Civilised man does not eat all the food as it is available in nature. He cuts, crushes, cooks, processes and modifies in many ways before consuming, adding variety to the diet.

**DEFINITIONS**

**Food** is defined as anything solid or liquid which when swallowed, digested and assimilated, nourishes the body.

**Food Science:** Food is a mixture of many different chemical components. The study of food science involves an understanding of the changes that occur in these components during food preparation whether natural or induced by handling procedures. Many physical and chemical reactions occur during food preparation. These reactions may be a result of the interaction between components, with the medium of cooking, and the environmental conditions like heat, cold, light and air to which they are subjected during cooking. Study of food science also includes understanding the nutritive value of different foods and methods of preserving them during cooking. This information provides a foundation of theory and method on which to build the study of food preparation.

**Food additive** is defined as non-nutritive substances added intentionally to food, generally in small quantities to improve its appearance, flavour, texture or storage properties.

**Fermented food** is produced by the action of bacteria or moulds which act on carbohydrates and proteins present in foods and hydrolyse them to simpler products yielding predigested foods.

**Food Technology** is the application of principles of food science and engineering to the processing and preserving large quantities of food.

**Food fortification** is defined as the process whereby nutrients are added to foods in relatively small quantities to maintain or improve the quality of the diet of a group, a community or a population. (WHO).

**Biofortification** is the process of improving nutrient content in crops through breeding or genetic modification.

**Food Chemistry** is the discipline that is involved in investigating the composition, structure and properties of food stuffs and their components.
Non-nutrients of foods are organic compounds having no nutritional function. They may be toxins or beneficial substances like fibre or compounds that may improve palatability or pharmacological importance.

Functional food provides health benefits beyond the nutrient contribution when they are eaten on a regular basis in adequate amounts. Functional food has positive effect on a person’s health, physical performance or state of mind.

Phytochemicals are non-nutrient compounds found in plant derived food that have biological activity in the body.

Food safety and regulation is related to food sanitation in public health and rules and regulations governing it.

Antioxidants include compounds that protect biological systems against the potentially harmful effects of processes or reactions that can cause excessive oxidations (USDA).

FUNCTIONS OF FOOD

Foods are classified according to their functions in the body.

Energy yielding
This group includes foods rich in carbohydrate, fat and protein. One gram of carbohydrate gives 4 calories. One gram of protein gives 4 calories. One gram of fat gives 9 calories. This group may be broadly divided into two groups:

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

Cereals provide in addition to energy large amounts of proteins, 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 provide energy, they also contribute to some extent to minerals and vitamins.

Pure carbohydrates like sugars provide only energy (empty calories) and fats provide concentrated source of energy and fat soluble vitamins.

Body building
Foods rich in protein are called body-building foods. They are classified into two groups:

- Milk, egg, meat, fish: They are rich in proteins of high biological value. These proteins have all the 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.

Protection and regulation
Foods rich in protein, vitamins and minerals have regulatory functions in the body e.g., maintaining the heart beat, water balance, temperature. Protective foods are broadly classified into two groups.

- Foods rich in vitamins and minerals and proteins of high biological value e.g., milk, egg, fish, liver.
- Foods rich in certain vitamins and minerals only e.g., green leafy vegetables and fruits.
Food contains certain phytochemicals and antioxidants which help in preventing degenerative diseases. Food plays an important role in the prevention of cancers, heart diseases and in controlling diabetes mellitus.

Some examples for functional foods are whole grains, soyabean, green leafy vegetables, coloured fruits and spices.

### FOOD GROUPS

Foods have been classified into different groups depending upon the nutritive value, for the convenience of planning diets. Food groups like ‘Basic four’, suggested by ICMR can be used for planning diets.

#### Basic four suggested by ICMR

<table>
<thead>
<tr>
<th>1. Cereals, Millets and Pulses:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Cereals and millets:</em> Rice, wheat, ragi, maize, bajra, jowar, rice flakes, puffed rice.</td>
<td><em>Energy, protein, invisible fat, thiamine, folic acid, riboflavin, iron and fibre.</em></td>
</tr>
<tr>
<td><em>Pulses and legumes:</em> Bengal gram, black gram, cow pea, peas (dry) rajma, soyabean.</td>
<td><em>Energy, protein, invisible fat, thiamine, riboflavin, folic acid, iron and fibre.</em></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2. Milk and Animal Products:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Milk, curd, skimmed milk, cheese</td>
<td><strong>Protein, fat, riboflavin, calcium.</strong></td>
</tr>
<tr>
<td>• Chicken, liver, fish, egg and meat.</td>
<td><strong>Protein, fat and iron.</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3. Vegetables and Fruits:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• <em>Green leafy vegetables:</em> Amaranth spinach, gogu, drumstick leaves, coriander leaves, fenugreek.</td>
<td><strong>Riboflavin, folic acid, calcium, fibre, iron, carotenoids.</strong></td>
</tr>
<tr>
<td>• <em>Other vegetables:</em> Carrots, onion, brinjal, ladies finger, beans, capsicum, cauliflower, drumstick</td>
<td><strong>Carotenoids and fibre.</strong></td>
</tr>
<tr>
<td>• <em>Fruits:</em> Mango, guava, tomato, papaya, orange, sweet lime, watermelon</td>
<td><strong>Carotenoids, vitamin C, riboflavin, folic acid, iron and fibre.</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>4. Oils, Fats and Nuts:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• <em>Oils and Fats:</em> Butter, ghee, hydrogenated fat, cooking oils.</td>
<td><strong>Energy, essential fatty acids and fat soluble vitamins.</strong></td>
</tr>
<tr>
<td>• Sugar and jaggery.</td>
<td><strong>Energy, jaggery has iron.</strong></td>
</tr>
<tr>
<td>• Nuts</td>
<td><strong>Protein and ω-fatty acids</strong></td>
</tr>
</tbody>
</table>
In planning balanced diets, food should be chosen from each group in sufficient quantity. Cereals and pulses should be taken adequately; fruits and vegetables liberally; animal foods moderately and oils and sugars sparingly.

**Food pyramid**

Figure 1-b shows ICMR food guide pyramid. It is meant for use by the general healthy population as a guide for the amount and types of foods to be included in the daily diet.

Health is related to the food consumed. To maintain good health, ingesting a diet containing the nutrients in correct amounts is essential. A balanced diet is one which contains different types of food in such quantities and proportions so that the need for calories, proteins, fats, minerals and vitamins is adequately met and a small provision is made for extra nutrients to withstand short duration of leanness. Deficiency of any nutrient affects health of an individual. Food has not only nutrients but also nutraceuticals which prevent degenerative diseases.

Table 1.1 gives nutrient deficiency symptoms and sources of nutrients and explains how food is related to health.

### Table 1.1: Food in relation to health

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Sources</th>
<th>Deficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy, Protein</td>
<td>Fat, sugar cereals, pulses, egg, meat.</td>
<td>Underweight, marasmus, kwashiorkor</td>
</tr>
<tr>
<td>Calcium</td>
<td>Milk, green leafy vegetables gingelly seeds.</td>
<td>Rickets, osteomalacia, tetany</td>
</tr>
<tr>
<td>Iron</td>
<td>Liver, green leaf vegetables, rice flakes, jaggery.</td>
<td>Anaemia</td>
</tr>
<tr>
<td>Vitamin-A</td>
<td>Liver, egg yolk, butter, green leafy vegetable, carrots.</td>
<td>Night blindness</td>
</tr>
<tr>
<td>Thiamine</td>
<td>Yeast, outer layers of cereals, pulses, nuts.</td>
<td>Pain in the calf muscle, weakness of heart muscle</td>
</tr>
<tr>
<td>Niacin</td>
<td>Groundnuts, whole cereals, pulses.</td>
<td>Dementia, diarrhoea, dermatitis</td>
</tr>
<tr>
<td>Vitamin-B_6</td>
<td>Meat, liver, vegetables, whole cereal grains.</td>
<td>Anaemia, angular stomatitis</td>
</tr>
<tr>
<td>Folic acid</td>
<td>Fresh green leafy vegetables, lady’s finger, cluster beans.</td>
<td>Megaloblastic anaemia</td>
</tr>
<tr>
<td>Vitamin-B_{12}</td>
<td>Yeast, fermented foods.</td>
<td>Pernicious anaemia</td>
</tr>
<tr>
<td>Vitamin-C</td>
<td>Citrus fruits, amla, guava.</td>
<td>Bleeding gums</td>
</tr>
<tr>
<td>Vitamin-D</td>
<td>Eggs, flesh foods, sunlight.</td>
<td>Rickets, osteomalacia</td>
</tr>
</tbody>
</table>

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

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.
OBJECTIVES OF COOKING

Improves the taste and food quality
Cooking improves natural flavour and texture of food. For example roasting groundnuts, frying onions and papads, cooking rice and roasting coffee seeds improve the flavour. Cooking meat with spices, rice with spices in making pulav, frying cashewnuts in ghee, addition of turmeric, curry leaves, pepper in pongal, blend flavour with one another during cooking.

Too much of cooking lowers the flavour as flavouring compounds are volatile. Over-cooked pulav, does not taste as good as well cooked pulav.

Destruction of micro-organisms
Micro-organisms are present everywhere and some are useful in making curd, cheese and bread. Some are harmful and cause infections or produce toxins, e.g., *clostridium botulinum* and *solemnella*. Some moulds produce toxins. *Aspergillus flavus* produces aflatoxin in groundnuts, cereals and spices. This aflatoxin is a health hazard.

One of the most important methods of protection of food against harmful micro-organisms is by the application of heat. Cooking food to the required temperature for a required length of time can destroy all harmful microorganisms in food e.g., pasteurised milk.

Tapeworm or its larvae which infest pork can be killed by proper application of heat. By cooking, food is made safe for consumption.

Improves digestibility
Cooking softens the connective tissues of meat and the coarse fibres of cereals, pulses and vegetables so that the digestive period is shortened and gastrointestinal tract is less subjected to irritation. Cooking improves the texture hence it becomes more chewable. Cooking also bursts the starch granules of pulses and cereals so that the starch digestion is more easier, rapid and complete. When dry heat is applied to starches they are converted to easily digestible dextrins. Cooking increases the access to enzymes and improves digestibility.

Increases variety
By cooking, same food can be made into different dishes. For example, rice can be made into plain, pulav, lemon rice, biryani, or combination with pulses and idli. Wheat can be made into chapatis, puri, paratha or halwa.

Increases consumption of food
Cooking improves the texture and makes the food chewable. Improvement in texture and flavour by cooking increases the consumption of food to meet our nutritional requirement.

Increases availability of nutrients
Raw egg contains avidin which binds biotin making biotin unavailable to the body. By cooking, avidin gets denatured and biotin is available to the body.

Trypsin inhibitors present in soyabean and duck egg get denatured on cooking and availability of protein is improved. Toxic substances from kesari dhal can also be removed by boiling it and throwing away the water. Cooking increases the quality of protein by making some aminoacids available to the body.
Studies have shown that when iron pans are used for cooking, the iron content of the food increases. This iron is available to the body.

**Increases antioxidant value**
Cooked tomatoes are associated with greater health benefits, compared to uncooked, because the heating process makes lycopene more easily absorbed by the body. Lycopene – the pigment present in tomatoes – reduces the risk of some cancers.

**Concentrates nutrients**
This may be due to removal of moisture or using combination of foods or due to cooking procedures, e.g., sweets.

**Pesticide residue**
Pressure cooking, frying and baking minimise the harmful effect of pesticide residue. Boiling milk destroys the pesticide residue. In general heating reduces pesticide residues in all substances.

**Limitations of cooking**
- Thiamine, which is heat sensitive, may be lost during cooking. Water soluble nutrients are leached into the water during cooking. Vitamin A and C content may be reduced due to oxidation and heat.
- Quality of protein may be reduced due to destruction of certain aminoacids during cooking e.g., bread crust has less quality of protein compared to the inside portion.

## PRELIMINARY PREPARATIONS

The term used to describe the tasks done before or ahead the final preparation of food is preliminary preparation. Preliminary treatment of food includes cleaning, peeling and stringing, cutting and grating, sieving, soaking, processing, coating, blanching, marinating, sprouting, fermenting, grinding, drying and filtering.

**Cleaning:** The term cleaning is applicable to vegetables, fruits and many other food products. Many food products may have portions to be discarded, for example, withered or discoloured leaves in green leafy vegetables.

Other aspect of cleaning is washing. This term is applicable to fruits, vegetables, cereals, pulses and non-vegetarian foods. Washing fruits renders them dirt-free. Washing cereals or dals helps to remove husk, mud and any other unwanted matter. Hard vegetables are scrubbed under cold running water.

About 75–80 per cent of pesticide residues are removed by cold water washing. Washing with 2 per cent salt water removes most of the contact pesticide residues that normally appear on the surface of the vegetables and fruits.

The pesticide residues that are on the surface of grapes, apples, guavas, mangoes and vegetables like tomatoes, brinjals and ladies finger require 2–3 washings. The green leafy vegetables must be washed with 2 per cent salt water in a large bowl.

**Advantages:**
- Insecticides, sprays, chemicals and dirt are removed.
- Washing in warm water helps to kill the worms e.g., worms in cauliflower.
• Washing flesh food products helps to remove blood, dirt and unwanted impurities.
• Cleaning process helps to remove gills from fish, hard shells from prawns and crab.

Disadvantages:
• Washing cereals like rice causes loss of B complex vitamins especially thiamine. This can however be reduced by quick and thorough washing.
• Water-soluble vitamins are lost when fruits and vegetables are cut and then washed.

Peeling and stringing: Both these methods involve the removal of non-edible or fibrous portion of fruits or vegetables e.g., peeling of banana and potato, stringing of beans. Peeling brings about loss of nutrients present under the surface of food, hence the product should be boiled or blanched and then peeled e.g., vitamin C in potatoes. Colour of beetroot can be preserved better when it is cooked with the skin.

Advantages:
• Non-edible or fibrous portion is removed.
• Dirt and chemicals which is retained after cleaning on the skin can be removed.
• Appeals better to the eye after peeling and stringing e.g., potatoes and beans.

Disadvantages:
• Some nutrients might be lost e.g., peeling and exposing fruits can bring loss of vitamin C.
• Some edible portion might be removed alongwith peel.

Cutting and grating: This is dividing the food into smaller pieces, thus helping in easy cooking. Various terms under this are:
• Cut : To divide into pieces or to shape with knife.
• Chop : To cut into no specified shape.
• Mince : To chop very fine.
• Dice : To cut into small uniform cubes.
• Slice : To cut into uniform slices.
• Grate : To cut finely with a grater.

Cutting is a general term which includes all the others. Apart from knife, various other machines are used to cut like food slicer, chopper, grinder and vertical cutter.

Advantages:
• The product is easily cooked.
• It is easily consumed.
• Spoiled portion of the food can be discarded.
• Appearance of the food can be improved, e.g., salads.
• Grating helps in proper blending of the product.

Disadvantages:
• Smaller the size, greater the surface area, greater the loss of nutrients, hence cutting is preferred to grating but, however, certain recipes need grating.

Figures 1c and d show standard vegetable cuts and Fig. 1e shows some decorative cuts.
Cubes

Chiffonade

Julienned

Roll cuts

Diagonal cuts

Flower cuts

Figure 1-c: Vegetable cuttings.
Sieving: Sieving is done to remove coarse fibres and insects. It is also done in preparing cakes for blending of flour with baking powder.

Advantages:
- Helps in removal of dirt, worms, fibre and stones from the whole grains.
- The shelf life of food products can be improved.