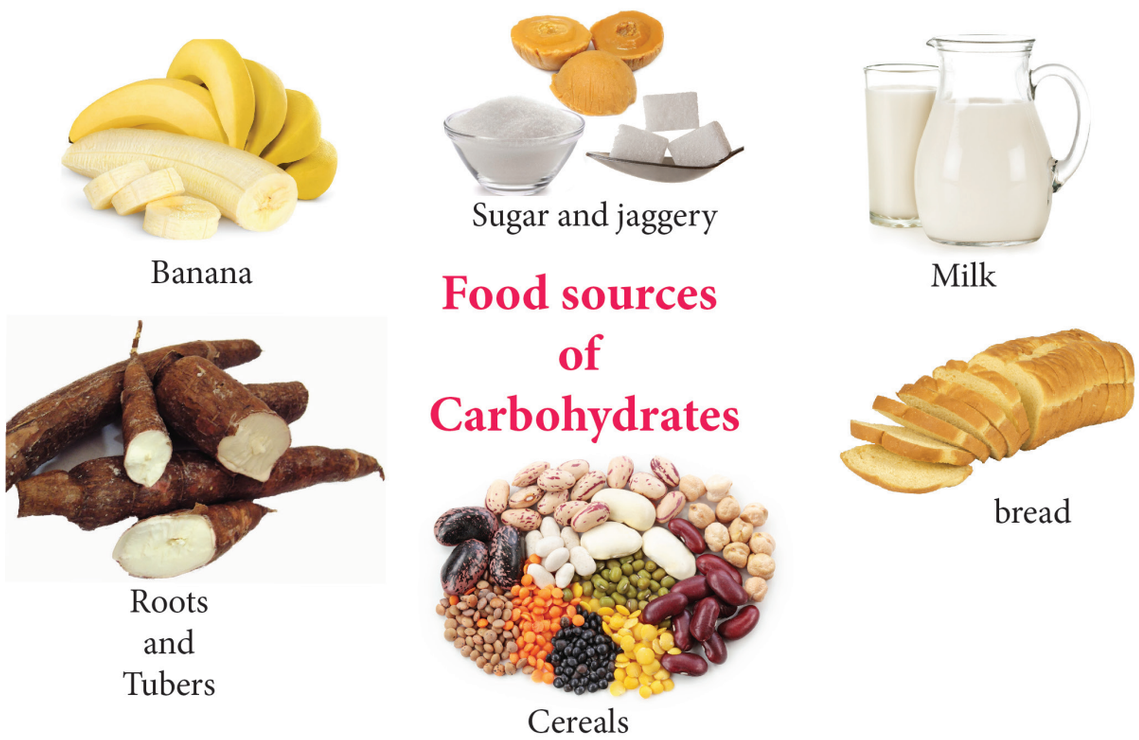

Fig 9.2: Food sources of Carbohydrates

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9.5 Requirements of carbohydrates

The body has a specific need for carbohydrates as a source of energy for the brain and other tissue cells,for the synthesis of lactose in milk(lactating women) and galactose and other sugars present in the cerebrosides and muco-polysaccharides. The percentage of calories derived from carbohydrates in diets consumed by a vast majority of people in the developing countries is as high as 60 – 70%.The carbohydrate calories should be atleast 40% in well-balanced diets.The optimal levels of carbohydrates in the diet, taking into account the physiological needs for proteins and fats are given in table 9.2

9.6 Dietary fibers

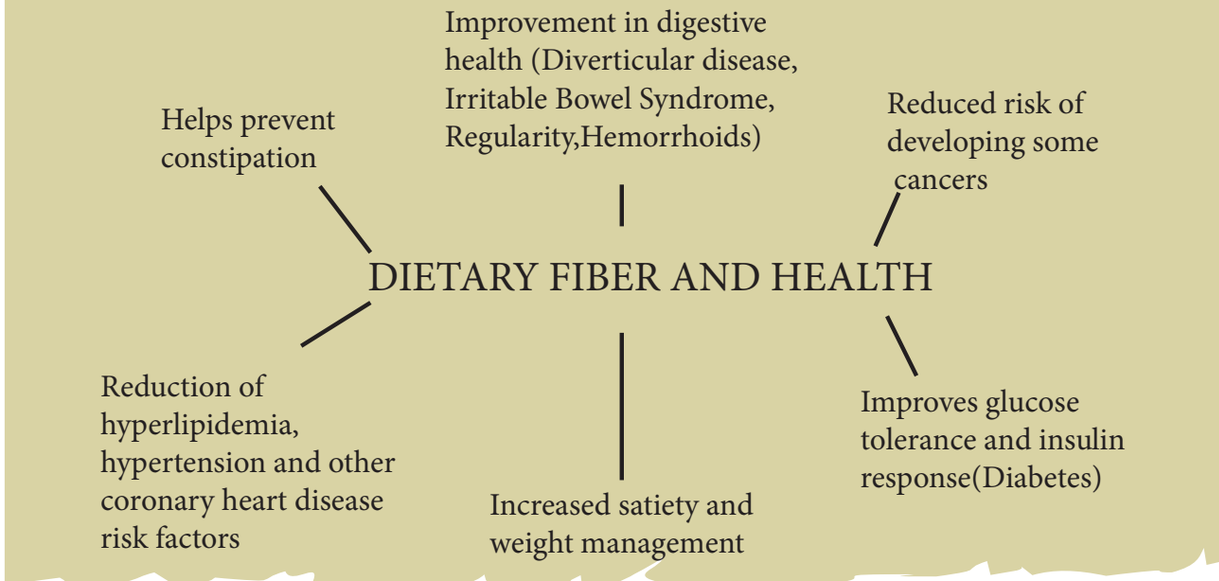
Dietary fiber is defined as that portion of plant material ingested in the diet that is resistant to digestion by gastro intestinal secretions. It consists of cellulose, hemicellulose, pectins, gums and mucilages as well as non-polysaccharide lignin. Some bacteria in the large intestine can degrade some components of fibre releasing products, that can be absorbed into the body and used as energy source.

Table 9.2 Optimal level of carbohydrates in the diet

Age group	Optimal level of carbohydrate calories as percent of total calories
Adults	50- 70
Pregnant and lactating women	40-60
Infants(1-12 months)	40-50
Preschool (1-5 years)	40-60
Older children and adolescents	50-70

Dietary fibers

In a nutshell..... Benefits of dietary fiber



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a) **Cellulose** : It is the main constituent of plant cell walls. It is found in all vegetables, fruits and legumes.

b) **Hemicellulose:** It is the main constituent of cereal fibres.It is also present in all vegetables and hulls of legumes.

c) **Pectins:** Pectins are formed by the combination of large number of galacturonic acid molecules. In the presence of sucrose and citric acid, pectin forms a gel. It is used in the food industry as an ingredient of jams and jellies.

d) **Gums and mucilages:** They are non-structural components of plant cells that are soluble in hot water. They are used as additives and stabilizers by the food industry.

e) **Lignin**: They are the tough, woody parts of plants.

Dietary fibers can also be classified as soluble and insoluble fibers based on their solubility in water. Insoluble fibers do not dissolve in water(Cellulose,hemi-cellulose and lignin) and soluble fibres readily dissolve in water(Pectins, gums and mucilages). The types, sources and action of fibre in the body is summarized in **table 9.3**

Food for thought — choose wisely!

What's most important is the type of carbohydrate you choose to eat because some sources are healthier than others. The amount of carbohydrate in the diet – high or low – is less important than the type of carbohydrate in the diet. For example, healthy, whole grains and whole wheat bread, rye and barley are better choices than highly refined white bread or french fries.

Foods high in carbohydrates are an important part of a healthy diet. Carbohydrates provide the body with glucose, which is converted to energy used to support bodily functions and physical activity. But carbohydrate quality is important; some types of carbohydrate-rich foods are better than others:

Table 9.3 Types, Sources and Action of fiber

Types of fiber	Major food sources	Action in the body
Soluble fibers Gums, pectins, mucilages	Citrus fruits, apple, oats, barley, legumes	• Delay gastro intestinal transit • Delay glucose absorption • Lower blood cholesterol
Insoluble fibers Cellulose Hemicellulose	Whole wheat products, wheat bran, whole grain breads, cereals and vegetables like green peas, beans, cabbage. Skin of vegetable and fruits, grains	• Accelerate Gastro intestinal transit • Increase faecal weight • Slow starch hydrolysis • Delay glucose absorption

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- The healthiest sources of carbohydrates—unprocessed or minimally processed whole grains, vegetables, fruits and beans—promote good health by providing vitamins, minerals, fiber, and a host of important phytonutrients.

- Unhealthier sources of carbohydrates include white bread, pastries, sodas, and other highly processed or refined foods. These items contain easily digested carbohydrates that may contribute to weight gain, interfere with weight loss and promote diabetes and heart disease.

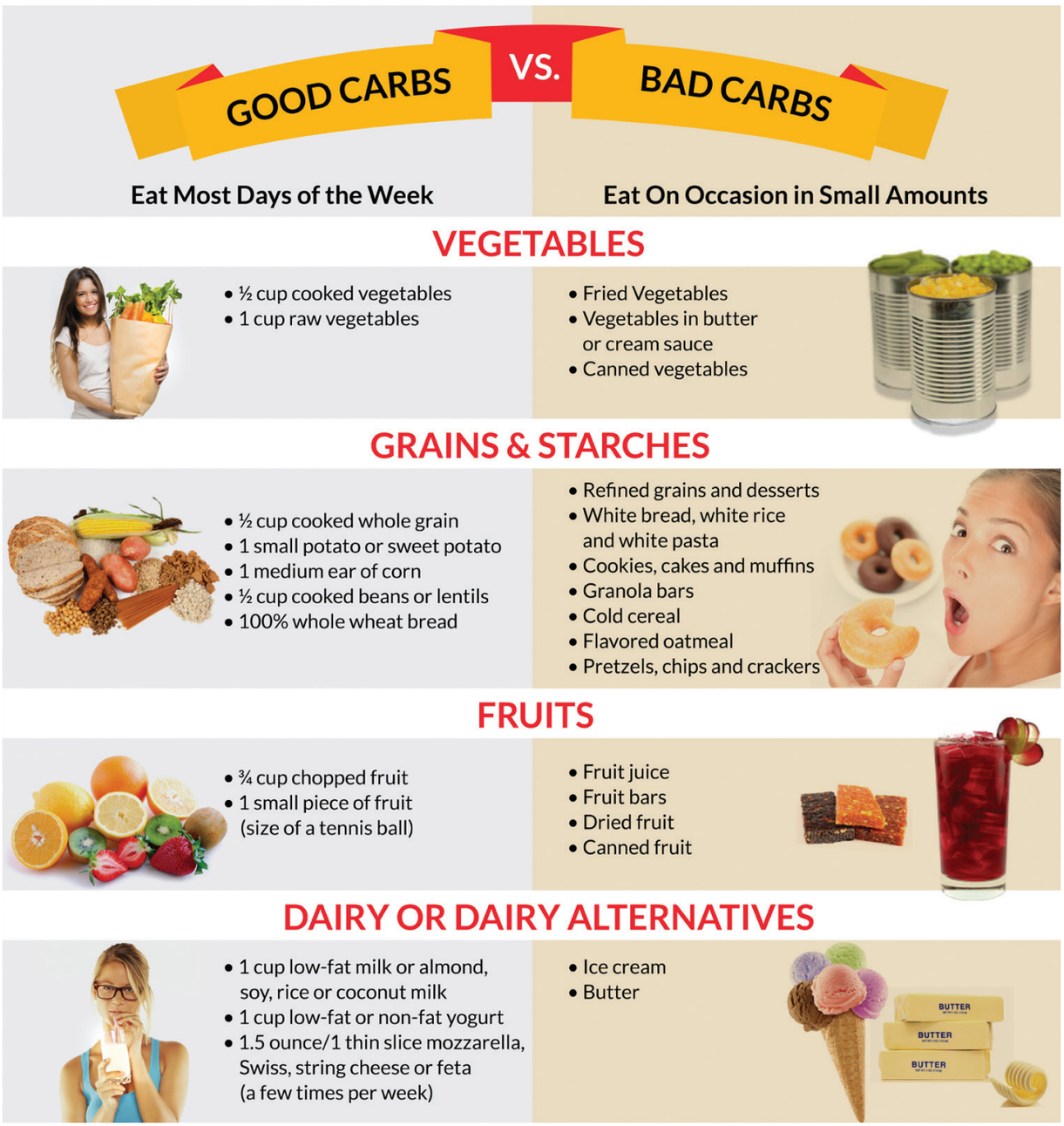

Fig 9.3: Good Carbs Vs Bad Carbs

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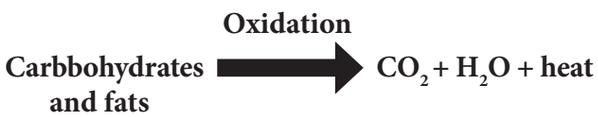
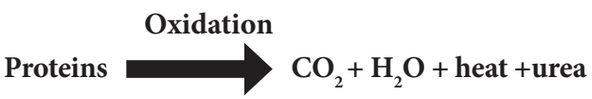
9.7 Energy

Energy is the capacity to do work. Energy must be supplied regularly to meet the needs of the body for survival. The body needs energy for maintaining body temperature, metabolic activity, supporting growth, for physical work, to maintain constant body weight and good health.

9.7.1 Energy yielding food factors

The energy yielding food factors are (i) carbohydrates (ii) fats and(iii) proteins. Within the body, these are oxidised in the cells. The process is one of continuous utilization of O_2 and production of CO_2 H_2O and heat.





9.7.2 Units of energy – calorie and joule

The energy value of foods can be expressed in terms of kilocalories(KCal) or megajoules(MJ).The International Union of Nutritional Sciences has suggested the use of megajoule as the energy unit in place of Kcal. These units are defined as follows:

Kilocalorie: One kilogram calorie is the quantity of heat required to raise the temperature of 1 kg of water through 1° C.

Joule: A joule is defined as the energy required to move 1kg mass by 1 metre by a force of 1 Newton acting on it.

Newton: One Newton is the force needed to accelerate 1 kg mass by less than a second.

1 Kcal = 4.184 KJ

1000Kcal = 4.184 Megajoule(MJ)

1 MJ = 240Kcal

9.7.3 Energy value of foods

The energy in various foods is measured by calorimetry. Calorimetry is the measurement of heat loss.The energy value of foods is determined using the instrument called Bomb calorimeter.

9.7.4 Gross Energy value of foods

When samples of carbohydrate, fat, protein are burned, the amount of heat produced is always the same for each of these nutrients. The average gross energy value of carbohydrates,fats and proteins determined with bomb calorimeter is as follows:

1g of Carbohydrate = 4.1 kcal

1g of fat = 9.45 kcal

1g of protein = 5.65 kcal

9.7.5 Physiological energy value of foods

In the utilization of carbohydrates, fats and proteins in the body a certain percentage of these nutrients is lost in digestion and the nitrogen of protein is excreted in urine as urea which still contains some energy value.The average losses in digestion in human subjects have been estimated to be 2.0% for carbohydrates,5.0% for fats and 8.0% for proteins. The loss of energy in urea is estimated to be 1.2kcal per gram of protein oxidised. The physiological energy values of foods calculated from the gross energy values after allowing for the losses in digestion and metabolism are as follows: Carbohydrates 4.0;fats 9.0 and proteins 4.0.

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These values are known as 'Atwater Bryant factors' or physiological fuel values.

9.7.6 Coefficient of digestibility

The coefficient of digestibility is used to express the proportion of an ingested nutrient that ultimately becomes available to the body cells. The coefficient of digestibility for carbohydrate, fat and protein are 0.98, 0.95 and 0.92 respectively. It is observed that carbohydrate and fat are metabolized almost completely, whereas protein metabolism is incomplete due to the presence of nitrogen.

The physiological fuel value, Co-efficient of digestibility and digestibility percent of carbohydrate, fat and proteins is presented in **table 9.4**.

9.8 Basal metabolism

Basal Metabolism is the minimum amount of energy needed by the body for maintenance of life when the person is at complete physical and mental rest and having normal body temperature and in the post -absorptive state (12 hours after the intake of last meal). Basal Metabolic Rate (BMR) is a measure of the energy required by the activities of resting tissue.

The Basal Metabolic rate can be measured directly from the heat produced (using a Respiration Calorimeter and Metabolic Chamber) or indirectly from O_2 intake and CO_2 expenditure when the subject is at rest.

9.8.1 Basal Metabolic Rate (BMR)

The rate of energy use for metabolism under basal metabolism is usually expressed as kcal/kg body weight per hour. The factors affecting BMR is presented in **table 9.5**

ACTIVITY - 3

List the energy , protein and fat value of any 4 commonly consumed foods (per 100g):

a) cereals

b) fruits

c) nuts

d) dairy products

Table 9.4 Types and Sources of Carbohydrates

Nutrient	Heat of combustion (kCal)	Co-efficient of digestibility	Digestibility percent	Physiological fuel value
Carbohydrate	4.1	0.98	98	4.0
Fat	9.45	0.95	95	9.0
Protein	5.65	0.92	92	4.0

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Table 9.5 Factors affecting Basal Metabolic Rate (BMR)

S.no	Factor	Effect on BMR
1	Body composition	More the lean body mass, higher is the BMR. This is due to greater metabolic activity in these tissues when compared to bones and fat. Men with a high proportion of muscle mass or lean body mass have a higher BMR than women
2	Fever	Fever raises the BMR. There is a 7% increase in BMR for each degree rise in body temperature in Fahrenheit and 13% increase for every degree Celsius rise in body temperature
3	Stress	Raises BMR.
4	Smoking and Caffeine	Increases BMR
5	Hyperthyroidism (Oversecretion of thyroxine)	The basal metabolic rate is elevated as much as 50-70%.
6	Growth	In tall people BMR is higher.
7	Pregnancy	During the last trimester of pregnancy, basal metabolic rate is increased by 15 - 25% as there is a increase in muscle mass of uterus, size of mammary gland, foetal mass and placenta, cardiac work and respiratory rate.
8	Fasting/Starvation	Lowers BMR
9	Hypothyroidism (under secretion of thyroxine)	The basal metabolic rate is decreased by 30%
10	Age	Lean body mass diminishes with age slowing the BMR. BMR is higher in infants and young children than in adults
11	Undernutrition	Prolonged undernutrition lowers the BMR.
12	Climate	In persons living in tropical climates,BMR is about 10% less than those living in temperate zones.
13	Sleep	BMR is reduced by 5%.

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9.9. Physical activity

Exercise is defined as any movement that makes the muscles work and requires the body to burn calories. There are many types of physical activity, including swimming, running, jogging, walking and dancing, to name a few.Being active has been shown to have many health benefits, both physically and mentally.

Fig 9.4: Physical activity

9.9.1 Types of Physical Activity

The four main types of physical activity are aerobic, muscle-strengthening, bone-strengthening, and stretching. Aerobic activity is the type that benefits your heart and lungs the most.

a) Aerobic Activity

Aerobic activity moves the large muscles, such as those in the arms and legs. Running, swimming, walking, bicycling, dancing, and doing jumping jacks are examples of aerobic activity. Aerobic activity is also called endurance activity. Aerobic activity makes the heart beat faster than usual and makes the person to breathe harder during this type of activity. Over time, regular aerobic activity makes the heart and lungs stronger and able to work better.

b) Other Types of Physical Activity

The other types of physical activity like muscle-strengthening, bone strengthening and stretching benefit the body in other ways.

Muscle-strengthening activities improve the strength, power, and endurance of the muscles. Doing pushups and sit-ups, lifting weights, climbing stairs, and working in the garden are examples of muscle-strengthening activities.

With bone-strengthening activities feet, legs, or arms support the body weight, and the muscles push against the bones. This helps make the bone stronger. Running, walking, jumping rope and lifting weights are examples of bone-strengthening activities.

Muscle-strengthening and bonestrengthening activities also can be aerobic, depending on whether they make the heart and lungs work harder than usual. For example, running is both an aerobic activity and a bone-strengthening activity.

Stretching helps improve flexibility and ability to fully move the joints. Touching toes, doing side stretches, and doing yoga exercises are examples of stretching.

9.9.2. Benefits of physical activity

1) Assists in weight control mainly by burning calories and thereby reducing body fat.
2) Raises self-esteem and physical awareness.
3) Reduces symptoms of ageing.
4) Allows body to use fats and sugars more efficiently.
5) Improves digestion and metabolism
6) Strengthens and improves the functioning of the heart and lungs.

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7) Reduces risk of heart disease and vascular disease by increasing the HDL cholesterol levels(Good cholesterol) in the blood.
8) Strengthens the muscles, ligaments, tendons, joints and bones.
9) Regulates blood pressure and helps in controlling hypertension.
10) Preventing osteoporosis by strengthening and slowing down the loss of calcium in the bones.
11) Regulates hormone levels and helps to alleviate premenstrual and menopausal symptoms.
12) Reduces stress and combats depression.
13) Promotes a positive outlook in life.
14) Improves immunity and increases resistance to infections.
15) Promotes a healthy lifestyle.

ACTIVITY - 4

Design a physical activity fact sheet which includes the following:

a) Definition of physical activity

b) Any 5 benefits of physical activity

c) 3 types of aerobic physical activity which you can do at school to be more physically active

d) 3 types of physical activity which can be done outside school to become more physically active

Summary

- Carbohydrates are so called because they contain carbon with hydrogen and oxygen in the same proportion as in water (2:1). The general formula is $C_nH_{2n}O_n$.
- Carbohydrates are classified according to the number of saccharide (sugar) groups present. They are broadly classified as simple carbohydrates(sugars) and complex carbohydrates(sugars).

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- The simple carbohydrates include monosaccharides (Singlesugar) and disaccharides (Doublesugars).Complex carbohydrates include starch, glycogen and fibers.
- The major monosaccharides are glucose, fructose and galactose.
- The disaccharides of nutritional importance are sucrose, maltose and lactose.
- The complex carbohydrates include starch, dextrin and glycogen.
- The principle function of carbohydrates is to serve as a major source of energy for the body.
- The important sources of carbohydrates in the diets of children and adults are cereals, millets, roots, tubers, pulses, sugar and jaggery, while milk and sugar are important sources in the diets of infants.
- The percentage of calories derived from carbohydrates in diets consumed by a vast majority of people in the developing countries is as high as 60 – 70%.
- Dietary fiber is defined as that portion of plant material ingested in the diet that is resistant to digestion by gastro intestinal secretions.
- The healthiest sources of carbohydrates—unprocessed or minimally processed whole grains, vegetables, fruits and beans—promote good health by delivering vitamins, minerals, fiber and a host of important phytonutrients.
- Energy is the capacity to do work.
- The energy yielding food factors are (i) carbohydrates (ii) fats and (iii) proteins.
- The energy value of foods can be expressed in terms of kilocalories(KCal) or megajoules(MJ).
- Basal Metabolism is the minimum amount of energy needed by the body for maintenance of life when the person is at complete physical and mental rest and having normal body temperature and in the post -absorptive state (12 hours after the intake of last meal).
- Exercise is defined as any movement that makes the muscles work and requires the body to burn calories.
- There are many types of physical activity, including swimming, running, jogging, walking and dancing, to name a few.
- Being active has been shown to have many health benefits, both physically and mentally.

Glossary

Terms	Meaning
Detoxification	It is the physiological or medicinal removal of toxic substances from a living organism, including the human body, which is mainly carried out by the liver.
Hemorrhoids	They are swollen veins in the lowest part of the rectum and anus.
Irritable bowel syndrome(IBS)	It is a group of symptoms—including abdominal pain and changes in the pattern of bowel movements without any evidence of underlying damage.
Lean body mass (LBM)	It is a component of body composition calculated by subtracting body fat weight from total body weight.
Osteoporosis	It is a condition of fragile bone with an increased susceptibility to fracture.

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Questions

Part - A

Choose the correct answer: (1 mark)

1) One gram of carbohydrate yields _____ kilocalories.

a) 4

b) 5

c) 9

d) 3

DXCPT

2) _____ is the only source of energy for the CNS.

a) lactose b) sucrose

c) glucose d) fractose

3) Sucrose on hydrolysis gives _____ _____

a) Glucose and fructose

b)Glucose and galactose

c) Glucose and lactose

d) Glucose and Glucose

4) _____is an intermediate product formed during starch hydrolysis.

a) dextrin b) amylase

c) lactase d) sucrose

5) Fructose is also known as_____.

a) levulose b) dextrose

c) sucrose d) glucose

6) BMR increases by _____ percent for every degree Fahrenheit rise in body temperature.

a) 7 b) 13

c) 15 d) 8

Part - B

Write short answer: (2 marks)

1) What are carbohydrates?

2) Give any 2 food sources of complex carbohydrates

3) What is malt sugar?

4) What are amylases?

5) What are pectins?

6) Define Basal metabolism.

7) List any 2 benefits of regular physical activity.

Part - C

Answer in brief: (3 marks)

1) What is meant by protein sparing effect of carbohydrates?

2) Differentiate between soluble and insoluble fibres.

3) What are healthy carbohydrates? Give examples.

4) What is glycogen? Give its functions.

5) What is the physiological fuel value of the macronutrients?

6) What is meant by gross energy value of foods?

Part - D

Answer in detailed: (5 marks)

1) What are the functions of carbohydrates?

2) What is dietary fibre? Explain the types of fibre with their food sources.

3) How can you determine the energy value of foods?

4) What are the factors affecting BMR?

5) What are the benefits of regular physical activity?

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Unit 10

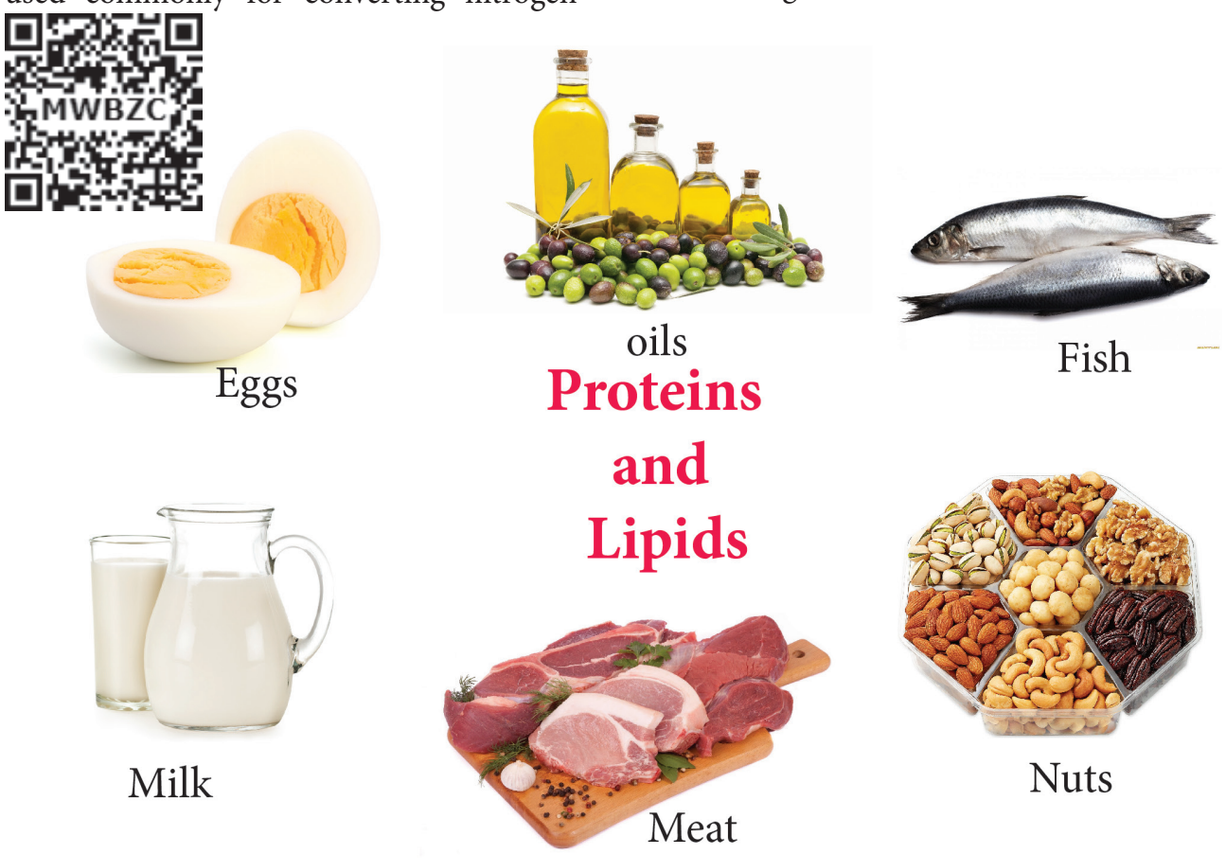
PROTEINS AND LIPIDS

The word '**Protein**' is derived from a Greek word 'protos' meaning 'primary or holding first place' which is appropriate name for an essential life forming and life sustaining substance of all organisms. Proteins contain nitrogen, but the nutritive value of protein-rich foods does not depend upon the total nitrogen content, but on the constituent of aminoacids. The nitrogen content of proteins varies from about 14 to 20 % and in most of the proteins, the value is about 16%.This average figure of 16% is used commonly for converting nitrogen content of foodstuffs or tissues into proteins (multiplied by the factor 6.25 [100/16].

Fat is a member of the class of compounds called '**Lipids**'. The lipids in foods and in the human body include triglycerides (fats and oils), phospholipids and sterols. Lipids perform many tasks in the body, but most importantly, they provide energy.

In this lesson, the students will be able to:

- understand the importance of protein for growth



Proteins and lipids

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- know the effects of protein deficiency in children.
- gain an understanding of lipids as a concentrated source of energy.
- differentiate between healthy and unhealthy fats in the diet.

10.1 Origin and composition of proteins:

Origin

Amino acids are small units that combine to form a protein molecule. Plants synthesise amino acids with the help of bacteria and fungi from : (i) soil, which supplies the necessary nitrogen and sulphur; (ii) water, which provides oxygen and hydrogen; and (iii) atmospheric carbon dioxide, which supplies carbon and oxygen. Animals cannot synthesise amino acids from basic elements, but derive them from ingested plants. Thus, the primary source of all proteins is the vegetable kingdom.

Composition

Proteins are chemical compounds that contain the same atoms as carbohydrate and lipid – Carbon(C), Hydrogen (H) and Oxygen (O). Which is not present in CHO and lipibs. They also contain nitrogen (N) atoms. These Nitrogen atoms give the name 'amino' (nitrogen containing) to the amino acids that are the links in the chains referred to as proteins.

DO YOU KNOW...?

- Proteins are the building blocks of life
- Proteins are used for tissue repair and healing

10.2 Structure of proteins

About 20 different amino acids may appear in proteins. All amino acids share a common chemical 'backbone' and it is these backbones that are linked together to form proteins. Each amino acid also carries a side chain, which varies from one amino acid to another. The side chains make the amino acids differ in sizes, shape and electrical charge. The side chains on amino acids are what makes proteins so varied in comparison with either carbohydrate (or) lipids.

Each amino acid contains a carboxyl (COOH) or acidic group and an amino (NH_2) or basic group. The amino acids are mostly linked together in forming a protein molecule through NH_2 group of one amino acid condensing with COOH group of another amino acid with the elimination of one molecule of water, and a compound thus formed is called a peptide and the linkage is called '*peptide linkage*'.

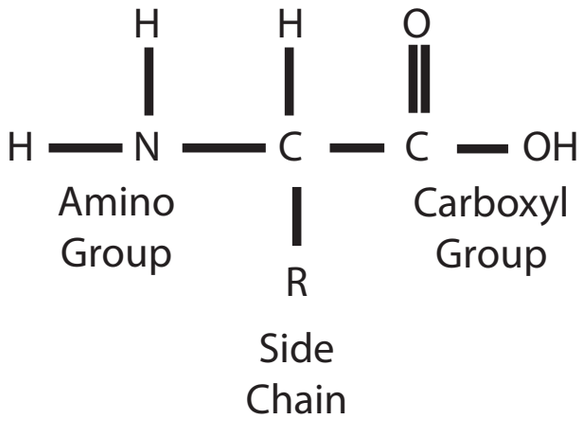

Fig 10.1: Amino acid structure

Protein chains

The 20 amino acids can be linked end-to-end in a virtually infinite variety of sequences to form proteins. When two amino acids bond together, the resulting

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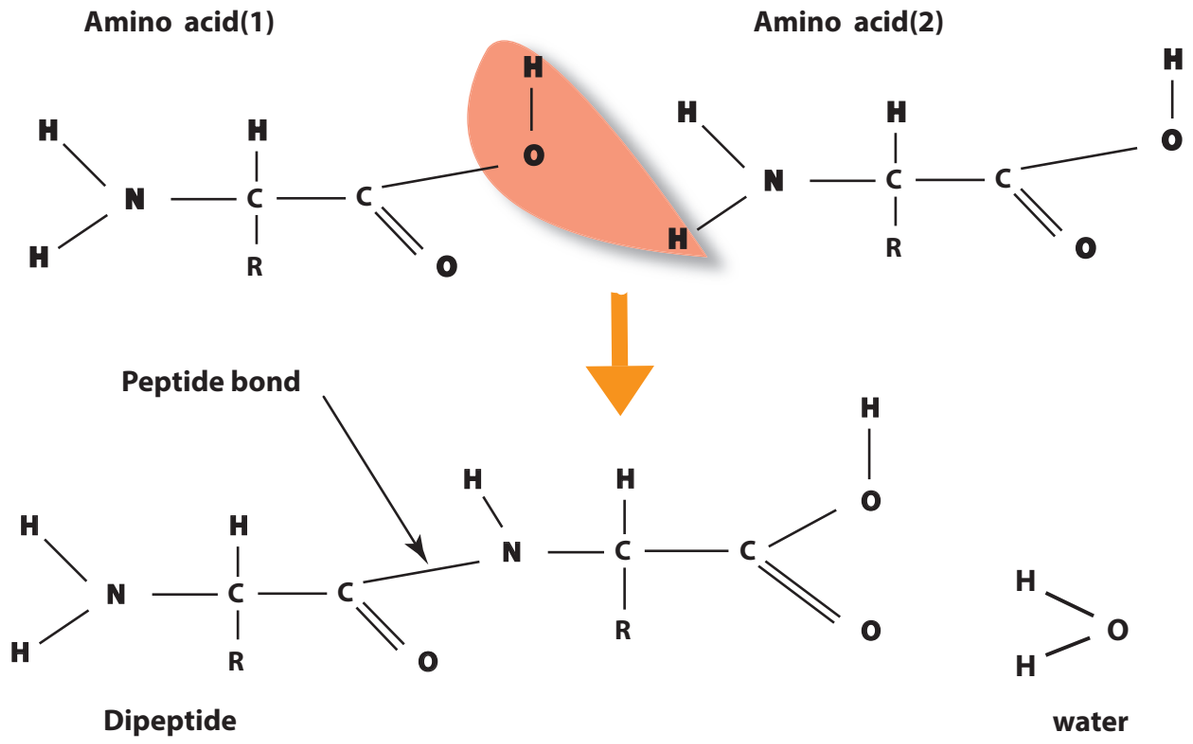

Fig 10.2: Structure of dipeptide

structure is known as dipeptide. Three amino acids bonded together to form a tripeptide. As additional amino acids join the chain, the structure becomes a polypeptide. Most proteins are polypeptides that are 100 to 300 amino acids long.

10.3 Classification of proteins

Proteins are large molecules formed by the combination of a number of aminoacids. About 20 amino acids have been found to occur in proteins and are important from the point of view of human nutrition. Amino acids can be classified as follows:

10.3.1 Nutritional Classification of Amino Acids

I. Essential Amino acids (Indispensable Amino acids)

An *essential* amino acid may be defined as one which is necessary for the growth and health of all living organisms and which cannot be synthesised in the body and must therefore be supplied through dietary intake. There are nine amino acids considered essential for the human infant, out of which Histidine is considered non-essential for the adult.

II. Semi-essential Amino acids (Conditionally Essential Amino acids)

Sometimes a non-essential amino acid can become essential. During illness or conditions of trauma, or in other special circumstances the need for an amino acid that is normally non-essential may become greater than the body's ability to produce it. In such circumstances, that amino acid becomes essential for the ill person. Amino acids that behave this way are referred to as **'Conditionally Essential'** amino acids for critically ill people.

Methionine can be converted to cystine, but cystine cannot be converted to

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methionine. Similarly, phenylalanine can be converted to tyrosine, but not vice-versa. yet these spare the requirements of the corresponding essential amino acid. Hence, cystine and tyrosine are sub-classed as semi-essential amino acids.

III. Non-Essential Amino acids (Dispensable)

These amino acids can be synthesized in the body and not necessarily obtained through dietary intake.

The nutritional classification of amino acids is presented in **table 10.1**

10.3.2 Classification of Proteins (Based on chemical composition)

a) **Simple proteins**: It is composed entirely of amino acids only.

b) **Conjugated or Complex proteins:** It is made up of amino acids and other organic or inorganic compounds.

Table 10.1: Nutritional classification of amino acids

Essential	Semi-essential	Non-essential
Histidine	Arginine	Glutamic acid
Lysine	Tyrosine	Aspartic acid
Tryptophan	Cystine	Alanine
Phenylalanine	Glycine	Proline
Methionine	Serine	Hydroxyproline
Threonine		Cysteine
Leucine		
Isoleucine		
Valine		

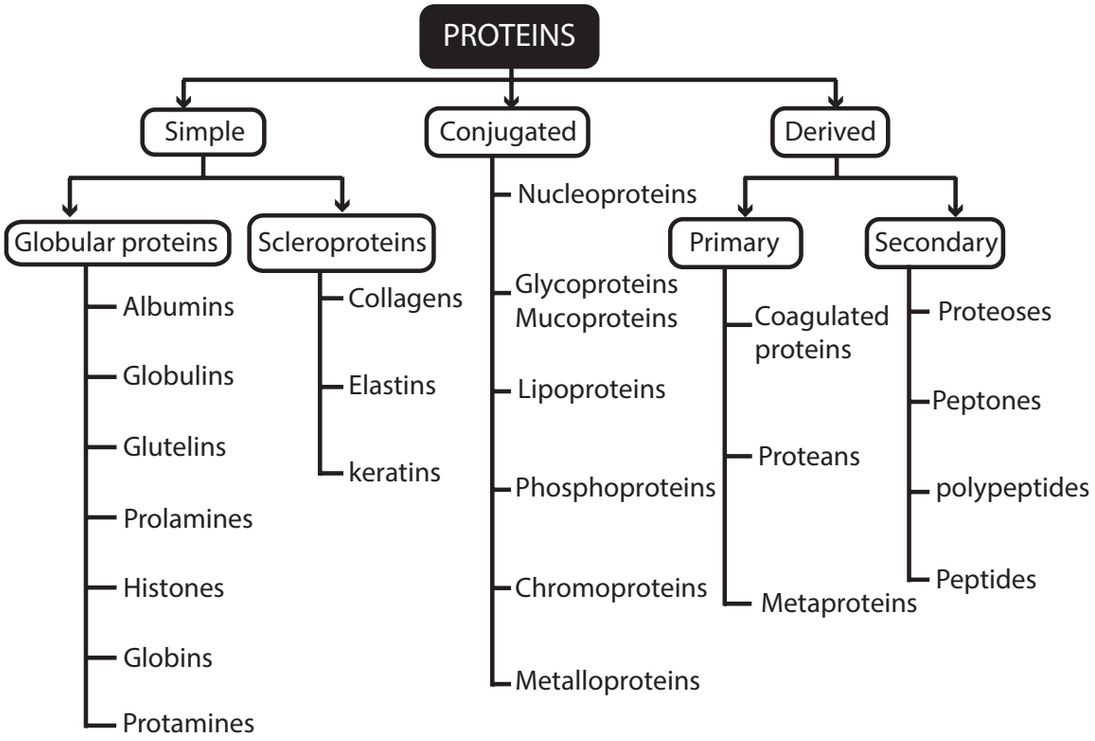

Fig 10.3: Classification of Proteins based on chemical composition

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The non-amino acid group is termed as Prosthetic group (e.g.) Lipoproteins - Chylomicrons

c) **Derived proteins:** These are derivatives of proteins resulting from the action of heat, enzymes or chemical reagents. This group also includes the artificially-produced polypeptides(e.g.)Fibrin

10.3.3 Classification of proteins (Based on nutritional value)

Proteins are classified into two types based on nutritional values as follows:

1) **Complete proteins:** These contain all the essential amino acids in sufficient quantity to supply the needs of the body. They support life even if supplied as the sole source of protein. These proteins are of animal origin (e.g) milk, meat, poultry, egg and fish. The quality of these proteins is much superior to those of incomplete proteins.

2) **Incomplete proteins:** These proteins are deficient in one or more of the essential amino acids and therefore, they do not support life on their own. All plant sources of proteins (i.e) vegetables, fruits, cereals, pulses, nuts and oilseeds contain incomplete proteins to varying degrees.

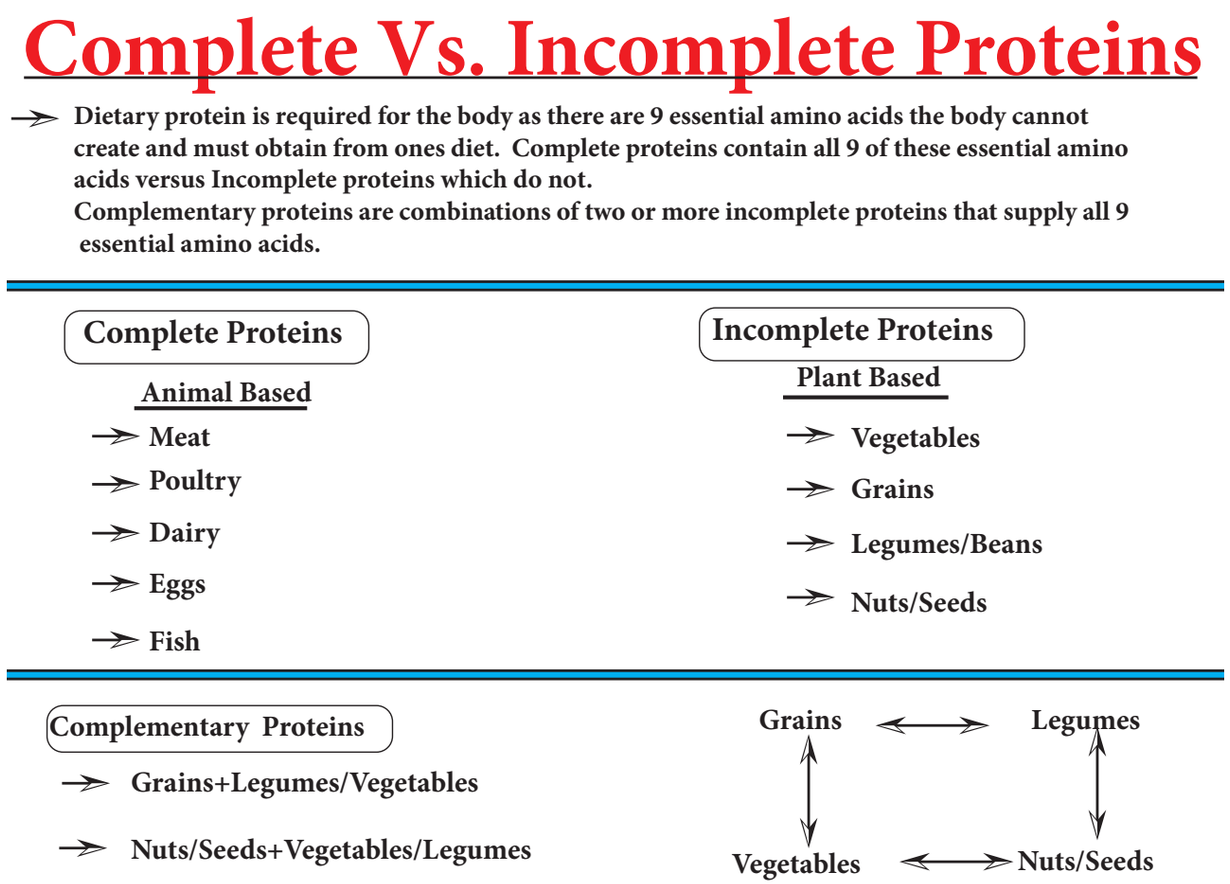

Fig 10.4: Complete Vs Incomplete protein

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Pongal

Rice kheer

Fig 10.5: Complementary proteins

ACTIVITY - 1

Match the right answer

1) Polypeptides	-	Essential amino acid
2) Legumes	-	Complete protein
3) Proline	-	Conjugated protein
4) Arginine	-	Non-essential amino acid
5) Tryptophan	-	Derived protein
6) Meat	-	Simple protein
7) Nucleoproteins	-	Semi-essential amino acid
8) Albumin	-	Incomplete protein

Complementary proteins : If two sources of incomplete proteins are combined in the same meal, the resulting protein may be of better quality. These are called as ***Complementary proteins*** (e.g) Pongal prepared using moong dhal and rice is of better quality than rice or dhal cooked separately. Rice is deficient in aminoacid lysine, but rich in methionine. Pulses are rich in lysine, but deficient in methionine. So, rice and pulse combination will complement each other. Rice Kheer is another example, where animal and vegetable proteins –milk and rice are cooked together.

10.4 Food sources of proteins

Animal sources are complete proteins which includes meat, egg, fish and poultry and they are good protein foods in both quantity and quality. Milk is a valuable source of protein (casein) because although it does not contain a large quantity of protein, the quality is excellent.

Good sources of plant proteins are legumes, pulses, nuts and oil seeds, but their quality is poorer than that of animal foods. However, complementing two plant sources or combining an animal and a vegetable source in one meal increases the nutritional value of the meal tremendously. All vegetables and fruits are poor sources of proteins.

ACTIVITY - 2

- Display food sources of complete and incomplete proteins
- Prepare and display any dish which is an example of complementary proteins

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DO YOU KNOW...?

One gram of protein on oxidation yields 4 Kcal

Protein content of foods

The protein contents (range) of various groups of foods are given in **table 10.2**

Table 10.2: Protein content (range) of different groups of foods

Food groups	Protein content g/kg
Cereals and millets	6 -14
Pulses (legumes) dry	18 – 24
Oilseeds and nuts	18 – 40
Meat, fish and liver	18 -20
Eggs	12 – 14
Milk(fresh)/100ml	3.5 – 4.0
Milk,(whole) powder	26 – 28
Milk,(skimmed)powder	33 - 38
Vegetables(fresh)	
Leafy	1 – 4
Roots and tubers	1 – 1.5
Other vegetables	1 - 7

10.5 Functions of proteins

Proteins form a major part of total body structures and they participate in many activities in our body. The major functions of protein in our body is presented in **table 10.3.**

10.6 Protein requirements

The important factors affecting the utilization of dietary proteins are the following:

1) **Calorie intake :** For the maximum utilization of dietary proteins, the calorie intake should be adequate. If the calorie intake is inadequate, a part of the dietary protein will be wasted in meeting the energy requirements and the protein need will not be satisfied.

2) **Digestibility co-efficient of proteins:** In the utilization of dietary proteins, a part of the proteins is lost in digestion and in metabolism.

3) **Biological or nutritive value:** The protein in the diet should be derived from different sources such as cereals, pulses, nuts and oilseeds, milk and flesh foods. Since animal proteins possess, in general, a higher nutritive value than vegetable proteins, the diets of children, expectant and nursing mothers should in particular, contain large amounts of proteins derived from milk, eggs and fleshy foods.

The protein requirements depend on age and physiological state of the individual. The ICMR recommended dietary allowance for Indians is shown in **table 10.4.**

10.7 Effects of protein deficiency

Diseases due to the deficiency of proteins and calories occur commonly among weaned infants and pre-school children in India and other developing countries.

10.7.1 Protein Energy Malnutrition

Protein Energy Malnutrition (PEM) is defined as a range of pathological conditions arising from coincident lack of varying proportions of protein and calorie,

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Table 10.3: Functions of proteins			
1	Build and repair body tissues		Proteins form integral parts of most body structure such as skin, tendon, membranes, muscles, organs and bones. They support the growth and repair of body tissues.
2	**Regulation of body processes:** Proteins are required for highly specialized functions in our body. These proteins are as follows:		
	a.	Immune proteins	Antibodies, necessary for immunity reactions, are protein in nature. Resistance to disease is an immunological response.
	b.	Hormones	Regulates body processes. Hormones such as adrenocorticotrophic hormone (ACTH) and insulin, are protein in nature
	c.	Enzymes	All enzymes are protein in nature and are required at every step of digestion, absorption, and metabolism
	d.	Nucleoproteins	These govern the synthesis of all body proteins (e.g) Histones, protamine
	e.	Contractile proteins	Actin and myosin are responsible for the action of muscles.
	f.	Blood proteins	Haemoglobin is a protein which carries oxygen. Other proteins found in blood are lipoproteins, transferrin, serum albumin and immunoglobulins. Serum albumin is also responsible for regulating osmotic pressure and maintaining the fluid balance of the body
	g.	Specific functions	Some amino acids have specific and specialized functions in the body • Tryptophan is a precursor of niacin and serotonin. Methionine supplies labile methyl groups for synthesizing choline, which prevents accumulation of fat in the liver • Glycine is required for the formation of the porphyrin ring of haemoglobin and is an important constituent of nucleic acids
3	Supply of energy		Proteins provide fuel for the body's energy needs [4 Kcal/gm].
4	Storage		Proteins help to store iron and copper.
5	Acid-base balance		Proteins help maintain the acid-base balance of the body fluids by acting as buffers.
6	Pregnant and lactating women		Provides amino acids for the growth of foetus in pregnancy and for the production of milk during lactation.

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Table 10.4: ICMR Recommended Dietary Allowances for Proteins

Group	Particulars	Protein requirement g/day
Man	Sedentary work	60
	Moderate work	
	Heavy work	
Woman	Sedentary work	55
	Moderate work	
	Heavy work	
	Pregnant woman	82.2
	Lactation (0- 6 months)	77.9
	Lactation (6-12 months)	70.2
Infants	0 – 6 months	1.16 g/kg/ day
	6 – 12 months	1.69g/kg/ day
Children	1 -3 years	16.7
	4 – 6 years	20.1
	7 – 9 years	29.5
Boys	10 -12 years	39.9
Girls	10 -12 years	40.4
Boys	13 – 15 years	54.3
Girls	13 – 15 years	51.9
Boys	16 -17 years	61.5
Girls	16 – 17 years	55.5

occurring most frequently in infants and young children and often associated with infection (WHO,1973)

PEM affects children under 5 years of age belonging to the poor underprivileged communities. Under nutrition is a complex condition with multiple deficiencies such as proteins, energy and micronutrient deficiencies often occurring together. According to WHO, malnutrition is an underlying factor in over 50 % of the 10 – 11 million yearly deaths of children under 5 years.

10.7.2 Classification of PEM

Protein energy malnutrition may be classified into three types as follows:

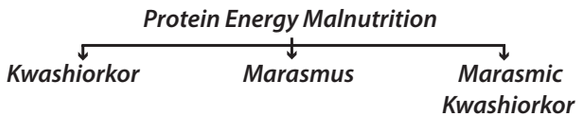

Fig 10.6: Classification of PEM

10.7.3 Causes of PEM

PEM is prevalent in all parts of the world and in all ages. It is primarily a disease that occurs in young children who live in poverty. In India, PEM is the most widespread form of malnutrition among pre-school children. A majority of them suffer from varying grades of malnutrition.

The paths leading from early weaning to Nutritional marasmus and from protracted breast feeding to kwashiorkor is schematically presented below:

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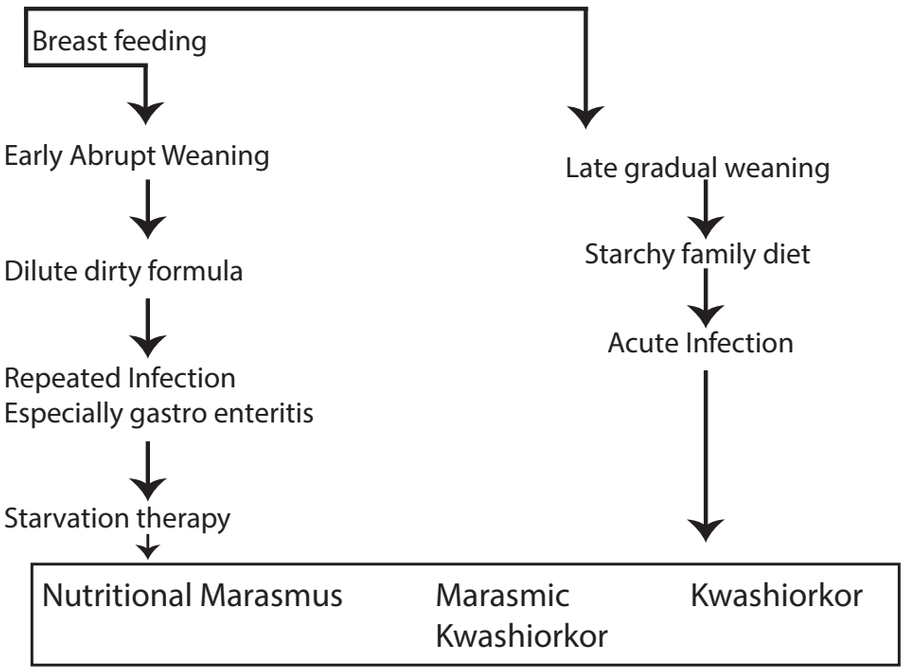

Fig 10.7: Causes of PEM

10.7.4 Clinical signs and symptoms of PEM

I. Kwashiorkor

This disease was first reported to occur in children in Africa by Dr.Cicely Williams in 1935.

It is caused by deficiency of proteins in the diet. The important symptoms of the disease are:

1) Growth failure
2) Oedema of the face and lower limbs
3) Muscle wasting
4) Fatty liver
5) Anorexia (loss of appetite)
6) Diarrhoea
7) Change in the colour, sparse, soft and thin hair.
8) Change in the colour of the skin (hypo and hyperpigmentation)
9) Anaemia
10) Vitamin A deficiency
11) Angular stomatitis (Cracks in the corners of mouth)
12) Cheilosis (inflammation and cracks in lips)
13) Moon face

II. Marasmus

This is caused by severe deficiency of proteins and calories in the diet. The important features are as follows:

1) Severe wasting of muscles
2) Loss of subcutaneous fat (Limbs appear as skin and bones)
3) Skin is dry and atrophic
4) Anaemia
5) Eye lesions due to Vitamin A deficiency
6) Irritability and fretfulness
7) Diarrhoea

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Fig 10.8: Kwashiorkor

Fig 10.9: Marasmus

8) Dehydration
9) Body temperature is sub-normal
10) Failure to thrive
11) Wrinkled skin - Old man's face
12) Grossly underweight

III. Marasmic Kwashiorkor

Children suffering from this disease show signs of both kwashiorkor and marasmus.

10.7.5 Differences between Kwashiorkor and Marasmus

Table 10.5: Differences between Kwashiorkor and Marasmus

Kwashiorkor	Marasmus
It develops in children whose diets are deficient of protein.	It is due to deficiency of proteins and calories.
It occurs in children between 6 months and 3 years of age.	It is common in infants under 1 year of age.
Subcutaneous fat is preserved.	Subcutaneous fat is not preserved
Oedema is present.	Oedema is absent.
Enlarged fatty liver.	No fatty liver.
Ribs are not very prominent.	Ribs become very prominent.
Lethargic	Alert and irritable.
Mild or no Muscle wasting.	Severe muscle wasting
Poor appetite.	Voracious feeder.
The person suffering from kwashiorkor needs adequate amounts of proteins.	The person suffering from marasmus needs adequate amount of proteins, fats and carbohydrates.

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10.7.6 Treatment of PEM

Children with severe PEM are often seriously ill when they first present for treatment. They should be admitted to a hospital for the treatment of life- threatening problems. Specific deficiencies should be corrected and metabolic abnormalities reversed. When the child's condition is stable and the appetite has returned,which is usually after 2- 7 days ,the treatment can be continued outside the hospital .

A. Hospital based management

1) **Dehydration:** Diarrhoea leading to dehydration is a serious and often fatal event in children with severe malnutrition. Skin elasticity is poor in children with marasmus and their eyes are normally sunken. Unlike Kwashiorkor, the altered skin elasticity is masked by oedema. Patients with mild to moderate dehydration can be treated by oral or nasogastric administration of fluids.

2) **Infection:** Infection is often the immediate cause of death in PEM. It is difficult to detect infections clinically as fever and rapid pulse rate may not be present in severely malnourished patients. Since infection is common, antibiotics should be given routinely to all malnourished patients. Children with complications should be treated with broad spectrum antibiotics like amoxicillin and ampicillin. Intestinal infections like ascariasis must be treated with appropriate de-worming agents.

3) **Hypoglycemia:** A child may become drowsy or develop convulsions due to hypoglycaemia. In mild cases, oral administration of 50 ml of 10% glucose may be sufficient. If a child develops convulsions or becomes unconscious, 10% glucose should be given intravenously (5ml/kg) followed by 50ml of 10% glucose by nasogastric tube.

4) **Hypothermia:** Marasmic children are prone to have low body temperature. If the room is cold, the child should be properly covered with a blanket. The state of shock should be treated with intravenous injection of glucose –saline or blood transfusion.

5) **Anaemia:** Severe anaemia is dangerous, as it can result in heart failure. If the haemoglobin falls below 5g/dl, blood transfusion should be given.

B. Dietary management

Although treatment of complications can reduce mortality, proper dietary management is important for complete recovery. The child should be given a diet providing sufficient quantities of calories and protein, in gradually increasing amounts, without provoking vomiting or diarrhoea. It is best to begin with liquid formula, as it is easy to feed and measure the intake. Initially the child may refuse the feeds due to lack of appetite. As the appetite improves and child starts taking food by mouth, solid supplements can be introduced. The diet should be given frequently and in small amounts.

High energy intakes (150Kcal/kg) and high protein intakes (3-4g/kg) are required for rapid recovery. Most hospitals use milk-based formulas for feeding

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malnourished children. Either fresh milk or skimmed milk can be used for preparing the formula. Sugar and vegetable oil are added to increase the energy content. In older children, an entirely liquid diet is not necessary as they can accept solid foods. A mixed cereal-based diet can be given with added oil to increase energy density.

Fig 10.10: Dietary management for PEM

ACTIVITY - 3

(Think and answer)

1) Ramu has stunted growth, severe diarrhoea, moon face and oedema. What is he suffering from?

_____

2) Sheela has dry wrinkled skin, severe muscle wasting and diarrhoea. What is she suffering from? _____

_____

3) Suggest a calorie and protein rich breakfast for a child recovering from PEM.

Vitamin and Mineral supplements

Vitamin and mineral supplements should be given for all malnourished children. Daily supplements of iron (60mg/day) and folic acid (1 microgram/day) should be given to correct anaemia along with multivitamin preparation.

With this treatment, clinical improvement is seen within a week. The child becomes alert and the appetite improves; Oedema disappears in about 7 -10 days. During this period, there may be some weight loss, but thereafter, the child starts gaining weight . After the child is discharged form the hospital, he should be followed up in the out-patient clinic or at home till he reaches normal weight for height.

Low cost recipes for children recovering from PEM

1) Ragi, green gram, jaggery - puttu
2) Ragi, Bengal gram, wheat - puttu
3) Wheat rava, green gram dhal, vegetable - upma
4) Rice, green gram dhal - pongal / khichdi
5) Rice, bengalgram - porridge

LIPIDS

The term 'Lipids' is applied to a group of naturally occurring substances characterized by their insolubility in water, greasy feel and solubility in organic solvents. They occur in the plant and animal kingdom. Fats are a more concentrated form of storage of energy than carbohydrates. In the presence of adequate supply of carbohydrates, fat is stored in the adipose(fatty) tissue.

10.8 Chemical composition of lipids

Fat is a complex molecule constituting a mixture of fatty acids and an alcohol, generally glycerol. Like carbohydrates, it

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contains carbon, hydrogen and oxygen, but it differs from a carbohydrate in that it contains more carbon and hydrogen and less oxygen. When oxidized, it gives nine kilocalories. A molecule of fat consists of three molecules of fatty acids and one molecule of glycerol. It is also known as *triglyceride*.

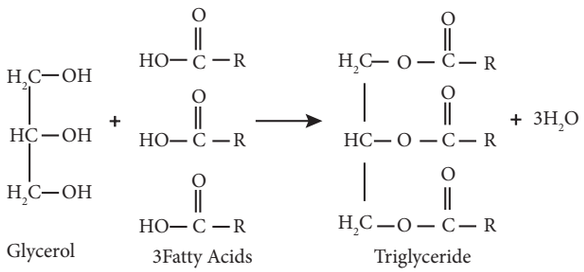

Fig 10.11: Formation of Triglyceride

10.9 Differences between fats and oils

Fats and oils have many types of triglycerides. Nature of fat or oil depends on the type of fatty acids attached to the glycerol molecule.

Table 10.6: Difference between Fats and Oils

S.no	Fats	Oils
1	Fat is solid at room temperature	Oil is liquid at room temperature
2	Fat is obtained from animals (i.e) butter, ghee, egg yolk ,meat	Oils are obtained from plant sources (i.e) mustard oil, groundnut oil, almond oil
3	Fats have only saturated fatty acids	Oils have saturated and unsaturated fatty acids

DO YOU KNOW...?

- Fats are a concentrated source of energy
- Good fats can promote health and bad fats can increase risk of chronic diseases

Fig 10.12: Fats and oils

10.10 Classification of fats

Fats are classified into 4 categories as follows:

I. On the basis of chemical composition
II. On the basis of fatty acids
III. On the basis of requirement
IV. On the basis of sources

10.10.1 On the basis of chemical composition

Fats can be classified into 3 main groups as follows:

1) Simple lipids

These are esters of fatty acids and glycerol. They are also called as neutral fats or triglycerides. These neutral fats make up 98 -99% of food and body fats. (e.g) fats and oils

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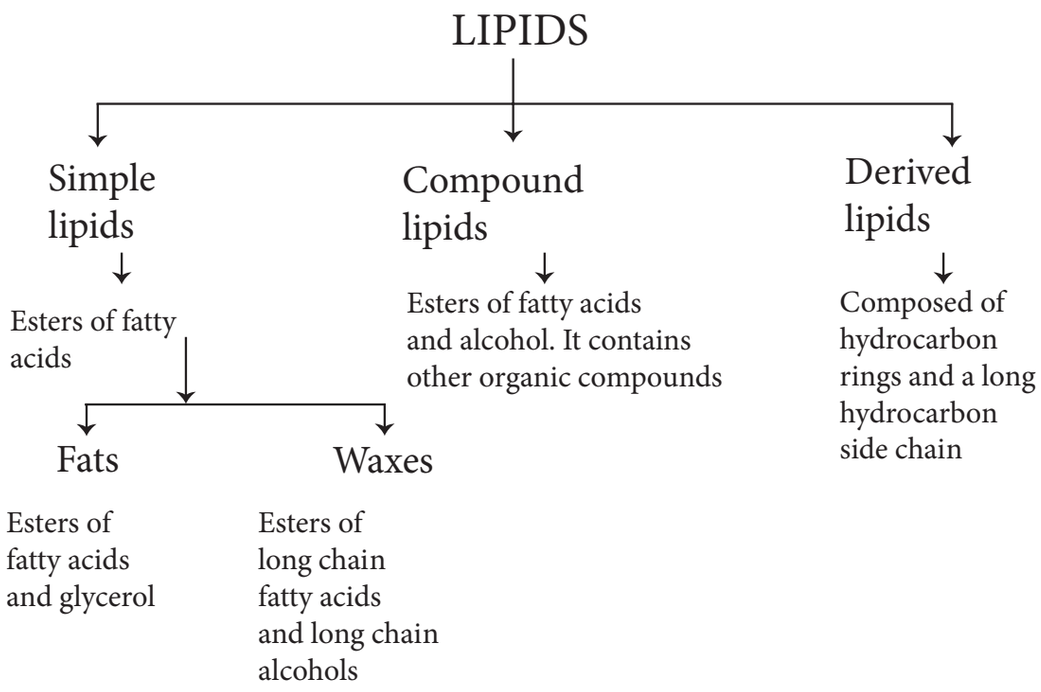

Fig 10.13: Classification of fats based on fatty acids

Waxes: A wax is a simple lipid which is an ester of fatty acids and long chain aliphatic alcohols. The alcohol may contain 12-32 carbon atoms. Waxes are found in nature as coatings on leaves and stems. The wax prevents the plant from losing excessive amounts of water.

2) Compound lipids

The compound lipids contain, in addition to fatty acids and glycerol,some other organic compounds.

(i) **Phospholipids:** These contain phosphoric acid and a nitrogenous base in addition to fatty acids and glycerol(e.g.)Lecithin and cephalin.

(ii) **Glycolipids:** Complex lipids containing carbohydrates in combination with fatty acids and glycerol(e.g) Cerebrosides.

(iii) **Lipoproteins:** Lipoproteins are the most important as they are the carriers of lipids in the blood and form cell membranes.

3) Derived lipids

These are substances liberated during hydrolysis of simple and compound lipids which still retain the properties of lipids. The important members of this group are sterols, fatty acids and alcohol.

(i) **Sterols :** Sterols are solid alcohols and form esters with fatty acids. In nature they occur in the free state in the form of esters. Based on their origin sterols are classified as cholesterol (animal origin) and phytosterol (in plants).

Cholesterol is a waxy, fat-like substance found in all cells of the body and has several important functions in the body. It is synthesized in the body by the liver independent of the dietary intake. The body normally synthesizes about 2 grams of cholesterol. The dietary sources of

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cholesterol includes animal foods. It is used in the body for synthesizing hormones, Vitamin D and substances which help to digest foods. High blood cholesterol is a risk factor for heart disease. Rich sources of dietary cholesterol include meat, poultry (with skin), organ meats like brain, kidney, liver and full fat dairy products.

(ii) **Fatty acids:** They are the key refined fuel form of fat that the cell burns for energy. They are the basic structural unit of fats and they may be saturated or unsaturated. (e.g) oleic acid, linoleic acid, linolenic acid, palmitic acid and myristic acid.

10.10.2 On the basis of fatty acids

Fats can be classified based on the fatty acids present in them as follows:

1) Saturated fatty acids

A saturated fat is a type of fat in which the fatty acid chains have all or predominantly single bonds. Various fats contain different proportions of saturated fat. Saturated fatty acids, especially palmitic and stearic acids are found in animal products such as cream, cheese, butter, other whole milk dairy products and fatty meats which also contain dietary cholesterol. Certain vegetable products have high saturated fat content, such as coconut oil and palm kernel oil. Many prepared foods are high in saturated fat content, such as pizza, dairy desserts and sausage.

2) Unsaturated fatty acids

An unsaturated fat is a fat or fatty acid in which there is at least one double bond within the fatty acid chain.

(i) **Monounsaturated fatty acid (MUFA):** A fatty acid chain is monounsaturated if it contains one double bond. Monounsaturated fats are good fats. A diet high in MUFA can reduce blood cholesterol levels, lowers risk of heart disease, stroke and breast cancer, reduces pain in rheumatoid arthritis and helps in

Fig 10.14: Food sources of Saturated fats

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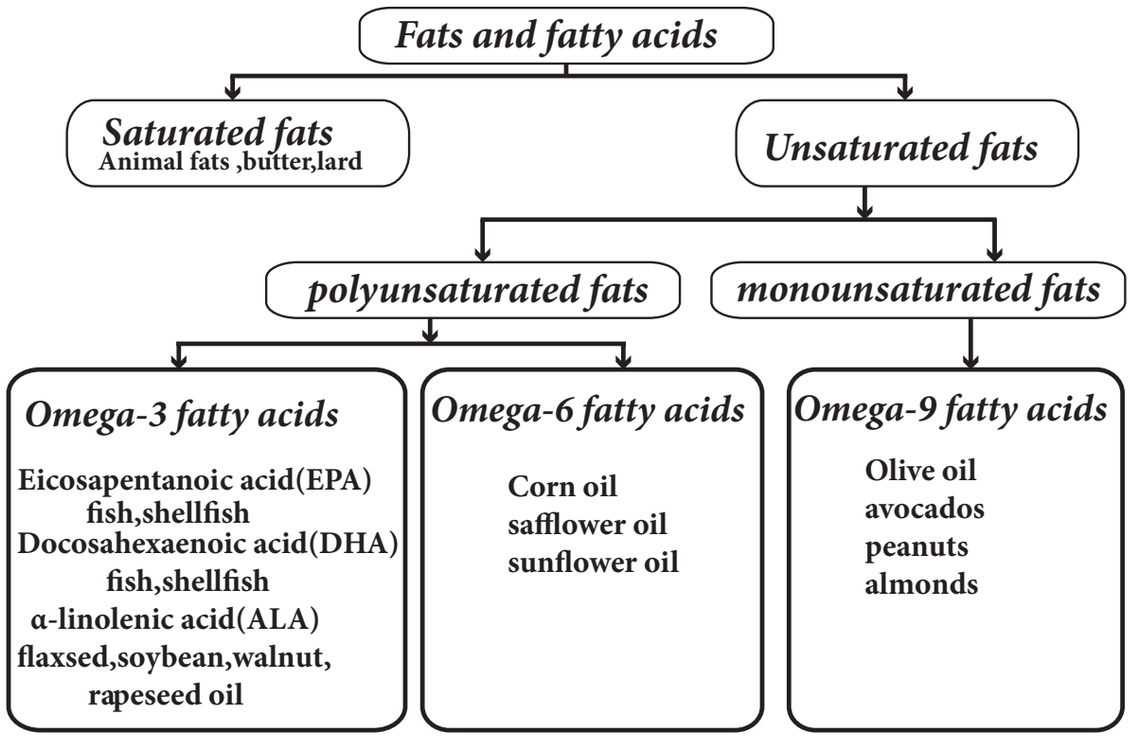

Fig 10.15: Classification of fats based on fatty acids

weight loss. Foods which contain MUFA (Oleic acid) are avocados, olives, olive oil, peanut butter and peanut oil. It is also known as omega-9 fatty acid.

(ii **Polyunsaturated fatty acid (PUFA):** A fatty acid is polyunsaturated if it contains more than one double bond. They are of two types, namely Omega-3 and Omega-6 fatty acids.

a) **Omega-3:** It is also called ω−3 fatty acids or n−3 fatty acids with a double bond (C=C) at the third carbon atom from the end of the carbon chain. The three types of omega−3 fatty acids involved in human physiology are α-linolenic acid (ALA) [found in plant oils], eicosapentaenoic acid (EPA), and docosahexaenoic acid (DHA) [both commonly found in marine oils]. Common sources of plant oils containing the omega−3 ALA fatty acid include walnut, flaxseed, flaxseed oil,soybeans and chia seeds.The sources of animal omega−3 EPA and DHA fatty acids include fish and fish oils.

The health benefits of omega-3 fatty acids are immense and they have been proven effective in the treatment and prevention of hundreds of medical conditions which includes high cholesterol, depression, anxiety, cancer, diabetes mellitus, inflammatory diseases, arthritis and cardiovascular diseases.

b) **Omega-6:** Omega-6 fatty acids (also referred to as ω-6 fatty acids or n-6 fatty acids) are a family of pro-inflammatory and anti-inflammatory polyunsaturated fatty acids that have in common a final carbon-carbon double bond in the n-6 position, that is the sixth bond, counting from

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Fig 10.16: Rich sources of omega-3 fatty acids

the methyl end. Omega-6 fats, also known as linoleic acid, are available only in food. The human body cannot make them, so they are considered as essential fats. They support brain function, bone health, reproductive health, hair growth and regulation of metabolism. Good sources of linoleic acid include vegetable oils.

10.10.3 On the basis of requirement

Fatty acids are of 2 types:

1) Essential Fatty Acids

Fatty acids which are essential to be taken in our diet because they cannot be synthesized in our body are known as Essential Fatty Acids. (eg.) Linoleic, linolenic and arachidonic acids.

2) Non-Essential Fatty Acids

Non-Essential Fatty Acids are those which can be synthesized by the body and which need not be supplied through the diet. Palmitic acid, oleic acid and butyric acid are examples of non– essential fatty acids.

10.10.4 On the basis of sources

Fats are divided into 2 types based on their source, namely visible and invisible fats. Some fats and oils added to food or used for

Fig 10.17: Rich sources of omega-6 fatty acids

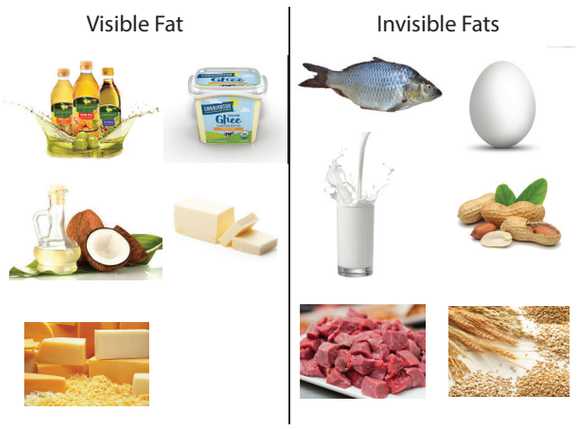

Fig 10.18: Sources of visible and invisible fats

ACTIVITY - 4

Match the right answer

1) Fish oil	-	MUFA
2) Olive oil	-	Saturated fat
3) Corn oil	-	Omega 3 fatty acid
4) Cholesterol	-	Pulses
5) Red meat	-	Omega 6 fatty acid
6) Invisible fat	-	Organ meats

frying are visible fats. These are also known as pure fats. Many foods like milk, cream, egg yolk, meat, fish and even cereals and legumes contribute substantial amount of invisible fats (not visible in the food) to the diet.

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10.11 Hydrogenated fats

Hydrogenation (or, more accurately, "partial hydrogenation," as the process is incomplete) is the forced chemical addition of hydrogen into omega-6 polyunsaturated oils to make them hard at room temperatures, primarily as a cheaper and less perishable substitute for butter. The liquid fat becomes a solid fat and the unsaturated fatty acid contents decrease as a result of hydrogenation. Common hydrogenated fats include hydrogenated or partially hydrogenated cottonseed, palm, soy and corn oils, but theoretically almost any polyunsaturated oil can be hydrogenated. During the process of hydrogenation, hydrogen is added to the unsaturated linkage with nickel as catalyst.

A major health concern during the hydrogenation process is the production of trans fats. Trans fats are the result of a side reaction with the catalyst of the hydrogenation process. This is the result of an unsaturated fat which is normally found as a cis isomer converts to a trans isomer of the unsaturated fat. Isomers are molecules that have the same molecular formula but are bonded together differently. A cis isomer has the hydrogens on the same side, whereas a trans isomer has hydrogen atoms on the opposite side. Due to the added energy from the hydrogenation process, the activation energy is reached to convert the cis isomers of the unsaturated fat to a trans isomer of the unsaturated fat .

Although trans fats are edible, consumption of trans fats has been shown to increase the risk of coronary artery disease in part by raising levels of the lipoprotein LDL (often referred to as "bad cholesterol"), lowering levels of the lipoprotein HDL (often referred to as "good cholesterol"), increasing triglycerides in the bloodstream and promoting systemic inflammation. Trans fat are found in margarine, vanaspathi, baked goods such as doughnuts, pastries, cookies, deep fried foods like fried chicken and French-fried potatoes, microwave popcorn, snack chips, processed foods and confectionery fats.

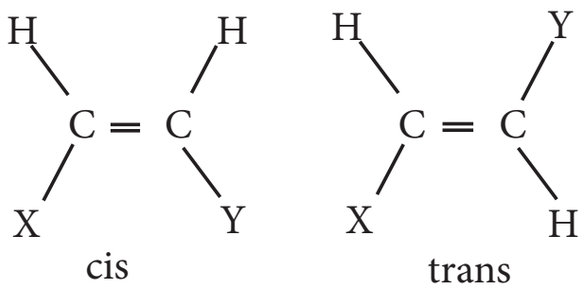

Fig 10.19: Cis and trans fats

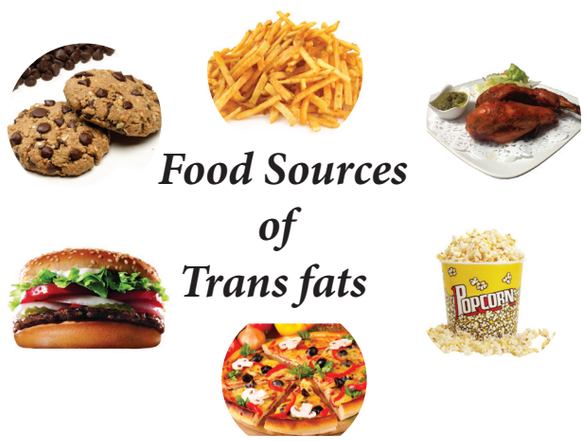

Fig 10.20: Food sources of trans fats

ACTIVITY - 5

1) Display food sources of GOOD and BAD fats.
2) What on the foods containing trans fats which you frequently consume and list their harmful effects.

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DO YOU KNOW...?

when oxidized one gram of fat gives 9 kcal.

10.12 Functions of fats

Fats perform several important functions:

1) Fats are a concentrated source of energy. one gram of fat gives 9 kilocalories of energy. Fat is stored in the body in the adipose tissue and provides energy to the body when required.
2) Fats are the constituents of cell membrane structure and regulate the membrane permeability.
3) Subcutaneous fat acts as an insulator and helps in retaining body heat.
4) They are essential for the digestion, absorption and utilization of fat soluble vitamins like Vitamin A, D, E and K.
5) Fats are important as cellular metabolic regulators (Steroid hormones and prostaglandin).
6) Fats have a sparing action on vitamin B_1 (i.e) if fat consumption is adequate, not much vitamin B_1 is needed.
7) Fats improve the palatability of the diet and give satiety value.(ie.)feeling of fullness in the stomach.
8) The calories in fat spare proteins from being oxidized for energy.
9) Cholesterol is needed for synthesis of sex and adrenal hormones (steroid hormones).
10) Substituting a fat high in PUFA or MUFA for a fat high in saturated fatty acids can decrease the level of blood cholesterol levels and hence reduce risk of heart disease.

10.12.1 Functions of Essential Fatty Acids

1) Maintenance of the functioning and integrity of cellular and sub-cellular membrane.
2) Regulation of cholesterol metabolism by transporting it between the blood and body tissues.
3) Acts as precursors for important group of hormone like compounds-prostaglandins which aid in regulating vascular function and help relieving pain and inflammation.
4) Delays blood clotting time.

10.13 Fat requirements

The ICMR recommended allowances of fat for Indians is given in **table 10.7.**

10.14 Deficiency and excess of fat in the diet

a) Effects of EFA deficiency

Deficiency of fat in the diet causes the deficiency of essential fatty acids. Deficiency of essential fatty acids leads to 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. The condition is characterized by the presence of horny eruptions on the posterior and lateral aspects of the limbs on the back and buttocks.

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Table 10.7: ICMR Recommended Dietary Allowances for Fats

Group	Particulars	Visible fat (g/day)
Man	Sedentary work	25
	Moderate work	30
	Heavy work	40
Woman	Sedentary work	20
	Moderate work	25
	Heavy work	30
	Pregnant woman	30
	Lactating woman (0-6 months)	30
	Lactating woman (6 -12 months)	30
Infants	0 – 6 months	-
	6 – 12 months	19
Children	1 – 3 years	27
	4 – 6 years	25
	7 - 9 years	30
Boys	10 – 12 years	35
Girls	10 – 12 years	35
Boys	13 – 15 years	45
Girls	13 – 15 years	40
Boys	16 – 17 years	50
Girls	16 – 17 years	35

Phrynoderma is cured rapidly by the administration of linseed or safflower seed oil rich in EFA. Infants fed on an EFA deficient diet develop irritation and changes in the skin within a few weeks. The skin appear as dryness and desquamation with oozing in the folds. Diarrhoea may also occur, supplementation of the diet with linoleic acid helps to restore the skin to normal condition.

b) Effects of Excess of fat

1) Leads to Obesity because more than required calories are consumed. In addition, the excess carbohydrates are also converted to fat for storage in the body resulting in obesity.
2) Slows down digestion and absorption of foods.
3) Interferes with the absorption of calcium by combining with calcium to form an insoluble calcium soap.
4) Cause ketosis unless adequate carbohydrate is present to complete the oxidation of fat.

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Fig 10.21: Effects of EFA deficiency - Phrynoderma

DO YOU KNOW...?

Ketosis is a normal metabolic process. When the body does not have enough glucose for energy, it burns stored fats instead; this results in a build-up of acids

ACTIVITY - 6

1) How is excess fat or cholesterol in the body linked with heart disease?
2) What is known as Good cholesterol and Bad cholesterol?

SUMMARY

- Proteins are the building blocks of life.
- Proteins are used for tissue repair and maintenance.
- Amino acids are small units that combine to form a protein molecule.
- Aminoacids are classified as essential, semiessential and non essential aminoacids.
- Proteins are classified as simple proteins, conjugated or complex proteins and derived proteins.
- Proteins are also classified as complete proteins and incomplete proteins.
- If two sources of incomplete proteins are combined in the same meal, the resulting protein may be of better quality. These are called as Complementary proteins.
- Animal sources are complete proteins which includes meat, egg, fish and poultry and they are good protein foods in both quantity and quality. Milk is a valuable source of protein because although it does not contain a large quantity of protein, the quality is excellent.
- Good sources of plant proteins are legumes, pulses, nuts and oil seeds, but their quality is poorer than that of animal foods.
- All vegetables and fruits are a poor source of protein.
- The main functions of protein are building and repair of body tissues and regulation of body processes.
- Protein Energy Malnutrition (PEM) is defined as a range of pathological conditions arising from coincident lack of varying proportions of protein and calorie ,occurring most frequently in infants and young children and often associated with infection.
- The treatment of PEM include hospital based management and dietary management.

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- The term 'Lipids' is applied to a group of naturally occurring substances characterized by their solubility in water, greasy feel and solubility in organic solvents.
- They occur in plant and animal kingdom. Fats are a more concentrated form of storage of energy than carbohydrates.

Glossary

Terms	Meaning
Arthritis	It is a term often used to mean any disorder that affects joints. Symptoms generally include joint pain and stiffness.
Coronary heart disease (CHD)	It is a disease in which a waxy substance called plaque builds up inside the coronary arteries. These arteries supply oxygen-rich blood to the heart muscle.
Fatty liver	Fatty liver, or hepatic steatosis, is a term that describes the build-up of fat in the liver.
Hypoglycemia	A lower than normal level of glucose in blood (<70 mg/dl).
Hypothermia	The body loses heat faster than it can produce heat, causing a dangerously low body temperature.

Questions

Part - A

Choose the correct answer (1 mark)

1) Three amino acids bonded together form a _____
   a) Peptide b) Dipeptide
   c) Tripeptide d) monopeptide

2) _____ is considered as a non-essential amino acid for adults.
   a) Histidine b) Tryptophan
   c) Methionine d) Peptide

3) The protein requirement for a 12 year old girl is _____ per day.
   a) 39.9 g b) 40.4 g
   c) 42 g d) 41 g

4) 1 gram of proteins gives _____ Kcal.
   a) 4 b) 9
   c) 7 d) 5

5) One gram of fat gives _____ kilo calories.
   a) 9 b) 4
   c)7 d)3

6) _____ is a concentrated source of energy.
   a) Protein b) Carbohydrate
   c) Fat d) Lipids

7) _____ is also known as Good cholesterol.
   a) HDL b) LDL
   c) VLDL d) MDL

8) Deficiency of EFA causes _____.
   a)Anaemia b)Phrynoderma
   c)PEM d) Fever

9) Trans fats are formed during _____ of vegetable oils.
   a)Hydrogenation b)Extraction
   c) Refining d) oxidation

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10) _____ are rich in trans fats.
a)Processed foods b) Cereals
c) Pulses d) Vitamines

11) _____ is an example of essential fatty acid.
a) Oleic acid b) Linoleic acid
c) Palmitic acid d) Acid

12) A pregnant woman requires _____ grams of fat per day.
a) 20 b) 25
c) 30 d) 35

Part - B

Write short answer (2 marks)

1) What is an incomplete protein?
2) What are derived proteins?
3) List any 2 food sources of complete proteins.
4) What is Kwashiorkor? Give any 2 clinical signs of kwashiorkor.
5)What are simple proteins? Give examples.
6)What are simple lipids?
7)Give any 2 differences between fats and oils.
8)What is the chemical composition of lipids?
9)Give any 2 food sources of Omega-3 fatty acids.
10)What are the health benefits of MUFA?
11) What is cholesterol? Give examples of foods rich in cholesterol.

Part - C

Answer in brief (3 marks)

1) What are complementary proteins? Give examples.
2) What are Essential amino acids? List the essential amino acids.
3) Define PEM. Give the classification of PEM
4) List the causes of PEM
5) List any 3 low cost recipes for children recovering from PEM
6) What are polyunsaturated fatty acids? Classify them with examples.
7) What are EFAs ?Give examples
8) Differentiate between visible and invisible fats
9) Give the fat requirement for a 12 year old, 5 year old and 17 year old boy.
10) What are the effects of excess fat in the body?

Part - D

Answer in detailed (5 marks)

1) What is PEM? Give the classification of PEM and highlight on the clinical signs and symptoms of PEM.
2) What are the functions of proteins?
3) List the differences between Kwashiorkor and Marasmus.
4) How will you treat a child suffering from PEM?
5) Explain the nutritional classification of amino acids with examples.
6) Explain the following terms with examples:
a) Complete protein
b) Incomplete protein
c) Complementary proteins
7) What are lipids? Classify fats on the basis of their chemical composition.
8) What are essential fatty acids? Give their functions and effects of deficiency.
9) List the functions of fat in the body.
10) What are trans fats? List the food sources and harmful effects of trans fats.
11) What are unsaturated fatty acids ? Classify them and give their food sources and benefits.

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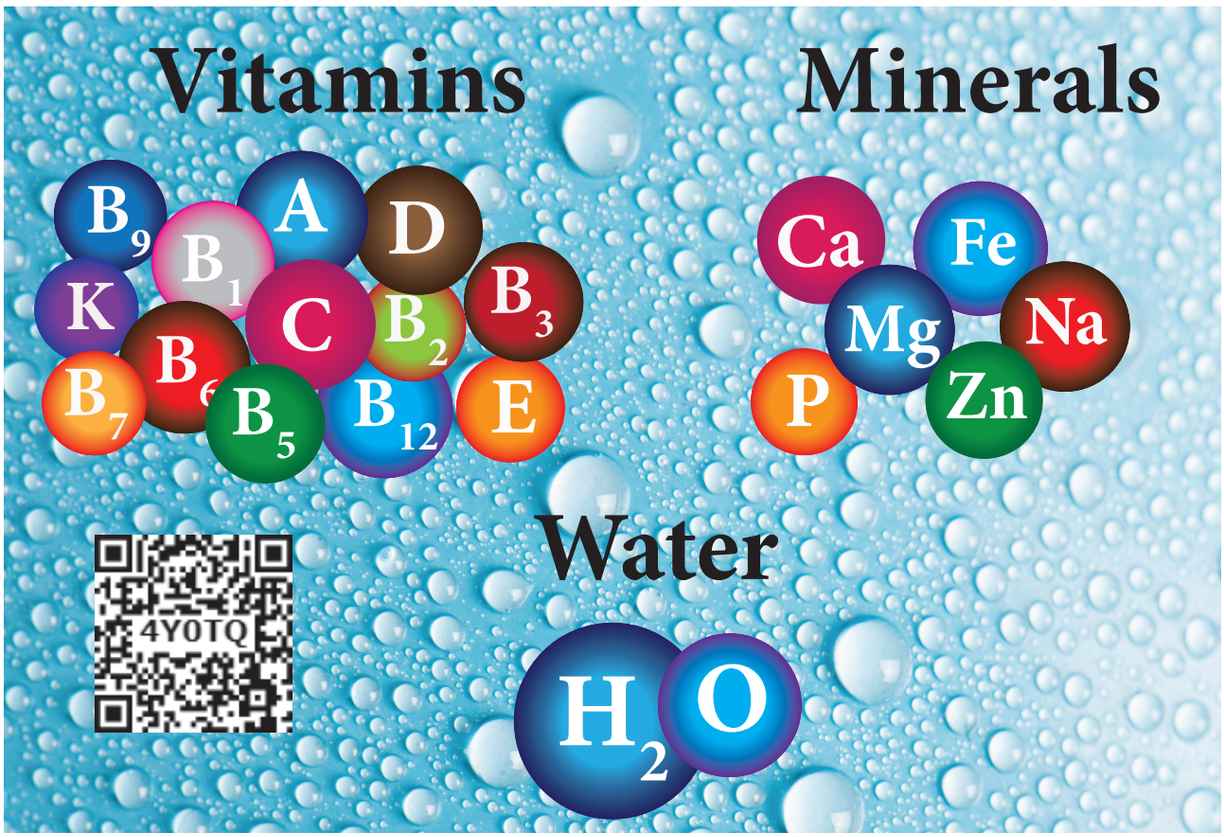
Unit 11

Vitamins, Minerals and Water

Vitamins and Minerals are micronutrients. They help to protect body from diseases. These micronutrients must be provided through the food we eat or through supplements. Vitamins are complex organic molecules that serve primarily as coenzymes or regulators of body metabolism. Minerals in contrast, are simple elements with important roles in both structure and function of the body. Water is one of the most important substances on earth's surface. All plants and animals depend on water for survival. Intake of water and loss must be balanced. Water is obtained through food and drinking water. Water balance in the body is regulated by minerals like sodium and potassium.

In this lesson, the students will be able to:

- understand different types of vitamins, minerals and their functions in the body.



Vitamins, Minerals and Water

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DO YOU KNOW...?

Vitamins are the discovery of 20th century scientists. In the history of nutrition, the findings of Casmir Funk, 1911 was a turning point who propounded the 'Vitamine' theory by feeding animals purified diet. Takaki, a physician in the Japanese Navy, first demonstrated that fatal diseases like beriberi could be treated with rice bran, vegetables, fish and meat. Thus the study of vitamins brought to light about 17 different vitamins. Each one of them has its own history, chemistry, structure, function, sources, requirements and disorder symptoms.

- know the important sources and deficiency symptoms of vitamins, minerals and water.
- importance of water in day to day life.

11.1 Classification of Vitamins

Vitamins differ from each other in physiological function, chemical structure, and distribution in foods. Plants synthesize all vitamins they require and therefore vegetables and fruits are rich sources of vitamins. They are broadly divided into two categories, on the basis of solubility in fats or water.

11.2 Fat Soluble Vitamins

Fat – soluble vitamins are soluble in fats and fat solvents. They are insoluble in water. So these vitamins are utilized only if there is enough fat in the body.

11.2.1 Vitamin A

Vitamin A was discovered in 1909 and its chemical name is retinol. Vitamin A compounds include retinol, retinal and retinoic acid. It has a specific function in the retina of the eye. Vitamin A occurs only in foods of animal origin. Vitamin A activity is possessed by carotenoids found in plants. Hence carotenoids are called Provitamin A.

Provitamins are substances that are chemically related to a vitamin but it must be changed by the body into the active form of the vitamin. Carotene is known as precursor of Vitamin A.

Functions

- It provides the required stimulation for vision in the retina and is essential for maintaining normal vision.

Table 11.1 Classification of Vitamins

Fat soluble vitamins	A, D, E and K. Fat soluble vitamins are stored in the liver and fatty tissues. These are not readily excreted from the body.
Water soluble vitamins	B (B_1, B_2, B_3, B_5, B_6, B_{12}) and C Water soluble vitamins travel in the blood and are stored in limited amounts. These are readily excreted from the body through urine.

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Fig 11.1: Food Sources of Vitamin A

- It helps in maintaining healthy skin and epithelial tissues.
- It is important for proper growth of bones.
- It helps in normal development of foetus
- It protects the mucous membrane of the digestive, respiratory and urinary tracts against infection.

Food Sources of Vitamin A

Vitamin A is present as retinol in animal sources such as egg yolk, fish (halibut, shark, cod), liver and cod liver oil. In plants, it is found in the form of carotene which gets converted to vitamin A in the body. Carrot, beetroot, turnip, papaya, mango, pumpkin, tomatoes, green leafy vegetables, drumstick, whole milk, butter, ghee etc., are very good sources of carotene.

Symptoms of Vitamin A deficiency

1. **Night blindness:** This is also called as Nyctalopia. Initially there is itching, burning and inflammation of eyelids and the person gradually loses vision in dim light.
2. **Keratomalacia:** This occurs due to poor intake or poor absorption of vitamin A. When conjunctival xerosis (conjunctival dryness) is not treated it may develop into a condition known as keratomalacia where the Cornea becomes dull and cloudy.
3. **Xerophthalmia:** The conjunctiva and corneaof the eyes become extremely dry, thickened and wrinkled followed by progressive cloudiness. This is due to keratinisation of the epithelial cells over the cornea. This condition

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is extremely common among all age groups in India and other developing countries where the vitamin A intake is low.

4. **Bitot's spot:** These are silver grey foamy deposits on the delicate membranes covering the white of the eyes. Softening of the cornea may lead to corneal infection, perforation and degenerative tissue changes, which may result in blindness.
5. Skin becomes rough, dry and scaly. This condition is known as **toad's skin.**

ACTIVITY - 1

Why Xeropthalmia condition is extremely common among all age groups in India and other developing countries?

11.2.2 Vitamin D

Vitamin D is otherwise known as 'sunshine vitamin' as it can be synthesized from sunlight by our body. Hence, vitamin D requirements of Indians are considered to

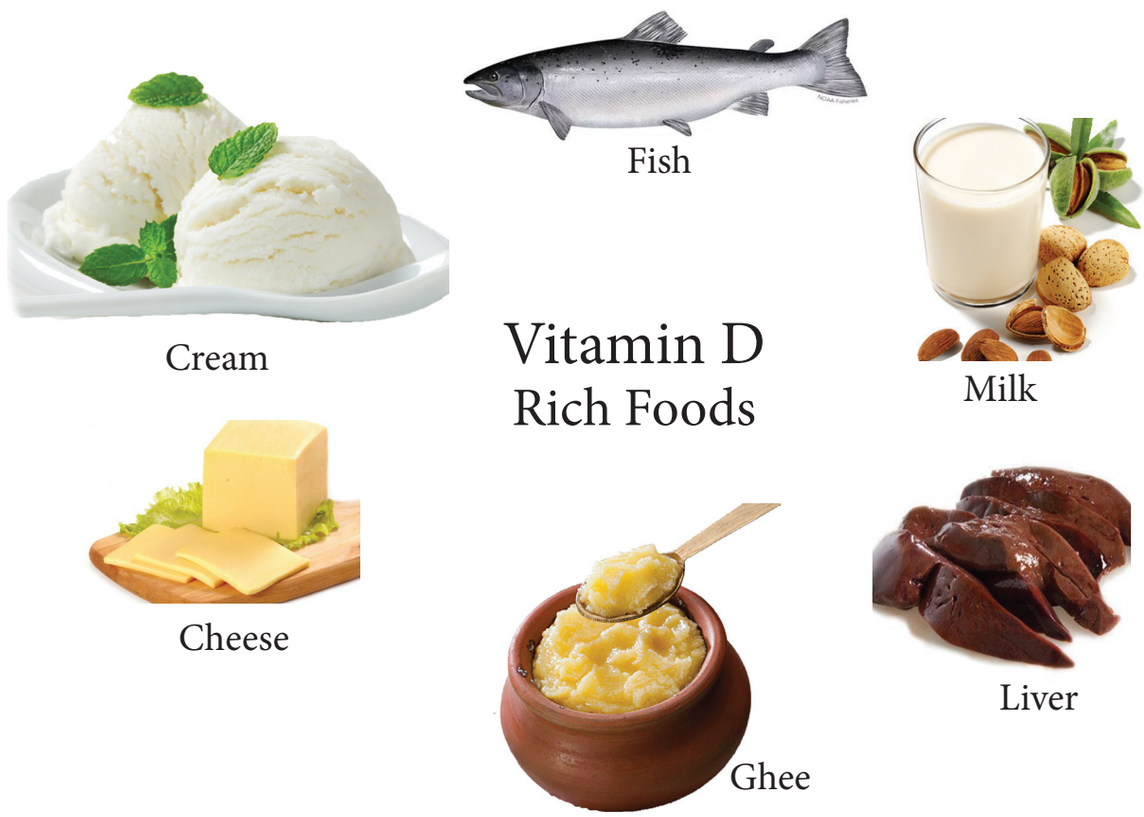

Fig 11.2: Food Sources of Vitamin D

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be met entirely by exposure to sunlight. In the absence of exposure to sunlight a daily intake of 400 IU vitamin D is suggested. Vitamin D is produced under the skin after exposure to ultraviolet rays. Vitamin D is now considered as a pro hormone rather than a vitamin and is required for Calcium absorption and bone formation.

DO YOU KNOW...?

Vitamin D:

D_2 (ergocalciferol) and D_3 (cholecalciferol)

Functions

- It helps in the formation of bones and teeth.
- It also improves the calcification of bones.
- It helps to increase the absorption of calcium and phosphorus.
- It helps in increase of calcium content in bones and blood.

Sources of Vitamin D:

Sunlight: Exposure of skin to sunlight brings about synthesis of vitamin D from 7 dehydrocholesterol.

Food sources: Cod liver oil, liver, salmon and herring fish, fortified milk, egg yolk, butter, cheese, ghee, cream, fortified milk, etc., are the best sources of Vitamin D.

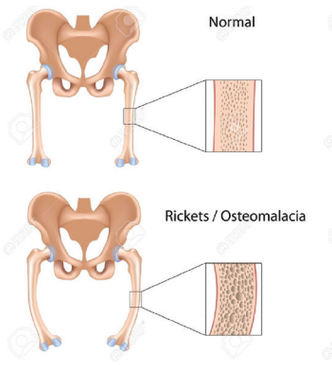
Vitamin D deficiency:

Deficiency in children

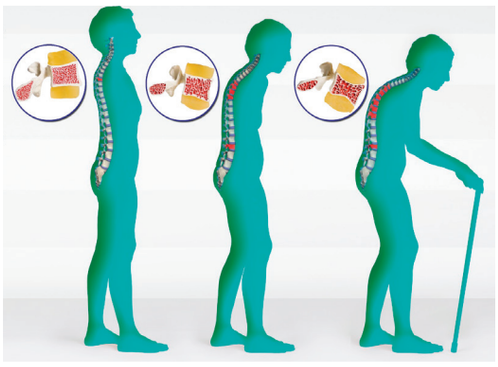
Rickets:

When children don't get enough vitamin D, they cannot absorb enough calcium and phosphorus to mineralize and harden the

A child with Rickets



Osteomalacia



Osteoporosis

Fig 11.3: Symptoms of Vitamin D

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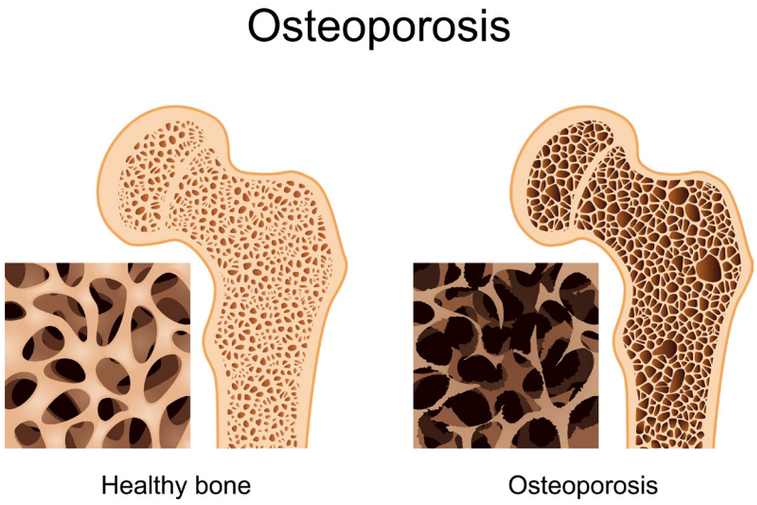

World Osteoporosis day
October-20

Fig 11.4: Osteomalacia

bones and teeth. If enough calcium and phosphorus are not deposited in the bones, the bones become weak, bend and deformed. They are unable to support their body weight and therefore become bent under pressure. this condition is known as "Rickets"

Symptoms:

- Bow legs (legs bow outwards).
- Knock knees (legs bow inwards with knees touching each other).
- Enlarged joints (The ends of long bones enlarge), Pigeon's Chest (ribs become hollow and bulge out).
- Teeth become soft and irregular in shape.
- Head becomes abnormally large and with bulging sides.

Symptoms in Adults

Osteomalacia:

1. Adults develope osteomalacia. In this disease, the bones become soft, fragile and easily bendable. They are more prone to multiple fractures.
2. Cramps are common.
3. Spinal cord, thorax, limbs and pelvis may be deformed and back may be hunched. Person may suffer from lower back pain.

Symptoms in Oldage

Osteoporosis: It is a calcium related health problem and occurs frequently in old people. This disease is characterized

Table 11.2: Differences between Osteomalacia and Osteoporosis

S.No	Clinical Features	Osteomalacia	Osteoporosis
1.	Skeletal pain	Persistent	Associated with fracture
2.	Fracture	Occasional	Very common
3.	Fracture healing	Delayed	Normal
4.	Deformity	Common	Absent
5.	Response to Vitamin D treatment	Dramatic	Nil
6.	Urinary calcium	Low	Normal or High

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by having light porous and spongy bones that break very easily. Severe bone pain is reported which is relieved by immobilization. Fractures occur due to brittle bones.

11.2.3 Vitamin E

Vitamin E protects all cell membranes They are called as tocopherol. This word is derived from the Greek word 'tocos' meaning child birth, and 'phenos' meaning to bear and 'ol' meaning alcohol. The vitamin is stored in all the tissues and the tissue stores can provide protection against the deficiency for long periods.

Functions

- Vitamin E is an important antioxidant.
- Promotes normal growth and development
- Promotes normal red blood cell formation
- Acts as anti blood clotting agent
- helps in absorption of vitamin A and vitamin C.
- Vitamin E dilates the capillaries and enables the blood to flow freely into the muscle tissue, thus strengthening both the tissues and the nerves supplying them.
- reduces the risk of heart diseases.

Food Sources of Vitamin E

The principle source of vitamin E is vegetable oils Eg- Corn, and peanut oil. Nuts and seeds Eg - Almonds, hazelnuts, sunflower seeds, safflower, soya bean oil and walnuts. Margarine, meat and fish, whole grains, wheat germ, spinach, lettuce, dark green leafy vegetables, black berries, apple, pears, legumes, eggs and milk are good sources of vitamin E. Human milk has more vitamin E than cow's milk and is sufficient for infants.

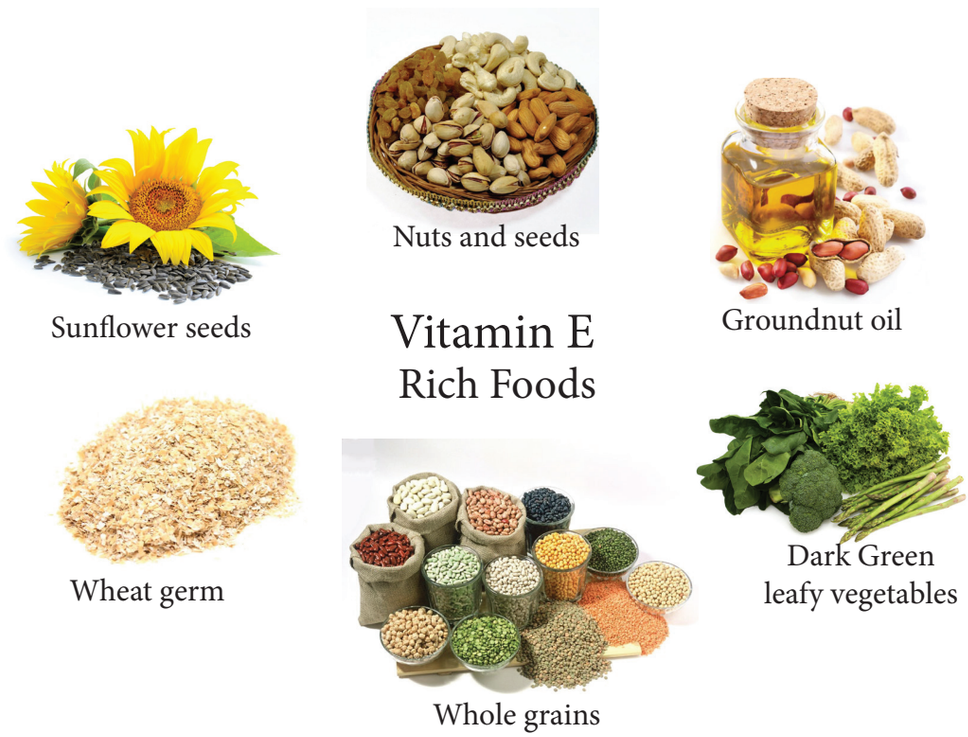

Fig 11.5: Food Sources of Vitamin E

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Symptoms of Vitamin E deficiency

- Anaemia in premature infants.
- Increased risk of oxidative damage to body tissues.
- Vitamin E deficiency may lead to heart and lung disease and brain stroke.
- Frequent blood clots may occur which in turn play a role in the production of varicose veins.

11.2.4 Vitamin K

Vitamin K is called "coagulation vitamin". It is essential for the production of a type of protein called prothrombin and other factors involved in the blood-clotting mechanism. Prothrombin levels in the blood determine the rate at which the blood will clot. For blood to clot, fibrinogen a soluble protein must be converted into fibrin. Thrombin catalyses the proteolysis of fibrinogen to yield fibrin.

Functions

- Helps in clotting of blood.
- Participates in bone formation and remodeling (synthesis of osteocalcin).
- It is necessary for the formation of bone matrix and mineral deposition.
- Vitamin K is essential for the prevention of internal bleeding and haemorrhages.
- It is important for the normal functioning of the liver.
- It is involved in energy producing activities of the tissues and nervous system.

Food Sources of Vitamin K

The concentration of vitamin K in foods is highest in dark green leafy vegetables, especially spinach. It is also found in soyabean, yoghurt, wheat, oats, milk, meat,

Fig 11.6: Food Sources of Vitamin K

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Fig 11.7: Symptoms of Vitamin K deficiency

lettuce, cauliflower, cabbage, broccoli and liver.

Symptoms of Vitamin K deficiency

- Leads to increased tendency to hemorrhages.
- Defective blood clotting.
- Bleeding occurs in nose.
- Prothrombin levels are reduced.

11.3 Water 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 B vitamins have important metabolic roles as coenzyme partners with cell enzymes that control energy metabolism and build tissue. Eight vitamins are there in this group.

11.3.1 Vitamin B_1 (Thiamine)

Thiamine acts as a catalyst in the oxidation process which prepares glucose in the body to provide energy. Vitamin B_1 is a vital coenzyme for the metabolism of fats, carbohydrates and proteins. So, without B_1 the body cannot use the food to make energy. It is known as 'Appetite vitamin' and makes a person feel hungry.

Functions:

- Thiamine helps increase hunger. Thus aids normal growth.
- Thiamine controls mental and nervous fatigue, irritability and restlessness.
- Promotes growth, protects the heart muscle and stimulates brain action.
- The vitamin improves peristalsis and helps to prevent constipation.
- Improves circulation of blood and promotes a healthy skin.

Food Sources of Thiamine

Whole grain cereals, wheat, rice, oats, yeast, sunflower seeds, peanuts, Bengal gram, capsicum, turnip, beet, fish, liver, legumes, nuts, wheat germ, baked beans, whole grains enriched breads and cereals, egg etc.,

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Fig 11.8: Food Sources of B_1

Symptoms of thiamine deficiency

- Loss of appetite, poor digestion.
- Muscular weakness and feeling tired
- Insomnia, mental depression,
- Loss of weight, leg cramps
- Digestive disorders
- Slow heart beat and
- Gastrointestinal problems

Deficiency Diseases

Thiamine deficiency causes Beriberi and there are three kinds of Beriberi

a) **Dry Beriberi** affects the nervous system, causing tingling and loss of sensation that may lead to limb paralysis and degeneration of nervous tissues. There is difficulty in walking. Foot and wrist drop also results.

b) **Wet Beriberi** affects the heart. There is difficulty in breathing. It enlarges the heart causing painful palpitations, disfunctioning of heart and heart attack.

c) **Infantile Beri** occurs in infants who cry without sound. Infants have difficulty in breathing, The body turns blue and may lead to death within 24-28 hrs.

It also leads to poor functioning of gastrointestinal tract and poor appetite.

11.3.2 Vitamin B_2 (Riboflavin)

Riboflavin is a water soluble and relatively heat stable vitamin. It is easily absorbed from the intestine and the excess is excreted through the urine. It is essential for the health of skin and for normal vision.

Functions

- Riboflavin plays an important role in the health of the eyes and alleviates eye strain and is essential for proper vision and healthy sight.

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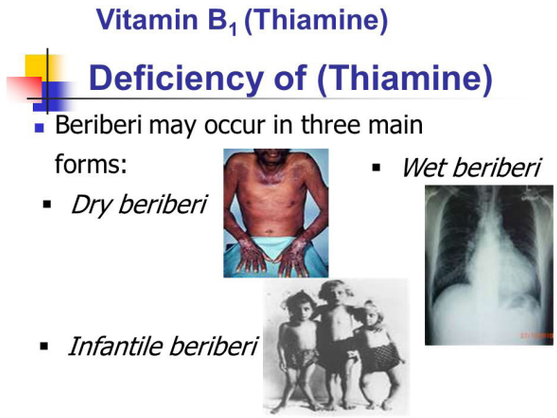

Fig 11.9: Symptoms of B_1 deficiency

- Riboflavin assists production of Red blood cells (RBC).
- It strengthens mucous lining of mouth, lips and tongue.
- It is required for normal growth and wound healing.
- Riboflavin is needed in every cell of the body. It helps cells to use oxygen so that the body can convert sources of energy into glucose.

Food Sources of Riboflavin:

Food Sources include yeast, milk, curd, cheese, eggs, chicken, liver, pork, spinach, carrot leaves, beets, brown rice, sprouts, beans and fruits like Apricots, papaya, custard apple. Nuts like almond and walnut are rich sources of riboflavin. Green leafy vegetables and enriched grains are moderate sources of Riboflavin.

Symptoms of Riboflavin deficiency

- Cracks and redness in corners of the mouth – Cheilosis.
- Painful, smooth, purplish red tongue – Glossitis.
- Sore throat.
- Inflamed eyes and eyelids, sensitivity to light.

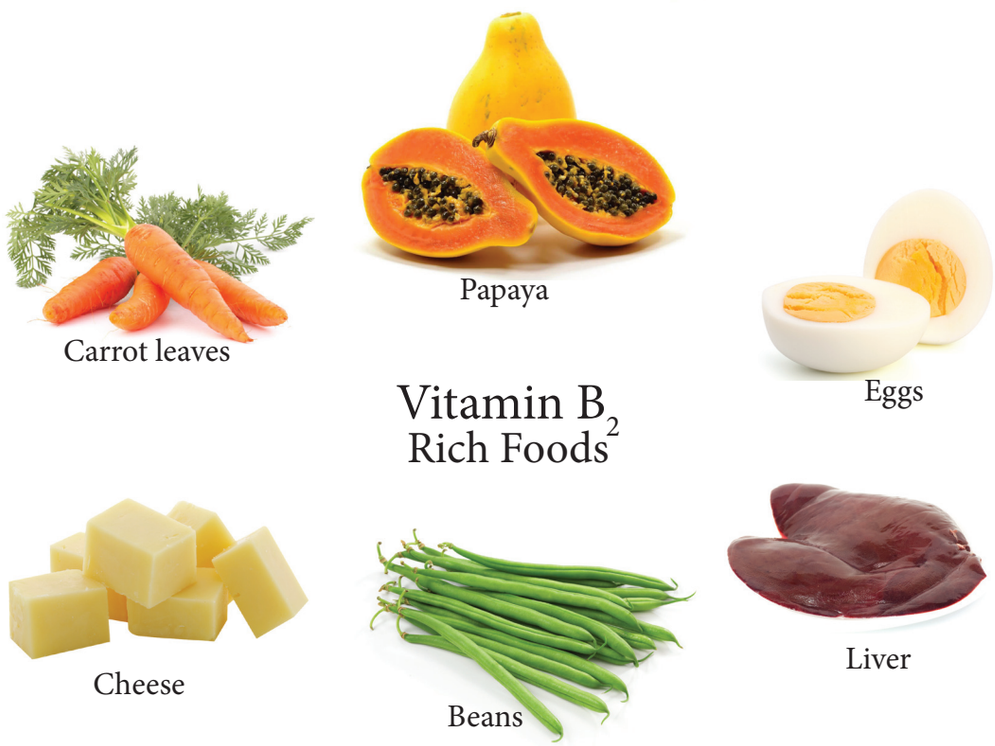

Fig 11.10: Food Sources of Vitamin B_2

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Fig 11.11: Symptoms of B_2 deficiency

- Itching and burning eyes.
- Intolerance to bright light, dim vision, water in eyes.
- Skin rashes and
- Digestive disturbances.

11.3.3 Vitamin B_3 (Niacin)

Niacin is a water soluble vitamin which is also known as vitamin PPF (Pellagra Preventive Factor). Niacin exists in two forms: nicotinic acid and nicotinamide.

Functions

- Important for proper blood circulation and healthy functioning of the nervous system.
- Promotes the health of digestive track.
- It repairs DNA.

Fig 11.12: Food Sources of Vitamin B_3

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- Regulates blood sugar levels.
- Lowers cholesterol levels.
- It is essential for normal functioning of skin and nerve system.

Food Sources of Niacin

Liver, chicken, meat, prawns, fish, legumes, cereal, mushroom, peanuts, green leafy vegetables, broccoli, dates, peas, groundnuts, almonds, sunflower seeds, avocado are rich in Niacin.

Symptoms of Niacin deficiency

- A mild deficiency of niacin may result in a coated tongue, sores in the mouth, irritability, nervousness, skin lesions, diarrhoea, forgetfulness, insomnia and headache.
- **Pellegra** - Niacin deficiency leads to Pellagra-a disease of 3D's- dermatitis, diarrhoea and dementia followed by death (if not treated).
- Dermatitis - This includes rough, scaly pigmented skin with rash on skin exposed to sunlight.
- Diarrhoea - loose stools and vomiting.
- Dementia - Symptoms include nerve damage, numbness in limbs, tingling in hands and feet, poor muscle coordination, disorientation and loss of memory.

11.3.4 Vitamin B_6 (Pyridoxine)

Pyridoxine is a colourless compound soluble in water and alcohol. It is well absorbed in the upper segment of the small intestine. It is stored in muscle but found in tissues throughout the body.

Fig 11.3: Symptoms of B_3 deficiency

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Functions

- Production of red blood cells.
- It is readily absorbed from intestines.
- Improves immunity.
- Improves nervous system functions.
- Reduces muscle spasms, cramps and numbness.
- Maintains proper balance of sodium and phosphorous in the body.

Food sources of Pyridoxine: Good food sources include whole grains, legumes, bananas, potato, liver, kidney and other meats, fortified breads and cereals. Sunflower seeds, soya beans, walnuts and yeast are the richest sources of pyridoxine among plant foods.

Symptoms of Pyridoxine deficiency

- Nervousness, Insomnia, Anaemia, oedema, mental depression.
- Loss of muscle control, muscle weakness, tooth decay.
- Arm and leg cramps,
- Water retention,
- Skin lesions and skin disorder.

11.3.5 Vitamin B_9 (Folic Acid)

Vitamin B_9 includes both folate and folic acid and is important for several functions in the body. It is important for women who are pregnant to consume enough folic acid.

Functions of folic acid: The different functions of folate include:

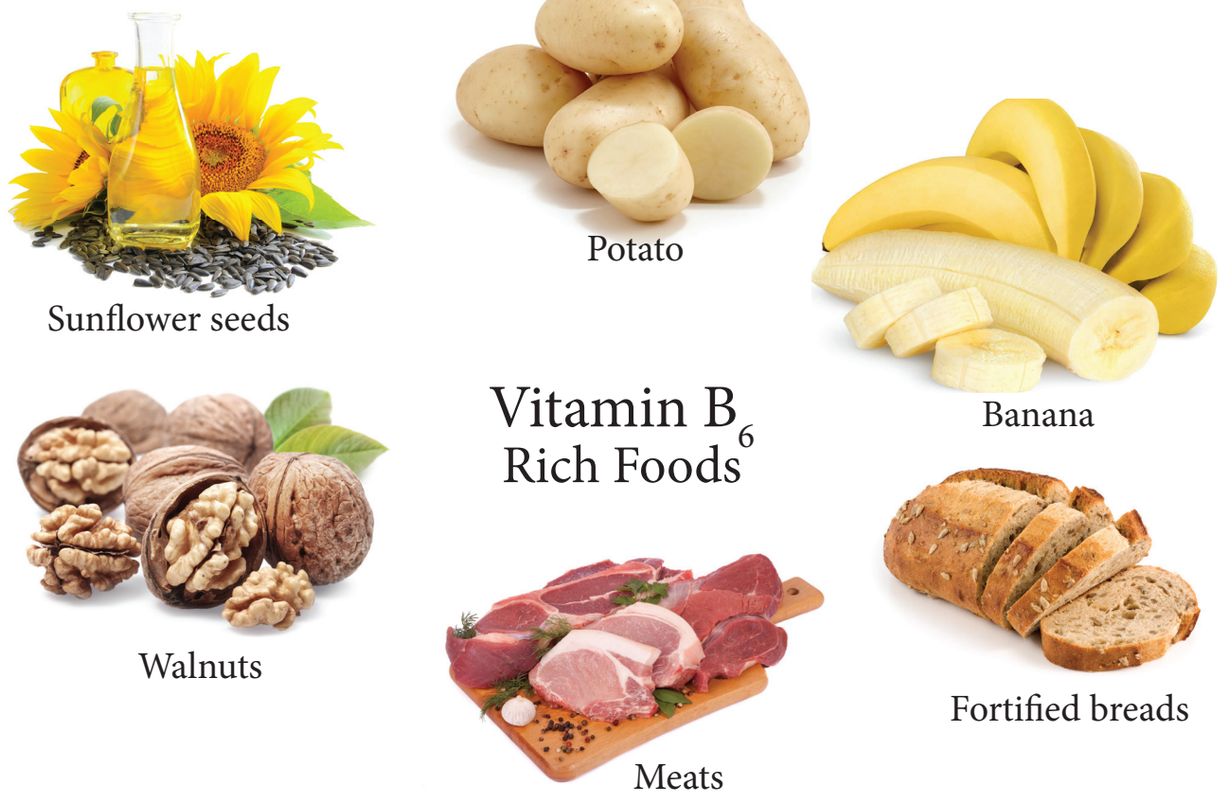

Fig 11.14: Food Sources of Vitamin B_6

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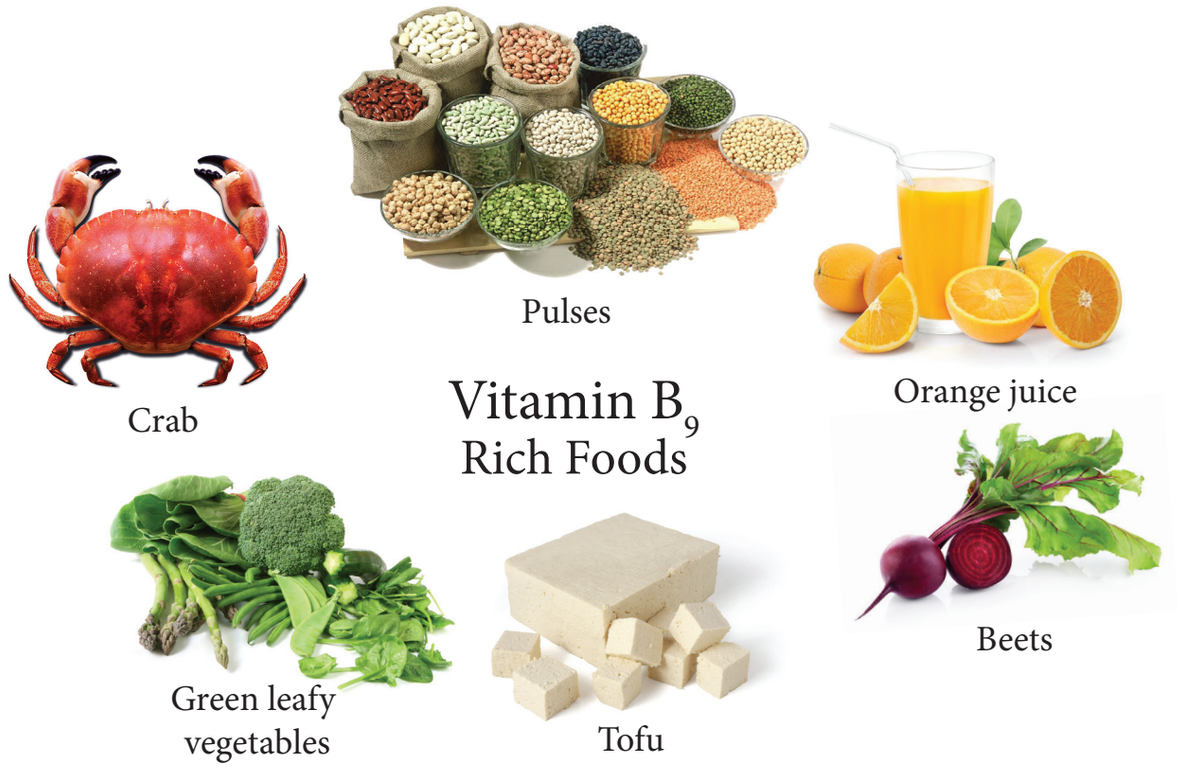

Fig 11.15: Food Sources of Vitamin B_9

- Folic acid helps the body to convert carbohydrates into glucose, which is used to provide energy.
- Folic acid helps in building of antibodies which prevent and heal infections.
- It helps in normal functioning of the nervous system and maintains the mental and emotional health.
- It helps in production of body's generic material - DNA and RNA.

Food sources of Folic acid: The rich sources of folate are fish, mutton, liver, egg, chicken, green leafy vegetables, pulses, Lentils, beans, asparagus, lettuce, Parsley, avocado, sunflower seeds, beets, broccoli, spinach, orange juice, tofu, fish, meat, fortified cereals, milk, cheese, eggs, oysters, crab etc.,

Symptoms of folic acid deficiency

- A recent study connected folic acid deficiency with autism.
- Loss of memory, severe and irreversible damage to nervous system and brain.
- Deficiency of folic acid causes megaloblastic anaemia.

11.3.6 Vitamin B_{12} (Cyanocobalamin)

The vitamin is named as cyanocobalamin because of the presence of cobalt and cyanide in its structure. It can be absorbed in the body only in the presence of intrinsic factor (IF).

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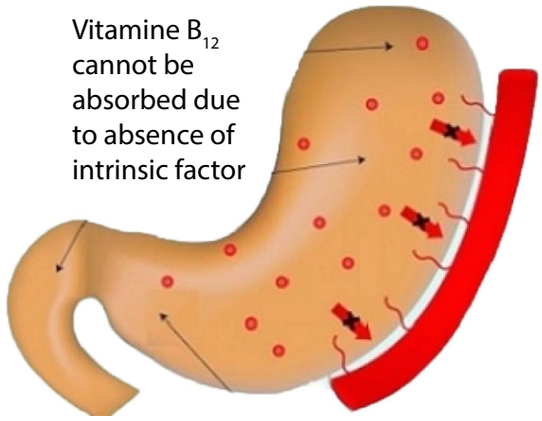
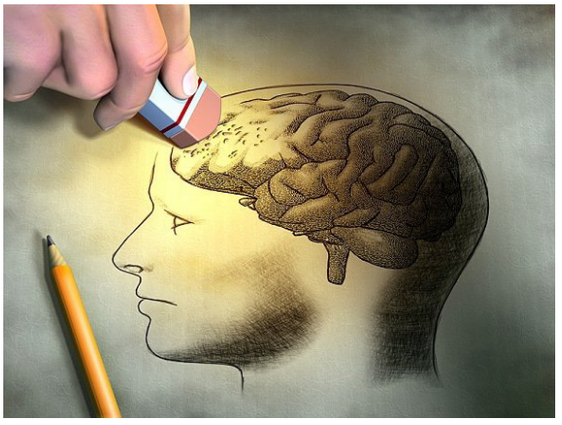
Vitamin B_{12} Deficiency



Pernicious Anaemia



Loss of memory

Fig 11.16: Symptoms of B_{12} deficiency

Functions

- It is essential for the production and regeneration of red blood cells.
- It improves concentration, memory and balance.
- It synthesises and regulates DNA.
- It plays an important role in normal functioning of brain and nervous system.
- It also helps to absorb folic acid.

Food Sources of Cyanocobalamin

Cyanocobalamin is synthesized by bacteria and is found in foods of animal origin. Liver is the richest source of cyanocobalamin. Meat, chicken, oysters, eggs, fish, milk, curd, cheese are good sources of Vitamin B_{12}.

Symptoms of Cyanocobalamin deficiency:

- Loss of memory
- Fatigue
- Anemia
- Severe and irreversible damage to the nervous system and brain
- Pernicious anaemia is caused due to its deficiency in the body which is an immune system disease.

DO YOU KNOW...?

Vitamin B_{12} is unique among all essential nutrients in having a highly specialised mechanism for its absorption. Its absorption from the intestines requires a factor called 'intrinsic factor (IF)' secreted by the stomach. It is a specific protein secreted by the mucosal cells lining the stomach. IF binds and absorbs vitamin B_{12}.

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Fig 11.17: Food Sources of Vitamin B_{12}

DO YOU KNOW...?

To prevent anaemia, two factors are required: an intrinsic factor produced by gastric parietal cells and the extrinsic factor of vitamin B_{12}.

11.3.7 Vitamin C

Vitamin C is also known as ascorbic acid. It is an antioxidant and a water soluble vitamin. It is destroyed by light, heat and when exposed to air and metals. During cooking much of it is destroyed. Iron and copper act as catalysts and cooking in these vessels increases the loss of vitamin C. When the vegetables are cut into fine pieces more enzymes are released and it causes more loss. Vitamin C is essential in cholesterol metabolism.

Functions:

- It is helpful in the formation of collagen, the cementing material between cells that holds them together.
- Vitamin C builds up natural body defence and helps provide immunity to the body.
- It helps the body to absorb more iron from plant sources.
- It aids in the healing of wounds.
- It helps to keep gums healthy.
- It helps body to fight infections.
- Improves bone formation.
- It prevents the deposition of cholesterol on the walls of the arteries and prevents heart diseases.

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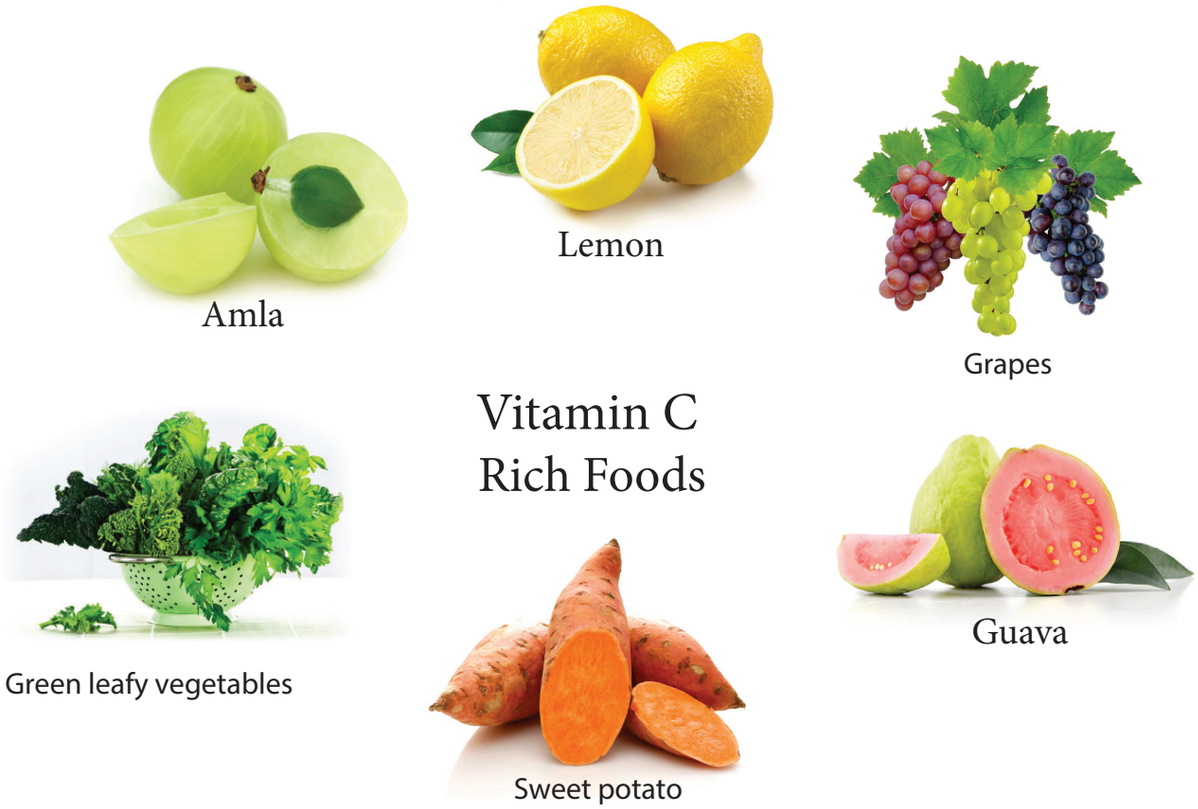

Fig 11.18: Food Sources of Vitamin C

Food Sources of Vitamin C: Amla, kiwi, strawberry, raspberry, grapes, berries, guava, citrus fruits like sweet lime, lemon, oranges, green leafy vegetables, spinach, hot chillies, turnip greens, broccoli, red bell pepper, tomato juice, raw tomato, sweet potato etc.,

Symptoms of Vitamin C deficiency

- Gums swell and bleed and become purple and spongy. This is known as pyorrhoea. Foul smell emits from the mouth.
- Deficiency can lead to scurvy in which a slight injury produces excessive bleeding and large hemorrhages are seen under the skin.
- There is tenderness, swelling and pain in the limbs.
- Reduced immunity causes simple infections like common cold, flu-viral, etc.,
- Irritability, aneamia, poor wound healing and Diarrhoea.
- Gastrointestinal discomfort.
- Weight loss, fatigue and joint pain.

11.4 Minerals

The body contains about 24 minerals, all of which must be provided by the diet. These are required by the body in very minute amounts and are often referred to as trace elements. The important ones are iron, iodine, calcium, zinc and sodium.

11.4.1 Iron

Iron was first recognized as a constituent of the body by Lernery in 1713. It is now known that all the iron in the body exists in combination with protein molecules.

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Vitamin C- Deficiency

Scurvy

Pyorrhoea

Fig 11.19: Symptoms of C deficiency

Overall the body contains 2.5g to 4.0g of iron. Most of the iron in the body is found in the blood, but some is present in every cell bound to iron containing enzymes. Iron is present in Haemoglobin which contains ferrous iron. It is essential for carrying oxygen to different tissues.

Functions

- Iron is an important mineral needed for the formation of haemoglobin which is responsible for carrying oxygen from the lungs to different cells and tissues of the body in the form of oxyhaemoglobin. Thus iron helps in the oxidation process.
- It acts as a co-factor for enzymes and other proteins.
- It is required for the formation of red blood cells.

Food Sources of iron:

Haeme iron from animal foods is better absorbed than non-haeme iron present in plant sources. Liver is the best source of iron. Iron is also absorbed well from red meat like lamb. Non-haeme iron is present in cereals, millets, pulses and green leafy vegetables. Of the cereal grains, wheat and millets like bajra and ragi are very good source of iron. Inclusion of about 50g of green leafy vegetables which are rich in iron in our daily diet can help meet a fair proportion of iron needs.

Symptoms of Iron deficiency:

Iron deficiency leads to Anaemia which has the following symptoms:

- Eyes, tongue and nails become pale.
- Person feels extremely tired and fatigued.
- Decreased physical activity and breathlessness on exertion.
- Tingling sensation in fingers and toes.
- Nails become brittle and become concave and appear like a spoon.
- Loss of appetite and giddiness.
- Poor coordination of body functions.

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Fig 11.20: Food Sources of Iron

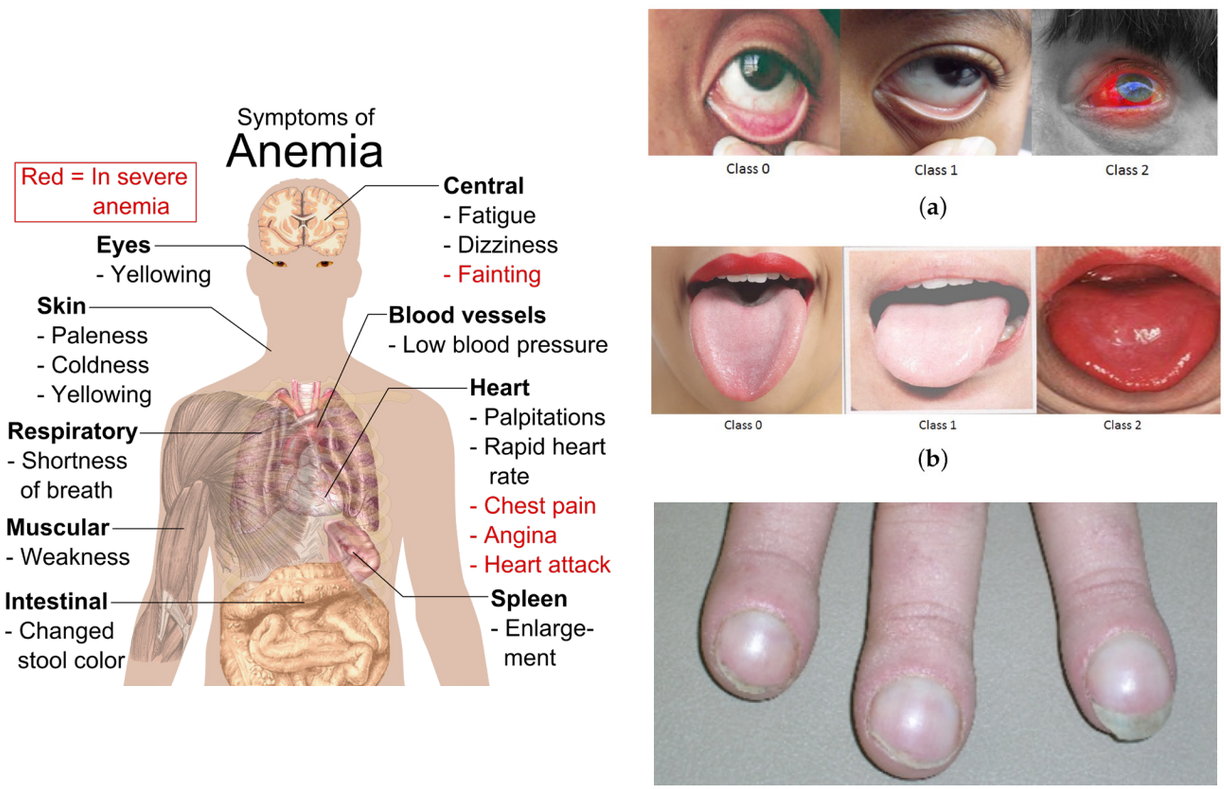

Fig 11.21: Symptoms of Iron deficiency

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11.4.2 Iodine

The significance of Iodine as an essential trace element lies in its role in thyroxine production. Iodine is a constituent of thyroxine, the active principle of the thyroid gland. The thyroid gland plays an important role in energy metabolism and in the growth of the body.

Functions

- It is essential for the production of thyroid hormone called thyroxin which is secreted by the thyroid gland.
- Thyroxin controls the basic metabolic rate in the body as it controls the metabolism of all nutrients.
- Thyroxin regulates the rate of oxidation within the cells.
- It stimulates the physical and mental growth.
- It regulates the functioning of nerve and muscle tissue.

Food Sources of Iodine:

Iodine is present only in small amounts in common foods, the quantity of iodine present depending on the iodine content of the soil. Iodised salt, sea salt, vegetables grown in the sea shore, garlic, onion, cheese and sea fish are good sources of iodine.

Symptoms of Iodine deficiency:

- Wide variety of physical and neurological disorders associated with iodine deficiency are called **"Iodine Deficiency Disorders - IDD".**
- **Goitre:** It is characterized by swelling of thyroid gland.
- **Cretinism:** Person is deaf and has a shuffling gait, retarded mental and

Garlic

Salt

Seafish

Iodine Rich Foods

Onion

Cheese

Fig 11.22: Food Sources of Iodine

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Fig 11.23: Symptoms of Iodine deficiency

physical growth, thus shorter in stature (dwarf).

- **Myxoedema:** Face of patient becomes expressionless.

11.4.3 Calcium

Calcium is the major element in the body and an adult man weighing 60 kg has nearly one kilogram of calcium. Almost 99% of this calcium is found in the hard tissues of the body, namely the bones and teeth. Vitamin D is essential for the absorption of calcium. In vitamin D deficiency, calcium absorption is impaired.

Functions

- It is essential for the formation of bones and teeth.

Fig 11.24: Food Sources of Calcium

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- It is essential for clotting of blood.
- It regulates the permeability of capillary walls.
- It is essential for the contraction of heart and muscle.
- It regulates the excitability of nerve fibres and nerve centres.
- It acts as an activator for the enzymes present in the gastric juice.
- It plays an important role in maintenance of health.
- Required for proper foetal growth.
- It speeds up all healing process.
- It is essential for proper utilization of phosphorus and vitamins A, C and D

Food Sources of calcium:

The richest source of calcium among animal foods is milk and among vegetables it is green leafy vegetables. Among green leafy vegetables, amaranth, fenugreek and drumstick leaves are particularly rich in calcium. Ragi is the main source of calcium. Sesame seeds with husk and small dried fish are also good sources of calcium.

Symptoms of Calcium deficiency:

- Bone mass is reduced when calcium deposit is less.
- Rickets in children, Osteomalacia in adults, Osteoporosis in old age occurs.
- Decreased growth rate.
- Very often fractures occur due to brittle bones.

11.4.4 Zinc

Zinc is an essential trace element which plays an important role in our body. Our body contains 2-3 grams of zinc. It has been found to be present in the hormone insulin. It plays an essential role in the formation of DNA and RNA. It aids in the healing of burns and wounds.

Functions:

- It plays a vital role in cell division and growth especially during pregnancy and prevents congenital abnormalities and premature delivery.
- It plays an important role in maintaining fertility in males.
- It provides immunity to our body.
- It helps in healing cuts, wounds, acne and rashes.
- It is important for healthy vision and prevents night blindness and cataracts.

Food Sources of Zinc:

Seafoods, meat, eggs are good sources of Zinc. Milk and milk products, whole cereals, pumpkin seeds, cashewnuts, spinach, legumes contain considerable amounts.

Symptoms of Zinc deficiency:

- Stunted growth.
- Loss of appetite.
- Dry and rough skin.
- Dull brittle hair.
- Brittle nails with white spots.
- Loss of memory.
- Reduced sense of taste and smell.
- Delayed healing of wounds.
- Frequent infections and acne.
- Diarrhoea and pneumonia can be fatal.

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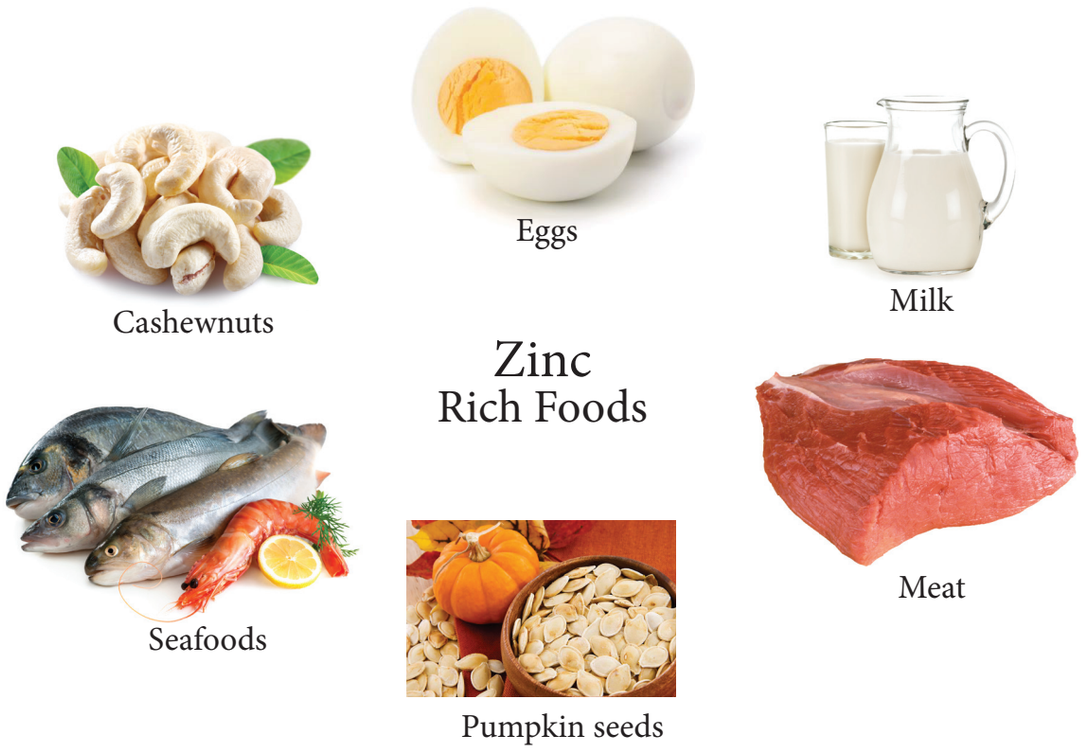

Fig 11.25: Food Sources of Zinc

11.4.5 Sodium

Sodium is a plentiful mineral in the body. It is essential in the recommended quantity for the body. A 50kg person would contain around 200g of sodium chloride Sodium is easily absorbed in the small intestine. Sodium is lost in sweat during exercise or in hot environments. Sodium and chloride compound is table salt.

Functions:

- Sodium is the most abundant cation in the extracellular fluid of the body.
- It acts with other electrolytes, especially potassium, in the intracellular fluid to regulate the osmotic pressure and maintain proper water balance within the body.
- It is the major factor in maintaining the acid-base equilibrium, in transmitting nerve impulses and in relaxing muscles.
- It maintains normal mineral content of extra and intra cellular fluid.

Food Sources of Sodium:

Vegetables like dry lotus stems and green leafy vegetables, dried fruits, roots like beetroot, carrot and radish are rich in sodium. Animal foods like milk, egg white, fish and meat contain substantial amount of sodium.

Symptoms of Sodium deficiency:

- Deficiency of sodium is caused by excessive sweating, prolonged use of diuretics, chronic diarrhoea.
- Deficiency may lead to nausea, muscular weakness, heat exhaustion and mental apathy. Oversupply of sodium is a more common problem because of overuse of dietary sodium chloride or common salt.

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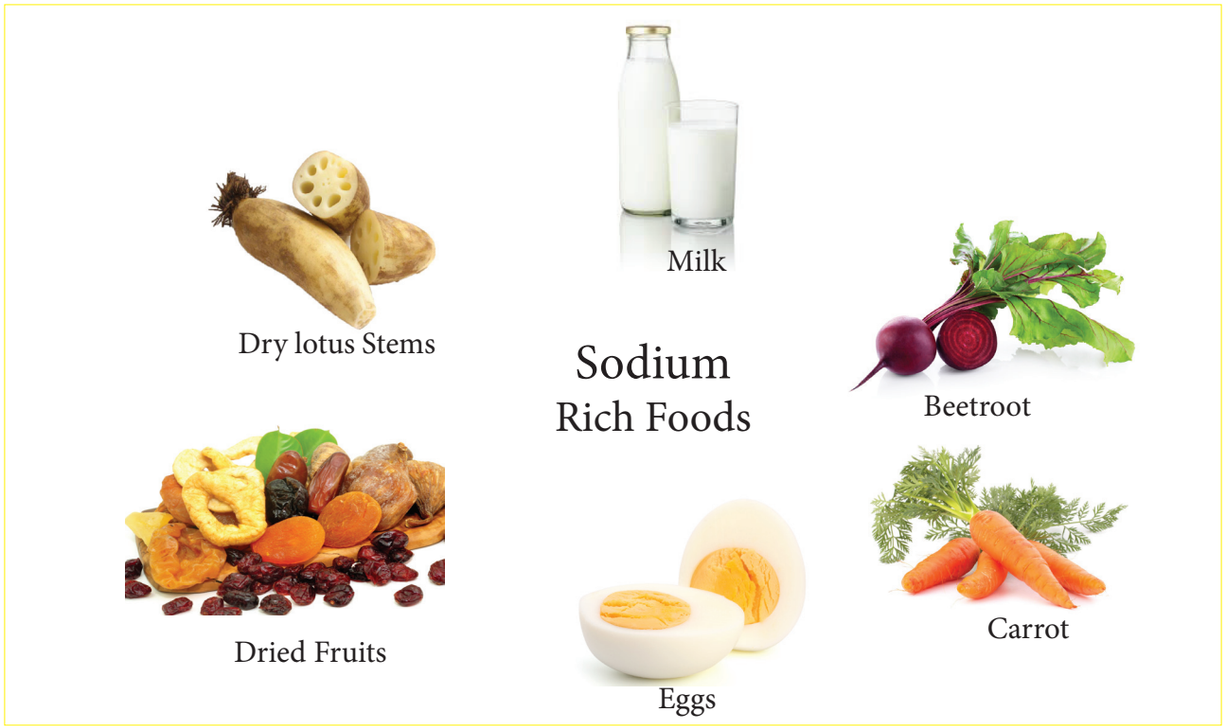

Fig 11.26: Food Sources of Sodium

- Too much sodium may lead to water retention, high blood pressure and even stomach ulcers.

11.5 WATER

Water is vital for human existence. Water is the largest component of the human body, making up to 60 to 70 percent of the total body's weight. This percentage of water in human being is required to be maintained. Infants have greater percentage of water than adults. Ageing declines the water percentage of the body. Water is second only to oxygen in its vital importance to the body. One can live without food for a longer time than one does without water. Water is colourless, calorie less compound of hydrogen and oxygen that virtually every cell in the body needs to survive.

Substances dissolve in water as ions with positive and negative charge. They are called electrolytes. The common electrolytes in our body are sodium, potassium and chloride. Because of this, water can dissolve most substances and in doing so, it enables minerals and other chemicals to undergo biological reactions in the body.

DO YOU KNOW...?

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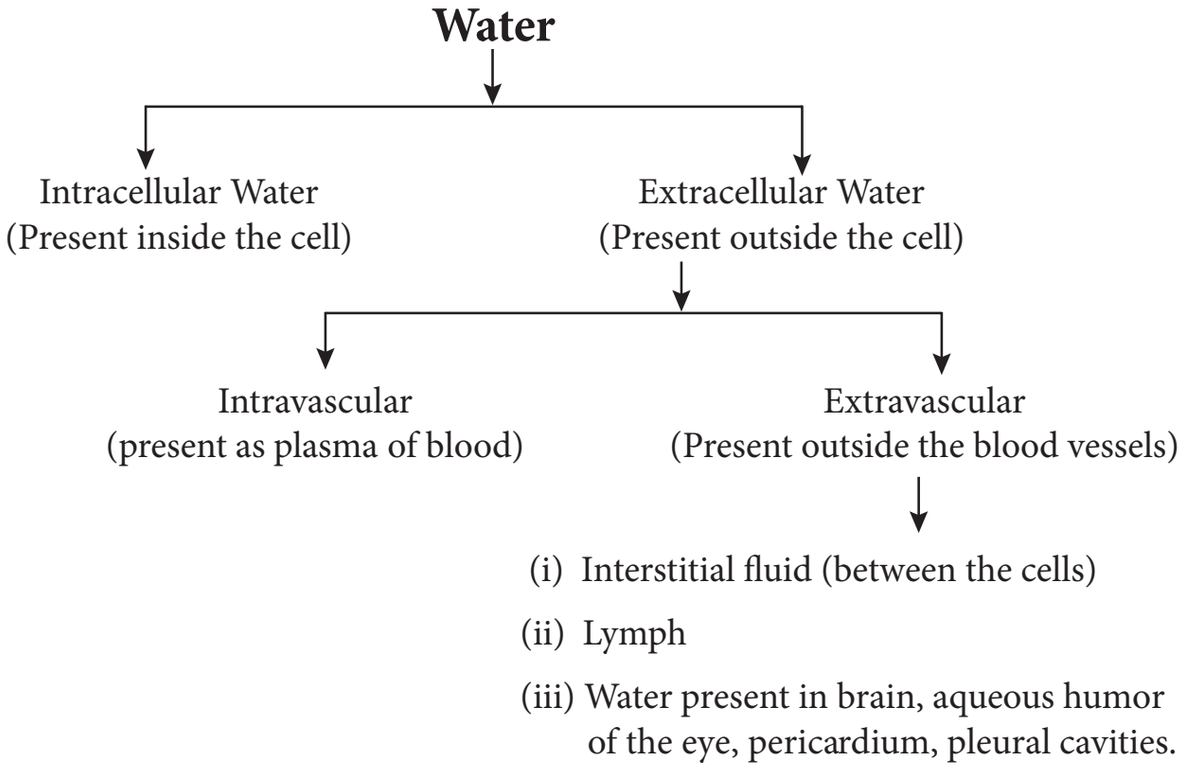

Fig 11.27: Distribution of water in the body

11.5.1 Distribution of water in the body

Total body water content is mainly determined by total amount of salt in the body. Salt and water concentration in the body is controlled by the kidneys.

11.5.2 Water in the body – Intracellular and Extracellular fluid

Water flows in and out of the body cells through cell membranes.

Intracellular fluid:

This is fluid contained within a cell represents about two thirds of all body fluids.

Extracellular fluid:

This is fluid present outside the cells, and represents about one-third of all body fluid.

Extracellular fluid is further divided into interstitial fluid which is water between cells and intravascular fluid which is water in the blood stream and lymph. Interstitial fluid forms a transport link between tissue cells and the blood.

11.5.3 Sources of water

The body has three sources of water. Besides drinking water, the following are the sources of water.

1. The water contained in food, eg. Fruits and vegetables contain 80-90 percent water. Milk contains 80-88 percent, meat contains 40-75 percent, flour, crackers and bread contain 5-35 percent of water.
2. In addition to water ingested fluids such soups and beverages also supply essential minerals and vitamins.
3. Metabolic water is formed by the metabolism of food in the body. It may amount to about 450ml per day.

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11.5.4 Functions of Water

Major functions of water :

1) **Carrier of nutrients:** Every nutrient in soluble form in water is carried from intestines to tissues through blood.

2) **Constituent of body fluids:** Water is the major constituent of all body fluids such as blood, urine, sweat, lymph.

3) **Regulation of body temperature:** Water helps to regulate and control body temperature. Heat is produced when food is burnt for energy. Water is evaporated through respiration and sweat and body temperature is maintained normal. Body's heat is lost through the skin, lungs, urine and faeces.

4) **Protection of delicate organs:** Water found around lungs, heart and brain protects them from outer injury.

5) **Water as lubricant:** Water acts as a lubricant in joints. Water around joints helps in normal movement.
It is an essential constituent of all the cells of the body and the internal environment.

11.5.5 Requirements

Requirement of water varies with climate, dietary constituents, activities and surface area of the body. As a rule a person should take enough water to excrete about 1200 –1500 ml of urine per day. In tropics because of greater water loss through perspiration, increased water intake is required to maintain urine volume. Normal intake of water ranges between 8 – 10 glasses per day.

Water is lost through feces, urine, lungs (expiration) skin (invisible perspiration and visible perspiration) amounting to about 2-3 liters per day. During infections and fever, the liquid intake should be increased as losses are higher. A moderate amount of water taken with or preceding a meal aids in digestion.

11.5.6 Dehydration

Dehydration results in extreme deficiency of water and fluids. Symptoms of dehydration are fatigue, headache, sullenness and in extreme cases, collapse.

The steps in the progression of dehydration are as follows.

1. Thirst
2. Decreasing blood volume, impaired physical performance.
3. Increased effort for physical work, nausea.
4. Failure to regulate excess temperature.
5. Muscle spasms.
6. Failing renal function, less or no urine formed.

Excessive loss of water takes place due to vomiting, diarrohea, haemorrhage, excessive perspiration, exudating, burns, uncontrolled diabetes mellitus, fever and hot weather. It can be fatal and can be easily avoided by proper fluid intake or oral rehydration therapy.

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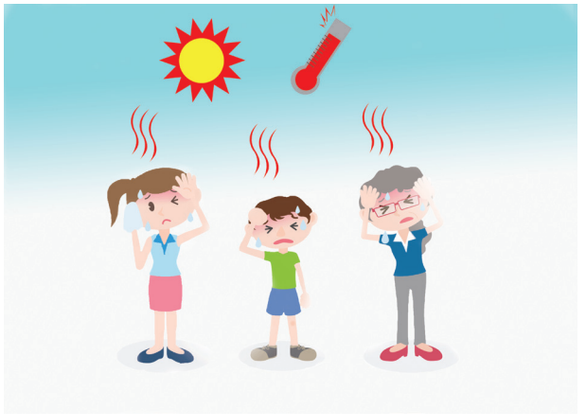

Fig 11.28: Symptoms of dehydration

11.5.7 ORT: (Oral Rehydration Therapy)

Oral rehydration therapy is a method of treating dehydration by making the patient drink a solution which can be prepared by dissolving salt and sugar in boiled and cooled water.

11.5.8 Water Intoxication

Water intoxication results due to excess intake of water. This results in an increase in the volume of intracellular fluid. This condition can lead to headache, nausea, vomiting, muscle twitching and convulsions. It can even be fatal.

DO YOU KNOW...?

Mention the disease conditions that need ORS?

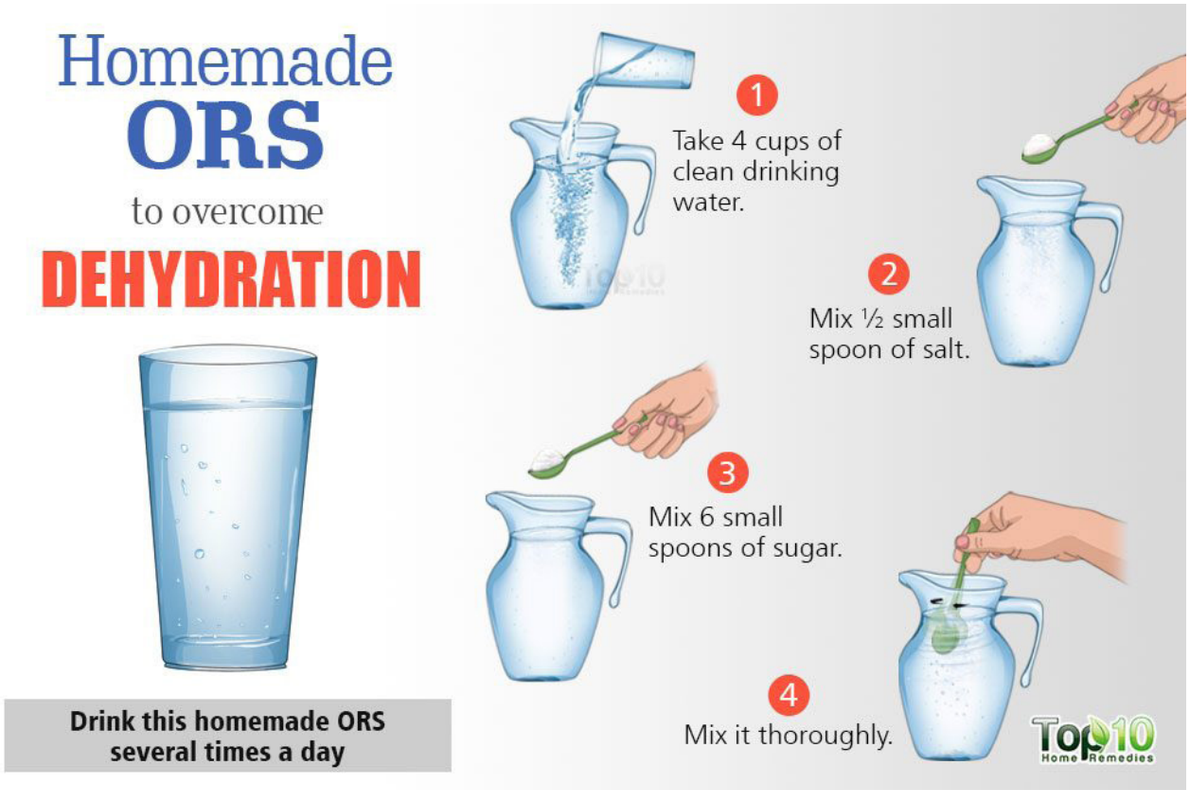

Fig 11.29: Oral Rehydration Therapy

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Summary

- Vitamins and Minerals are micronutrients which are present in small quantities. They help to protect body from diseases.

- They are broadly divided into two categories, on the basis of solubility in fats or water. Fat soluble vitamins - A, D, E and K. Fat soluble vitamins are stored in the liver and fatty tissues. These are not readily excreted from the body. Water soluble vitamins - B (B_1, B_2, B_3, B_5, B_6, B_{12}) and C. Water soluble vitamins are stored in limited amounts and are readily excreted from the body through urine.
- Vitamin A occurs only in foods of animal origin. Vitamin A activity is possessed by carotenoids found in plants. Hence carotenoids are called provitamin A.
- Vitamin D is otherwise known as 'sunshine vitamin' as it can be synthesized from sunlight by our body.
- Vitamin E protects cell membranes. They are called as tocopherol. Vitamin K is called coagulation vitamin. It is essential for the production of a type of protein called prothrombin and other factors involved in the blood-clotting mechanism.
- The B vitamins have important metabolic roles as coenzyme partners with cell enzymes that control energy metabolism.
- Vitamin C is also known as ascorbic acid. It is an antioxidant and water soluble vitamin. It is destroyed in light, heat and when exposed to air and metals.
- The body contains about 24 minerals, all of which must be provided by the diet. These are required by the body in very minute amounts and are often referred to as trace elements. The important ones are iron, iodine, calcium, zinc and sodium.
- Water is vital for human existence. Water is the largest component of the human body. Normal intake of water ranges between 8 – 10 glasses per day.
- Dehydration results in extreme deficiency of water and fluids. Oral rehydration therapy is a method of treating dehydration by making the patient drink a solution which can be prepared by dissolving salt and sugar in boiled and cooled water.

Glossary

Terms	Meaning
Coenzymes	A compound that is essential for the functioning of an enzyme.
Enzyme	A substance produced by a living organism that assists in chemical processes.
Precursor	A forerunner
Nyctalopia	A condition characterized by an abnormal inability to see in dim light or at night, typically caused by vitamin A deficiency.
Antioxidant	A substance that counteracts oxidation.

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Fibrinogen	A soluble protein present in blood plasma, from which fibrin is produced by the action of the enzyme thrombin.
Fibrin	An insoluble protein formed from fibrinogen during the clotting of blood. It forms a fibrous mesh that impedes the flow of blood.
Haemorrhage	An escape of blood from a ruptured blood vessel.
Intrinsic Factor	A substance secreted by the stomach which enables the body to absorb vitamin B_{12}.
Lymph	A colourless fluid containing white blood cells, which bathes the tissues and drains through the lymphatic system into the blood stream.
Exudating	A mass of cells and fluid that has seeped out of blood vessels or an organ, especially in inflammation.
Intoxication	Water poisoning or hyper hydration
Convulsions	A sudden uncontrolled movement of the body
Twitching	Make a short, sudden jerking movement

Questions

part - A

I. Choose the correct answer:
(1 mark).

1. _____ are complex organic molecules.
   a. Vitamins b. Minerals
   c. Water d. Vitamin A
2. _____ founded vitamine theory.
   a. Takaki b. Casmir Funk
   c. Water d. None
3. _____ are closely associated with body lipids and are easily stored.
   a. Fat soluble vitamins
   b. Water soluble vitamins
   c. Water
   d. Vitamins
4. _____ are called provitamin A.
   a. Carotenoids b. Retinol
   c. Vitamin A d. Vitamin E
5. _____ deposits on the delicate membranes covering the whites of the eyes.
   a. Bitot's spot b. Xeropthalmia
   c. Keratomalacia d. Vitamin D
6. _____is required for Ca absorption and bone formation.
   a. Vitamin D b. Vitamin A
   c. Vitamin C d. Vitamin B
7. Vitamin ____ dilates the capillaries and enables the blood to flow freely into blood.
   a. E b. A
   c. B d. K
8. _____levels in the blood determine the rate at which the blood will clot.
   a. Prothrombin b. Provitamin
   c. Intrinsic Factor d. Probiotic

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9. _____ enlarges the heart causing painful palpitations, disfunctioning of heart and heart attack.
   a. Wet Beri Beri
   b. Dry Beri Beri
   c. Infantile Beri Beri
   d. Wet and Dry Beri Beri
10. _____ includes rough, scaly pigmented skin with rash on skin exposed to sunlight.
   a. Dementia b. Diarrhoea
   c. Dermatitis d. Dieases
11. _____ is essential for carrying oxygen to different tissues.
   a. Iron b. Iodine
   c. Calcium d. Sodium
12. Oral rehydration therapy is a method of treating _____ by making the patient drink readily available preparations.
   a. Dehydration
   b. Water intoxication
   c. Hyponatraemia
   d. Dieases
13. This is vital for human existence _____
   a.Water b. Honey
   c. Sugar d. Jaggery
14. the normal intake of water amounts to _____
   a. 8-10 glasses b. 18-20 glasses
   c. 10-12 glasses d. 10-11 glasses

Part - B

Write shot answer (2 Mark)

1. List out the signs of Xeropthalmia.
2. Write the sources of Vitamin E.
3. Write the sources of Vitamin D.
4. Mention the iron rich foods.
5. List out Zinc rich foods.
6. What is mean by scurvy?
7. Give the full form of IDD.
8. How is water distributed in the body?
9. Differentiate between Goitre and Cretinism.
10. Write short notes on Provitamins.

Part - C

Answer in brief (3 Marks)

1. Give clinical symptoms of vitamin A deficiency
2. Explain the role of vitamin K in blood clotting.
3. Explain the deficiency diseases of Vitamin D in children, adult and oldage.
4. Explain vitamin E as an antioxidant.
5. Give the functions of Vitamin K.
6. What is pernicious anaemia?
7. List the functions of vitamin B_{12}
8. Discuss the deficiency symptoms of pyridoxine.

Part - D

Answer in detailed (5 Marks)

1. Elaborate on the functions of vitamin A.
2. List the functions of folic acid in the body.
3. Give the functions of vitamin C.
4. Discuss the functions of Iodine.
5. List the functions of Zinc.
6. Discuss the types of Beri Beri.
7. Explain the 3 D's of deficiency diseases.
8. Enumerate the functions of water in our body.

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ACTIVITY - 1

Essential vitamins!

List food that contain these important vitamins.

A Retinol	**Needed for healthy bones,teeth,skin,eyes,and nervous,resptratory and digestive systems.**
B_1 Thiamine	**Helps to release energy from food.Benefits heart and nervous system.**
B_2 Riboflavin	**Promotes healthy skin and helps body cells use oxygen.**
Niacin	**Essential for cell metabolism and use of carbohydrate.**
B_6	**Needed for protein, fat, and carbohydrate metabolism**
B_{12} Cobalamin	**Needed for development of red blood cells and healthy functioning of the nervous system.**
Folate	**Helps to produce red blood cells.**
C Ascorbic Acid	**Needed for sound teeth and bones.Helps the healing process.**
D Cholecalciferol	**Needed for calcium and phosphorus metabolism.**
E Tocopherol	**Helps restore cell membranes and other body structures.**
K Phylloquinone	**Essential for normel blood clotting.**

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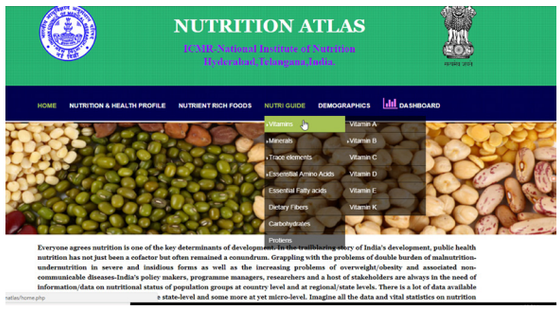
ICT CORNER

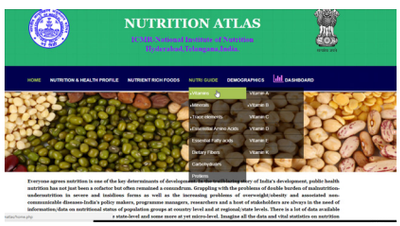
(VITAMINS & IT'S DEFIENCY DISEASES)

A **vitamin** is an organic compound and an essential nutrient that humans requires in limited amount This activity shows vitamins in food and food suggestions. It also shows what happens when the vitamin taken is less than adequate.



STEPS:

1. Type the URL link given below in the browser or Scan the QR code with your mobile to access website.
2. Click on **"Nutri Guide"** tab and 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.
5. Explore Biochemical, RDA, Dietary Sources Signs & Symptoms of all the Vitamins



DOWNLOADING

Click the following link or scan the **QR code** to access the website.

http://218.248.6.39/nutritionatlas/home.php

** Images are indicatives only.

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Unit 12

NUTRITION INTERVENTION PROGRAMMES AND POLICIES

Nutrition is a major factor in bringing out the maximum potential that one is endowed both physically and mentally. Widespread malnutrition is largely a result of dietary inadequacy and unhealthy lifestyles. The great advantages of looking at malnutrition as a problem in human ecology is that it allows for variety of approaches towards its prevention.

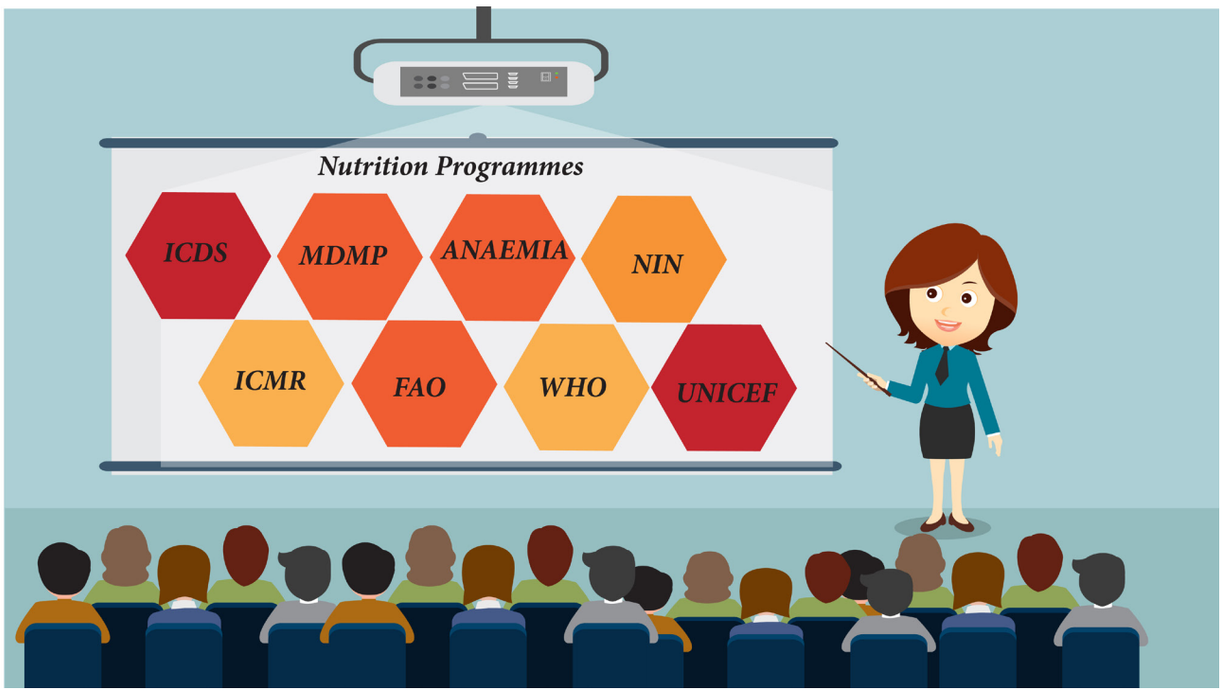
In this lesson, the students will be able to know about:

- the ongoing intervention programmes by the Government to overcome malnutrition.
- National and International agencies that fight against malnutrition.
- the various components of noon meal programmes which helps in the overall development of children.

12.1. Nutrition intervention programmes

12.1.1. Integrated Child Development Services (ICDS)

ICDS was initiated in 1975 with the twin objective of ensuring nutrition of preschool children through



Nutrition Intervention Programmes

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supplementary feeding and psychosocial development through early stimulation and education. The objectives also include supplementary feeding for pregnant and lactating women and nutrition education to ensure better child care and nutrition.

The nutrition components of ICDS aims to provide the following services:

- nutrition education to mothers for improving dietary intake and dietary diversity.
- nutrition education regarding appropriate infant and young child feeding practices.
- growth monitoring and detection of growth faltering.
- assist in providing massive doses of vitamin A, ORS and iron tablets.
- food supplementation to preschool children between the age of six months and six years, pregnant and lactating mothers and adolescent girls.

The Anganwadi workers are expected to survey all families in the community and identify pregnant, lactating women and preschool children, monitor the growth of children and provide food supplement to the three groups for 300 days in a year. ICDS guidelines specify that monthly weighing of children should be done in the crucial 0-24 months age group.

Mother and Child Protection card (MCP card) was introduced for

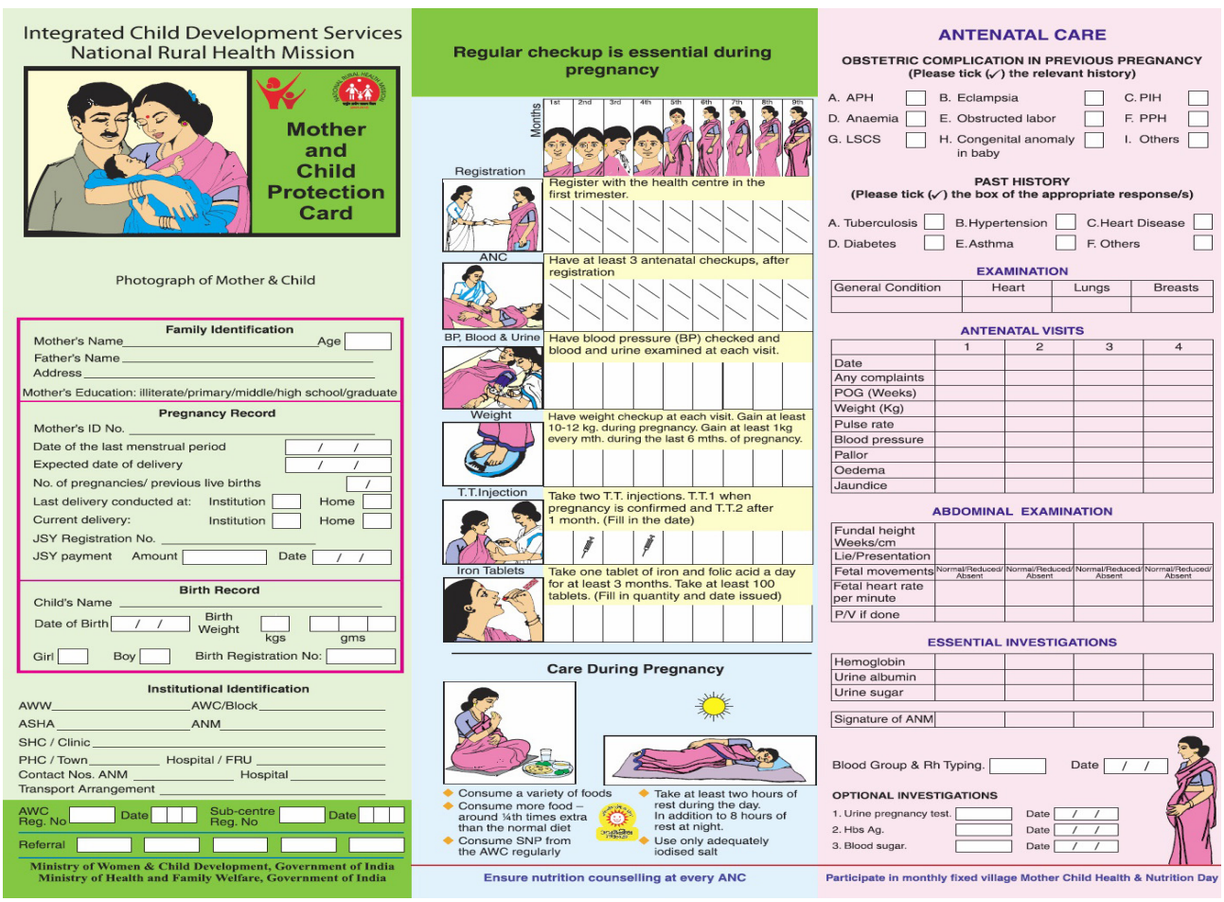

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Fig 12.1: Mother and Child Protection card (MCP card)

functionaries of National Rural Health Mission (NRHM) and ICDS from 1st April 2010 to progressively replace the earlier **JacchhaBacchha card**. The new MCP card is increasingly viewed as a critical tool for upkeeping maternal and child health in the updated coverage of both ICDS and NRHM.

12.1.2 Midday meal programme (MDMP)

The midday meal programme (MDMP) is also known as school lunch programme. This programme has been in operation since 1961 throughout the country. In formulating midday meals for school children, the following broad principles should be kept in mind:

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- The meal should be a supplement and not a substitute to the home diet.
- The meal should supply atleast one third of the total energy requirement and half of the protein need.
- Cost of the meal should be reasonably low.
- Meal should be such that it can be prepared easily in schools. No complicated cooking process should be involved.
- As far as possible, locally available foods should be used. This will reduce the cost of the meal.
- Meal should be frequently changed to avoid monotony.

ACTIVITY

1. Download the MCP card from the website icds_wcd.nic.in. Use the card to find out the health and nutritional status of pregnant mothers, infants and preschool children in your neighbourhood.
2. Case study: 3 year old Ram weighs 13 kgs and his height is 90 cms. Find out his nutritional status in the ICDS card.
3. Visit an Anganwadi centre near your house and find out what are the benefits offered to the beneficiaries.
   (i) Food only: Yes/No
   (ii) Education only: Yes/No
   (iii) Food and Education: Yes/No

Objectives of the school feeding programme are to :

- provide food for undernourished children and to improve the nutritional status and monitor it.

Fig 12.2: Mid-Day meal programme (MDMP)

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- increase school enrolment and attendance of children
- reorient good eating habits.
- incorporate nutrition education into curriculum.
- improve literacy and educational performance of pupils.
- encourage the use of local commodities.
- encourage community participation in the feeding programme.

The Mid-Day Meal Programme for school children comes under the Ministry of Human Development. The Government of India pays 40 percent of the expenditure and 60 percent is borne by the States. It covers all children upto the age of 15 years.

The Mid-Day Meal Programme was introduced in a large scale in 1960's by K.Kamarajar, former chief minister of Tamilnadu. But the first major thrust came in 1st july 1982 when the then chief minister of Tamilnadu DR.M.G.Ramachandran decided to implement the scheme for all children in goverment schools in primary classes. In this programme, students from classes I to V in Corporation, Government and Government aided schools are given free mid-day meal for 200 days in a year. Under this programme, the Government of India provides 100 grams of rice, 15 grams of dhal, 1 grams of oil and 20 paise worth of vegetables per indiviual. The meal given are based on a combination of cereals, pulses and leafy vegetables. Eggs are given thrice a week. Such a diet would increase the amount of vitamins and minerals and results in weight gain and clearance of deficiency symptoms.

What do children eat today in their midday meal :

- Upto 5th standard, 100 grams of rice per child per day
- Upto 10th standard, 150 grams of rice per child per day
- Egg on all working days. Banana alternative for vegetarians.
- First and third week of month, pulav made of black Bengal gram given for protein
- Second and fourth week, green gram sundal
- Fridays, chilli fried potato for carbohydrates
- Use of double fortified salt
- Sweet pongal is served on occasions

ACTIVITY

4. Visit the nearest noon meal centre in your area and find out the following details:
5. How many eggs are given per week for the beneficiaries? What are the benefits of giving eggs to the children?
6. Write the weekly menu given in the noon meal centre in your school.

Mid-Day meal programme has resulted in the following:

- Reduction in severe malnutrition in children.
- Increased enrolment rate at primary level.

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- Reduction in drop-out rate at school level.
- Developed attentiveness in them and thereby improved their power of comprehension.
- Improved their performance in examinations.
- Decreased the incidence of various diseases and physical disorders caused by starvation or intake of less nutritious food.
- Enabled parents to attend to their routine bread earning tasks.
- The gender difference in feeding the children reduced at home.
- A favourable attitude in parents in educating the children, specifically female children.

12.1.3. Prevention and control of anaemia

Prevention of anaemia requires approaches that address all the potential causative factors. These include:

1. **Dietary approach:** The following points need to be considered for the promotion of this strategy:
   - Promotion of consumption of pulses, green leafy vegetables, other vegetables which are rich in iron and folic acid and meat products rich in iron particularly for pregnant and lactating mothers and preschool children. Media can also be involved for creation of awareness.
   - Creation of awareness in mothers attending antenatal clinics and immunization sessions in anganwadi centres and crèches about the prevalence of anaemia, ill effects of anaemia and that it is preventable.
   - Addition of iron rich foods to the weaning foods of infants.
   - Regular consumption of foods rich in vitamin C to promote iron absorption such as orange, guava, amla, etc.
   - Promotion of home gardening to increase the availability of common iron rich foods such as green leafy vegetables.
   - Discouraging the consumption of foods and beverages like tea and tamarind that inhibit iron absorption, immediately after food especially by the vulnerable groups like pregnant women and children.
   - Promotion of iron fortified iodised salt.
2. **Supplementation:** Food based approaches through food fortification and dietary diversification are sustainable strategies for preventing iron deficiency and (Iodine Deficiency Disorder(IDD). As availability is low and dietary animal sources (haem -iron) are expensive, the key step towards addressing iron deficiency and IDD would be the implementation and scaling up of the IFA supplementation programme.

For preventing anaemia, low dosage iron is adequate. The National Anaemia Prophylaxis Programme (NAPP) in India, pregnant and lactating women receive 60 mg elemental iron+ 500 mcg folic acid (IFA tablet) daily for atleast 100 days during

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pregnancy and preschool children receive 20 mg elemental iron+ 100 mcg folic acid daily. To improve compliance, ensuring availability to all beneficiaries, follow up of pregnant women through ante natal care (ANC) for completion of therapy, counseling on common side effects, risks associated with anaemia, provision of incentives to frontline workforce, frequent evaluation to assess the programme, weekly or biweekly administration of iron and folate and inclusion of adolescent as beneficiaries are needed.

3. **National Iron$^+$ Initiative:** Taking cognizance of ground realities in the operation of the programme, Ministry of Health and Family Welfare took a policy decision to develop the National Iron$^+$ Initiative. This initiative will bring together existing programmes (IFA supplementation for pregnant and lactating women and children in the age group of 6-60 months). Thus National Iron$^+$ Initiative will reach the following age groups for supplementation :

Fig 12.2: National Iron$^+$ Initiative

- Biweekly iron supplementation for preschool children of 6 months to 5 years.
- Weekly supplementation for children from 1st to 5th grade in Government and Government aided schools.
- Weekly supplementation for school children (5-10 years) at anganwadi centres.
- Pregnant and lactating women, daily for 100 days.
- Weekly supplementation for women in reproductive age group.

In addition to increased iron and folate intake, improvement in environmental sanitation and personal hygiene are also needed to control worm infestations and infections. Deworming done regularly would help in reducing the incidence of anaemia and improve the efficacy of iron supplements. An improvement in food intake results in improvement in haemoglobin levels.

ACTIVITY

7. Find out the name of the medicine given for deworming in your school every 6 months.
8. How frequently are iron tablets given? Find out its composition.

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12.1.4 Prevention and control of vitamin A deficiency

1. Nutrition education
2. Dietary modification: The most rational and sustainable long term solution to control of vitamin A deficiency is to ensure that the community includes foods rich in vitamin A or its precursor regularly in their daily diets.
3. Periodic supplementation of vitamin A: Currently the massive vitamin A supplementation programme aims at providing the first dose of 1,00,000 IU at 9 months (at the time of measles immunization) to be followed by bi annual administration of 2,00,000 IU for children between the ages of 18 months and 59 months. The coverage under massive dose vitamin A administration has improved substantially after the initiation of biannual administration.
4. Fortification of commonly and widely consumed foods with vitamin A: Fortification or enrichment of widely consumed foods with vitamin A is another strategy to prevent and control vitamin A deficiency. Foods which are consumed daily by all sections of the community with little variation in the intake are generally utilized for the fortification. Fortified foods are integrated into the conventional food system as value added products to reach a large segment of population.

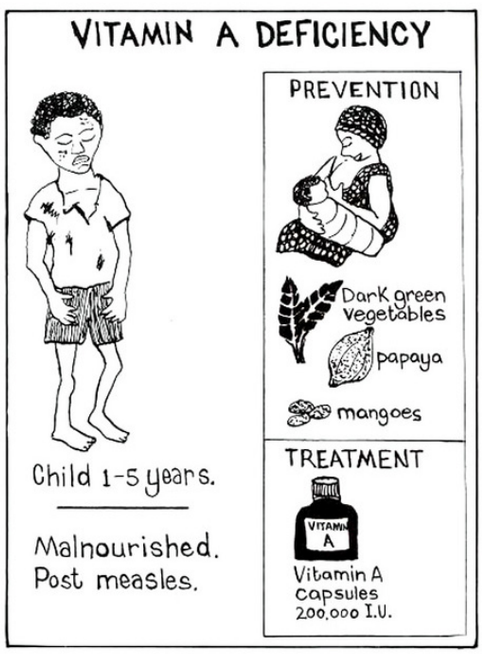

Fig 12.3: Vitamin a dose

12.2 Food Fortification Programme

Fortification of food items such as wheat flour, bread, milk, sugar, drinking water and common salt are in practice in different parts of the world.

Iodised salt: Common salt has been selected as a suitable vehicle for fortification of iodine to control IDD(Iodine Deficiency Disorder). The technology involved in fortification of salt with iodine involves either dry mixing or spray mixing of salt with iodine source mainly with potassium iodate. It is an economical, convenient

Fig 12.4: Iodised salt

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ACTIVITY

9. Selvi is a 3 year old suffering from vitamin A deficiency. Suggest to her mother what are the foods that can be included in Selvi's diet.
10. What are the nutrients fortified in salt available in ration shops?
11. What are the nutrients that are fortified in milk?

and effective means of mass prophylaxis in endemic areas.

Double fortified salt: Iodine deficiency disorders and iron deficiency anaemia are widely prevalent and often coexist in the country. Fortification of food with iodine and iron is recommended as one of the strategies to prevent and control these two deficiency disorders. NIN has developed a suitable technology for dual fortification of common salt with iodine and iron. The stability of iodine is satisfactory in double fortified salt with very little loss of iodine in six months.

12.3 National agencies

12.3.1 National Institute of Nutrition (NIN)

The National Institute of Nutrition (NIN) is one of the permanent research institutes of the Indian Council of Medical Research under the Ministry of Health and Family Welfare, Government of India. It was found in 1918 as part of Coonoor Pasteur Institute.

The objectives of National Institute of Nutrition are to :

- identify various dietary and nutrition problems prevalent among different segments of the population and continuously monitor diet and nutrition situation of the country.
- evolve suitable methods of prevention and control of nutrition problems through research, keeping the existing economic, social and administrative set up in view.
- investigate nutritional deficiencies, nutrient interactions and food toxicities at basic level for understanding the biochemical mechanism involved.
- provide training and orientation in nutrition to key health professionals.
- advise Government and other organizations on problems of nutrition.

12.3.2 Indian Council of Medical Research (ICMR)

The Indian Council of Medical Research (ICMR) is the apex body in India for the formulation, coordination and promotion of biomedical research. Intra mural research is carried out currently through the Council's 21 permanent research institutes. They do research on specific areas such as tuberculosis, leprosy, cholera and diarrhoeal diseases and viral diseases including AIDS. They also do

DO YOU KNOW...?

The headquarters of NIN is in Hyderabad. The headquarters of ICMR is in New Delhi

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research on malaria, kalaazar, nutrition and food and drug toxicology, reproduction, immunohaematology, oncology and medical statistics. Research is also done on major metabolic diseases, occupational health and non communicable diseases.

In recent years, the ICMR is also intensifying research in non communicable diseases such as cardiovascular diseases, metabolic disorders, mental health problems, neurological disorders, blindness, liver diseases and cancer. Medical information is strengthened to meet the growing needs and demands of the community.

12.4 International Organisations

12.4.1 Food and Agricultural Organisation (FAO)

The Food and Agricultural Organisation came into existence in October 1945 with a mandate to raise levels of nutrition and standards of living, to improve agricultural productivity, and to better the conditions of rural population. By seeking to improve nutrition through nutrition-sensitive agriculture and food based approaches.

The Nutrition Division aims to:

- Create sustainable improvements in nutrition, especially among nutritionally vulnerable households and population groups.
- Provide information, assessments and analysis to combat hunger and reduce all forms of malnutrition.
- Assist countries in identifying people who are insecure and vulnerable to nutritional problems.

Besides promoting food production and food security, one of the aims of FAO is to create a world, in which all children can grow, learn and flourish, developing into healthy, active and caring members of society.

12.4.2 World Health Organisation (WHO)

World Health Organisation is an agency of the United Nations. The organization came into function on 7th April 1948 which is celebrated as World Health Day. The most important objective that WHO seeks is the attainment of the most optimum level of the health of the people which would enable them to lead a socially, economically and mentally productive life.

WHO seeks to:

- Act as a directing and coordinating authority on international health activities.
- Collobarate the member states and other agencies in planning and carrying out health programmes.
- Prompt medical research and improve the under developed countries.
- Bring the health status to international level.
- Keep communicable diseases under constant surveillance, to give knowledge about health.
- Set certain standards for the quality control of drugs, vaccines and other detrimental substances to health.

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DO YOU KNOW...?

Dr.Henk Bekedam is the WHO representative of India. He took up his role on 27 November 2015. He is a Dutch National and a medical Doctor by training.

The WHO guidelines on Nutrition are as follows:

- Baby friendly Hospital initiative.
- Calcium supplementation in pregnant women.
- Consultation on the Dietary management of moderate malnutrition in under 5 children.
- Daily iron and folic acid supplementation in pregnant women.
- Interventions on diet and physical activity.
- Use of multiple micronutrient powders for home fortification of foods consumed by infants and children 6-23 months of age.
- Vitamin A supplementation for infants 1-5 months of age.
- Vitamin A supplementation for infants and children 6-59 months of age.
- Vitamin A supplementation for postpartum women.
- Vitamin A supplementation in pregnant women.
- Weekly Iron- Folic acid Supplementation (WIFS) in women of reproductive age.

12.4.3. United Nations International Children's Fund (UNICEF)

United Nations Children's Fund (UNICEF) was created at the end of World War II in 1946 to relieve the suffering of children in war torn Europe and for the past 70 years UNICEF has strived to improve the lives of children and their families throughout the world. UNICEF's nutritional priorities include:

- Infant and Child feeding.
- Delivering vital micro-nutrients.
- Promoting maternal nutrition/ preventing low birth weight.
- Monitoring infant growth rates.
- Providing nutrition in emergencies.
- Preventing death from starvation and disease.
- Supporting community based programmes.

Education is the key to opportunities and UNICEF believes that quality education is a right for all children, whether in the developing world or amidst conflict and crisis. UNICEF believes that all children have a right to survive, thrive and fulfill their potential for the benefit of a better world.

Summary

- The ICDS was initiated in 1975 with the twin objective of ensuring nutrition of preschool children through supplementary feeding and psychosocial development through early stimulation and education.

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- The major objective of the midday meal programme is to attract more children for admission to schools and retain them so that literacy improvement of children could be brought about.
- Prevention of anaemia includes dietary approach and supplementation.
- Vitamin A deficiency can be controlled by nutrition education, dietary modification, periodic supplementation and fortification.
- Common salt has been selected as a suitable vehicle for fortification of iodine to control IDD.
- The national agencies which work in the field of nutrition are NIN and ICMR.
- The international agencies in the field of nutrition include FAO, WHO and UNICEF.

Glossary

Terms	Meaning
FAO	Food and Agricultural Organisation
ICDS	Integrated Child Development Services
ICMR	Indian Council of Medical Research
IDD	Iodine Deficiency Disorders
MDMP	Midday Meal Programme
NIN	National Institute of Nutrition
NNAPP	National Anaemia Prophylaxis Programme
UNICEF	United Nations International Children's Fund
WHO	World Health Organisation

Questions

Part - A

Choose the correct answer (1 mark)

1. ICDS was initiated in the year _____.

   (a) 1965 (b) 1975

   (c) 1985 (d) 1984

2. In Tamil Nadu, the Chief Minister's noon meal programme was launched on _____.

   (a) 1st July 1982 (b) 2nd October 1976

   (c) 15th July 1966 (d) 14th June 1996

3. The headquarters of WHO is in _____.

   (a) Rome (b) Geneva

   (c) New York (d) Delhi

4. World Health Day is celebrated on _____.

   (a) 15th May (b) 7th April

   (c) 10th December (d) 12th may

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5. Iodine is fortified in _____.

   (a) sugar (b) rice

   (c) salt (d) honey

6. NIN is located in _____ .

   (a) Hydrebad

   (b) Mumbai

   (c) Chennai

   (c) New York

7. Common salt is fortified with _____ and _____.

   (a) iron and iodine

   (b) vitamin A and vitamin D

   (c) iron and protein

   (d) iron and protein

8. In Chief Minister's noon meal programme, eggs are given _____ a week.

   (a) once (b) thrice

   (c) four (d) all days.

9. FAO came into existence in _____.

   (a) October 1945

   (b) December 1953

   (c) November 1971

   (d) November 1972

10. Children 18 months to 59 months are given _____ IU of vitamin A every 6 months

    (a) 1, 00,000

    (b) 2,00,000

    (c) 3,00,000

    (d) 4,0000

Part - B

write short answers (2 marks)

1. Expand: (a)WHO (b) FAO.
2. What are the objectives of FAO
3. What are the reaserach areas of ICMR ?
4. Write a note on double fortified salt.
5. Write on Vitamin A prophylaxis programme.

Part- C

Answer in brief (3 marks)

1. Write on new Mother and child Protection card.
2. What are the objectives of school feeding programmes?
3. What are the foods given under midday meal programme?
4. What are the objectives of NIN?
5. Write on National Iron^{+} initiative.
6. Write on National anaemia prophylaxis programme.

Part- D

Answer in detail (5 marks)

1. Write on the WHO guidelines on nutrition.
2. What are the nutritional priorities of UNICEF?
3. How will you control vitamin A deficiency?
4. How will you control anaemia?
5. What are the broad principles in formulating midday meals for school children?

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NUTRITION AND DIETETICS PRACTICAL

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MEASURING TECHNIQUES

EX.NO.1

Aim:

To Understand the relationship of weight and volume

Materials needed:

Weighing Machine, Measuring Cups, Measuring Spoons, Knife and Vessels.

Measuring techniques of liquids and solids:

1. Dry ingredients, such as sugar and flour are measured in plastic and metal measuring cups.
2. Scoop the flour into the dry measuring cup, filling to overflowing. Level the flour off by dragging the straight edged utensil across the top of the measuring cup.
3. When small amounts of dry ingredients such as flour, sugar and baking powder, baking soda, salt and spices are to be measured – measuring spoons can be used.
4. Measuring cups for liquid ingredients must be placed on a level surface when measuring. Avoid lifting the cup to read the measure as it will probably tilt causing you to read inaccurate amount.
5. Read the level of the liquid by bending down so that the measuring cup is at eye level. Read the liquid level at the bottoms of meniscus.
6. Small amounts of liquid ingredient can be measured using measuring spoons.

Give the capacity of the following

1. One tea cup ----- gms
2. One teaspoon -----gms
3. One tablespoon -----gms
4. ¼ cup -----tsp
5. 2 table spoon -----tsp

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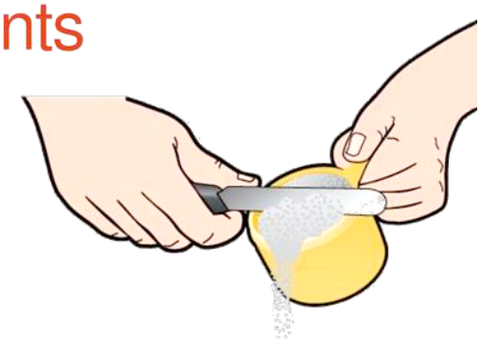
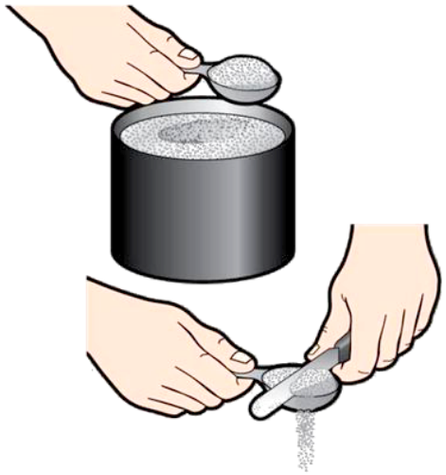
Measuring Dry Ingredients

For dry ingredients including flour, sugar, and salt, use dry measuring cups & spoons.

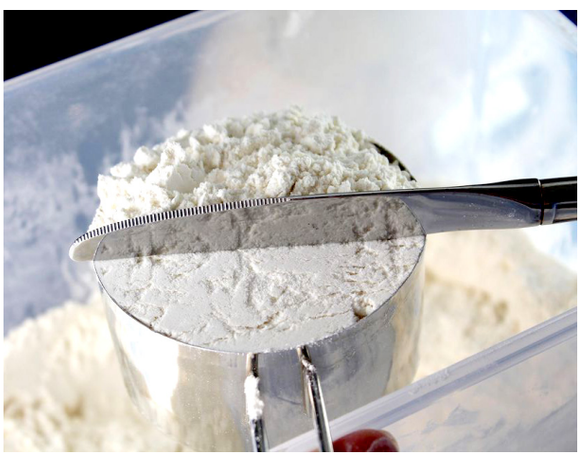
- Heap
- Level
- Empty



dry measuring cups



measuring spoons



Measuring liquids

Weighing Machine

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Cooking Methods

EX.NO.2

Aim:

To learn about different cooking methods

Procedure

The process of subjecting food to the action of heat is termed as cooking. Cooking takes place by moist and dry heat methods. Moist heat involves method water and steam. Air or fat are used in dry heat methods.

Moist heat methods are :

- Boiling
- Stewing
- Steaming
- Pressure cooking
- Poaching
- Blanching

Dry heat methods of cooking are

- Roasting
- Grilling
- Toasting
- Baking
- Sauteing
- Frying

Combination method of cooking is

- Braising

Preparation of food using boiling method

Rice Kheer

Ingredients

Full cream milk	-	1 litre
Soaked basmati rice	-	2 tsp
Sugar	-	7 tbsp
Cardamom powder	-	1/2 tsp
Chopped almonds	-	2 tsp
Saffron dissolved in rose water	-	5-6 strands in 1 tbsp of rosewater

Method

1. Pour the milk in a heated deep pan
2. Once it starts boiling add the soaked rice and stir well to prevent burning
3. After one boil, turn the stove to low flame and allow the milk to reduce to quarter. Keep stirring in between so that the rice does not stick to the bottom of the pan.

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4. Once the milk is reduced add sugar and let it dissolve for about 2 minutes.
5. Add cardamom powder, chopped almonds and the soaked saffron strands.

Results and discussions

By boiling method the food quantity increases and gets easily digested The prepared food tastes good and nutritious.

2.PREPARATION OF FOOD USING PRESSURE COOKING

Channa Masala

Ingredients

Kabuli channa	-	1 cup
Onion	-	100 gms
Tomato	-	200 gms
Oil	-	as needed
Ginger garlic paste	-	1 tsp
Coriander leaves	-	few
Channa masala	-	to taste
Salt	-	to taste

Method

- Soak Channa overnight and cook in pressure cooker
- Fry onion, ginger garlic paste and tomatoes in oil and cook till the oil comes out of it.
- Add Channa, salt, Channa Masala and coriander.
- Serve hot with fresh Onions and Coriander.

Result and Discussion

Pressure cooking method helps to cook the food to soft consistency and helps to retain the nutrients. It saves time and energy.

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3.DRY HEAT METHOD OF COOKING

Preparation of food using frying method

Greens Masala Vada

Ingredients

Bengal gram dhal	-	100 gms
Greens	-	100 gms
Onion	-	50 gms
Chillies,	-	2
oil and salt	-	as needed

Method

- Soak Bengal gram dhal for 2 hours, grind ¾ of the dhal coarsely.
- Wash Greens and drain the water thoroughly
- Cut onions and Chillies finely
- Mix all the ingredients Make Vadas and fry in oil.

Results and Discussions:

Frying method is the best method to prepare crispy foods. Oil enhances the flavour and taste of the food.

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4.PREPARATION OF FOOD USING ROASTING METHOD

Kesari

Ingredients

Bombay Rava	-	1 cup
Sugar	-	1 cup
Ghee	-	½ cup
Water	-	2 cup
Cashew nuts	-	as required
Raisins	-	as required
Beetroot natural color		

Method

- Fry Cashew nuts, Raisins in one tbsp of Ghee, and keep aside
- Fry Rava in Ghee till it becomes golden brown and cook in water
- Add Sugar and continue to cook
- Add Ghee, Cashew nuts and Raisins before removing from fire.

Results and Discussions:

Roasting methods brings out the flavor and makes the food partially cooked. Roasting method is easiest method of cooking without oil. Food items like roasted Bengal gram, Dhal varieties can be prepared by this method to enhance the taste of food and thus removes moisture from food.

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NUTRIENTS IN CEREALS AND PULSES

EX.NO. **3**

Aim: To identify the nutrients present in cereals and pulses.

Various Cereals, Pulses and their products were displayed. The students were asked to identify them and note the Nutritive value.

S.No	Name of the Product	Nutrients Present in the Food
1.	Corn (Makka Cholam)	
2.	Ragi (Kezhvaragu)	
3.	Jowar (Cholam)	
4.	Kuttirai Vali (Sanwa Millet)	
5.	Thinai (Italian Millet)	
6.	Moong Dhal	
7.	Cow Pea (Karamani)	
8.	Channa	
9.	Green Gram	
10.	Black Gram	

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CEREAL COOKERY

EX.NO. 4

Aim:

To prepare a cereal based weaning food

Role of cereal in cookery

- Cereals are used as thickening agent, e.g., corn flour in custards, corn flour in white sauce and macaroni in soups.
- Cereals are used as coating agent, e.g., Maida paste in Cutlets or bread Crumbs in cutlets.
- Cereals are used in sweet preparations, e.g., Rice Payasam and Wheat Halwa.
- Malted cereals are used in the preparation of beverages and weaning mixes.

Weaning is the gradual introduction of solid foods until the child is able to eat the food as the rest of the family. It is a replacement of breast feeding with other foods. Some of the weaning foods are well mashed cooked vegetables such as Potato, Sweet Potato, Carrot, Fruit Puree such as cooked Apple, Pear, Mango, Papaya, Banana etc. Well cooked cereal can be given to fulfill their appetite.

Formulation of recipe

Malted cereals

Washed Rice	-	½ cup
Washed Ragi	-	½ cup
Green Gram	-	½ cup

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Method

- Soak the above ingredients overnight in separate containers.
- Drain the water and tie the ingredients in separate clean moist muslin cloth.
- Keep in a warm place and allow to sprout.
- Once the sprouts appear, dry roast each cereal separately in a pan to remove excess moisture.
- Combine all the ingredients. Grind this mixture into a find powder and store in an air tight container.
- Take 15 gms of powder add enough water make a thin paste. Cook in slow flame till it gets cooked add salt or sugar to taste.

Results and Conclusion

Cereal based weaning food provides required calories and proteins to supplement the needs of an infant.

PULSE COOKERY

EX.NO. 5

Aim: To prepare a recepe using germinated pulses

Role of Pulse in cookery

- Pulses are rich in protein and B vitamins and improve the quality of cereal proteins.
- Pulses give satiety due to high protein and fibre content.
- Pulses improve flavor and consistency of dhal sambhar and rasam.
- They contribute to fermentation in Idli and Dosai batter.
- They are used in snacks like sundal, bajji, etc.

Sprouting of Green Grams

Germination is a process in which the nutritive value of the grams is improved. During sprouting minerals like calcium, zinc, and iron are released from bound form vitamin C is synthesized during germination. Thickening power in starch is reduced due to conversion of starch to sugars. Germination improves taste and texture. Germinated pulses add variety to the diet.

Formulation of recipe

Germinated green gram salad

Soak the green grams for at least 8 hours in fresh cool water in a wide mouth vessel.

Drain and rinse the green gram. Tie it in muslin cloth sprinkle water whenever the cloth gets dried. In a day or two days germination takes place.

Ingredients

Green grams	-	50 gms
Coconut scrapings	-	10 gms
Carrot scrapings	-	0 gms
Onion chopped	-	10 gms
Green chillies	-	2
Lemon juice	-	to taste
Cumin powder	-	to taste
Salt	-	to taste

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Method

Add coconut, carrot and onion to the sprouted green grams. Mix well, to the above ingredients, add chopped chillies, salt, cumin powder and lemon juice. Serve it by garnishing coriander leaves.

Conclusion

Sprouted green grams are rich in amylase, vitamin B and C. It gets digested easily and provides lot of fibre to the diet.

FRUITS AND VEGETABLES COOKERY

EX.NO. **6**

Introduction

Fruits and vegetables are very important commodities in our daily diet. They are life-enhancing medicines packed with vitamins, minerals, antioxidants and many phytonutrients (Plant-derived micronutrients).

List the fruits and vegetables that are rich in the following nutrients.

S.No	Iron	Vitamin A	Vitamin B	Calcium	Fibre
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					

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PREPARATION OF FRUIT SALAD

EX.NO. 7

Aim:

To prepare a recepe based on fruits.

Role of fruits in cookery

- Raw, whole or cut fruits can be served as an appetiser, or as a salad or for dessert.
- Fruits can be served in the form of juices or milk shakes.
- Apples are served as stewed apples.
- Fresh fruits can be preserved as jams, marmalades, preserves and dried fruits

Preparation of fruit salad

Ingredients

Apple	-	20gms
Pineapple	-	20gms
Orange	-	20gms
Banana	-	20gms
Papaya	-	20gms
Milk	-	100 ml
Sugar	-	20gms
Custard powder	-	10 gms

Method

- Cut fruits into cubes
- Mix custard powder in little milk
- Stir continuously till it thickness, cool and add to the fruits
- Garnish with cherries and serve cool

Conclusion

Fruit salad is rich in glucose, vitamin A & C, and minerals. It gives good quality protein. It is a colourful desert..

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PREPARATION OF VEGETABLE SALAD

EX.NO. **8**

Aim:

To prepare a vegetable based recepe

Role of vegetables in cookery

Vegetables are used universally in all recipes

- used in curries, salads and in sambar
- used as garnishing agents e.g., shredded carrot and coriander leaves
- used in chutneys (onion) and pickles (tomato, onion)
- used as part of recipes like pulao, avial and non-vegetarian dishes

Ingredients

Onion	- 1
Carrot	- 1
Baby corn	- 1
Cucumber	- 1
Cabbage	- few
Lemon	- 1 small
Pepper	- little
Coriander leaves	- to garnish

Method

- Cut or chop all vegetables finely
- Mix all the vegetables in a bowl
- Add little lemon juice and pepper

Conclusion

Vegetables Salad is rich in Vitamin C, A, Minerals and Fibre. It is a good diet for obese patients.

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MILK COOKERY

EX.NO.9

Aim

To prepare a milk based recepe.

Role of milk and milk products in cookery

- It contributes to the nutritive value of the diet, e.g., milkshakes, plain milk, flavoured milk, cheese toast.
- Milk adds taste and flavour to the product e.g., payasam,tea, coffee.
- It acts as a thickening agent along with starch e.g., whitesauce or cream soups.
- Milk is also used in desserts, e.g. Ice-cream, Puddings

Preparation of Basandi

Ingredients

Buffalo milk	- 500 ml
Sugar	- 1 tsp
Ghee	- 1 tsp
Almonds, Cashew nuts, Pista	- 2 tsp

Method

- Heat milk on low fire in heavy based kadai, stirring, constantly till it becomes thick.
- Add sugar, ghee and mixed nuts.
- Serve chill

Conclusion

The above milk cookery is rich in proteins, calcium, phosphorus and fat soluble vitamins. It provides fats and glucose.It is a very tasty desert.

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EGG COOKERY

EX.NO.10

Aim

To prepare an egg based recepe.

Role of Egg in cookery

- Eggs can be used as boiled, scrambled, fried (omelettes) or poached for table use.
- Eggs can be used as thickening agents for making stirred and baked custards, soups and puddings.
- They can be used for making cutlets, French toast or Bombay toast and banana fritters.

Egg curry

Ingredients

Hard boiled eggs	-	03
Ginger	-	1 piece
Oil	-	1 tbsp
Onion	-	1
Garlic	-	4 pods
Lime juice	-	1 tsp
Tomato	-	1
Salt	-	to taste
Coriander leaves		
Green chillies		

Method

- Remove shell of egg and cut into halves.
- Grind onion, ginger, garlic and green chillies
- Heat oil and fry the masala and add tomatoes and cook. When the gravy becomes thick, add lime juice and boiled eggs.

Conclusion

Egg curry is a good side dish for briyani and fried rice. It contains complete protein. Vitamin A, Fats and trace of iron.

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JAGGERY COOKERY

EX.NO. **11**

Introduction

Jaggery is a concentrated product of a cane juice and can vary from golden brown to dark brown in colour. It contains upto 50% sucrose,20% invert sugars and 20% moisture. It is used to make several indian deserts.It is a substitute for sugar.

Aim: To prepare a sugar based recepe.

Sweet Paniyaram

Ingredients:

Raw rice	-	1 cup
Urad dal	-	1 tbsp
Jaggery	-	1 + ¼ cup (grated or powdered)
Banana	-	1 (small one)
Green Cardamom	-	2 (powdered)
Finely chopped Coconut	-	1 tbsp
Ghee	-	for frying

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Method

1. Clean and soak rice with urad dal for 2 hours. Now grind it to a smooth batter.
2. Leave it outside for 3-4 hours for fermentation. Just before making appams, add jaggery,banana,greated coconut to the batter.
3. Now heat the paniyaram pan add 2 tsp ghee to each partition.
4. Pour the batter in each partition and cook it on low flame.
5. Cook for few minutes and then turn it with a stick to cook the other side till it turns to golden brown.and serve hot

Conclusion

Sweet paniyaram is a delecious evening snack. It provides high energy and iron.

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EX.NO. **12**

TEST FOR ADULTERANTS

Aim

To test for common adulterants present in food at home level

S.No.	Food item	Adulterant	Test
1.	Sugar	Chalk powder	Dissolve in a glass of water. Chalk will settle down at bottom indicates adulterant present.
2.	Chilli powder	Saw dust and colour	Sprinkle on the surface of water, saw dust floats. Added colour will make the water coloured.
3.	Rawa	Iron filling to add weight	Pass magnet through the rawa. Iron fillings get attracted to magnet.
4.	Milk	water	Pour few drops of milk on a polished surface. Pure milk leaves a white trail while flowing and the adulterated milk will flow without leaving a mark
5.	Honey	Sugar plus water	A cotton wick dipped in honey is burnt. If adulterated with water cotton wick will not burn or burns with a cracking sound.
6.	Tea dust	Used tea leaves dried, powdered and artificially coloured	Sprinkle the dust on the wet white filter paper. Spots of yellow, pink and red appearing on the paper indicates that the tea is artificially coloured.
7.	Black pepper	Papaya seeds	Papaya seeds are shrunken and greenish brown in colour. It has repulsive flavor while black pepper has pungent and hot flavor.
8.	Coconut oil	Any other oil	Keep the bottle of coconut oil in refrigerator. It solidifies while the adulterant does not.
9.	Common salt	Chalk powder	Dissolve in water. The water turns white and indicates presence of chalk powder.
10.	Coriander powder	Powdered Horse dung	Soak in water. Horse dung will float which can be easily detected.

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QUESTION BANK FOR XI STANDARD PRACTICALS

Nutrition and dietetics — 20 Marks

PART - A

1. Write the importance of cereals in cookery and formulate a recipe using boiling method Prepare and serve it. Calculate the energy and protein content of the preparation.

2. Write the importance of pulses in cookery. Formulate a recipe using pressure cooking. Prepare and serve it. Calculate the energy and protein content of the recipe.

3. Write the importance of vegetables in cookery. Formulate a recipe. Using frying method of cooking. Prepare and Display it. Calculate energy and carotene content of the recipe.

4. Write the importance of cereal in cookery. Formulate a recipe. Using roasting method. Prepare and serve it. Calculate the Energy and Protein content of the preparation.

5. Write on weaning. Formulate a weaning food. Prepare and serve it. Calculate the energy and protein content.

6. Write the importance of germination in cookery. Formulate a recipe. Prepare and serve it. Calculate the protein and vitamin B,C content.

7. Explain the benefits of fruits. Formulate a recipe. Prepare and serve it. Calculate the Energy and Vitamin C content of the recipe.

8. Explain the benefits of vegetables. Formulate a recipe. Prepare and serve it. Calculate the fiber and calcium content of the recipe.

9. Explain the importance and benefits of milk products. Formulate a recipe. Prepare and serve it. Calculate energy and protein content of the recipe.

10. Explain the importance of egg in cookery. Formulate a recipe. Prepare and serve it. Calculate the energy and protein content of the recipe.

11. Write the importance of jaggery in cookery. Formulate a recipe. Prepare and display it. Calculate the energy and iron content of the recipe.

PART - B

II. Find the adultrants present in the given sample.

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GLOSSARY

Angstroms	ஒளி அலைகளின் நீளத்தை அளந்து மதிப்பிடுவதற்குரிய நுண்ணளவைக்கூறு
Coagulation	உறைதல்
Charring	உணவு தீய்ந்து போதல்
Conduction	கடத்துதல்
Convection	வெப்பச்சலனம்
Radiation	கதிர்வீச்சு
Saturated	செறிவூட்டு
Amylase Rich Food	அமைலேஸ் செறிந்த உணவு
Bran	தவிடு
Distillation	வடித்தல்
Gelatinization	ஊன்பசையாக்கல்
Germination	முளைத்தல்
Gluten	கோதுமை புரதம்
Kilns	செங்கல் சூலை
Malting	மாவாக்கம்
Cling Wrap	பற்றக்கொள்ளுதல்
Pectin	பெக்டின் (கூட்டு சர்க்கரையின் ஓர் வகை)
Anti oxidants	எதிர் ஆக்ஸிஜனேற்றி
Phyto nutrients	தாவர நுண்ணூட்டங்கள்
Dietary Fibre	நார்சத்து உள்ள உணவு
Blanching	உணவு சமையல் முறை
Flavanoids	தாவர வேதிப்பொருளின் ஓர் வகை
Satiety	நிறை உணர்வு
Biological Value	உயிரியல் மதிப்பு
Scalding	சுடுநீரில் அமிழ்த்தித் தோலுரித்தல்
Eicosapentaenoic Acid	மீன்களில் காணக்கூடிய கொழுப்பு
Mono Unsaturated Fatty Acids	ஒற்றை செறிவுறா கொழுப்பு அமிலம்
Poly Unsaturated Fatty Acids	கூட்டு செறிவுறா கொழுப்பு அமிலம்

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High Density Lipoprotein	உயர் அடர்த்தி கொழுப்புகள்
Low Density Lipoprotein	குறை அடர்த்தி கொழுப்புகள்
Viscosity	பிசுபிசுப்புத் தன்மை
Restorative	மறுசீரமைப்பு
Rancidity	கெட்டுப்போதல்
Oxidation	ஆக்ஸிகரணமடைதல்
Chromic	நீடித்த நோய்
Aromatics	நறுமணப் பொருள் சார்
Flavouring agent	சுவையூட்டும் காரணிகள்
Colouring agent	நிறமேற்றும் காரணிகள்
Thickening agent	அடர்வூட்டும் காரணிகள்
Curing agent	பதப்படுத்தும் காரணிகள்
Souring agent	புளிக்கவைக்கும் காரணிகள்
Stimulant	தூண்டு பொருள்
Anti flatulence	வாயுக்கோளாறு நீக்கி
Carminative	வாய்வு நீக்கி
Anorexia nervosa	பசியிழப்பு நோய்
Anti spasmodic	தசைவலிக் குறைப்பு மருந்து
Galactogogue	பால்சுரப்பி ஊக்கி
Anti pyretic	உடல் வெப்பம் தணிப்பு
Carcinogenic	புற்று நோயாக்கும்
Lathyrism	முடக்குவாதம்
Flatulence	வாயுக்கோளாறு
Gastropathy	இரப்பை நோய்
Precursors	முன்னோடி
Calalyst	வினையூக்கி
Metabolism	வளர்சிதை மாற்றம்
Coenzymes	துணைநொதி
Fibrinogen	குருதிப்புரத இழையாக்கி
Fibrin	நார்புரதம்
Haemorrhage	இரத்தப்போக்கு
Intrinsic factor	அகக்காரணி
Exudating	கசிவு

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