1 Introduction to Food Science and Technology

Contents at a glance

Man needs adequate food for growth, development and maintenance, which lead an active and healthy life. The quality of human life depends on the type of food that one eats, its quality and quantity. Man eats what his forefather ate, if possible, and what his environment offers. Primitive man lives as hunters and gatherers, they collected their foods from wild animals and plants in raw forms. Man's food pattern changed after the discovery of fire. Man eats most of his food in cooked form and this is one of the many characteristics, which separates him from other animals.

As food production expanded, food safety has become a critical role in preventing the hazards and illness among populations. We are lucky to have a relatively safe food supply today, but historically only royalty had access to high quality food.

Food science is crucial to the success of the food industry, helping to develop thousands of products that make life better for today's consumer. Many companies consider research in this field a profitable investment. Also, thanks to food science, consumers are capable of experiencing food products from all over the world.

Incredibly, the moon and space have already been conquered by food science several decades ago when scientists had to figure out how to keep astronaut food safe. Going forward, our aim should be to inform the consumer about the products and processes that we create, develop environment friendly processes, and continue to create functional products.

1.1 What is Food?

Food refers to anything, which nourishes the body. It includes solids, semisolids and liquids which can be consumed to sustain body and keep it healthy.

Foods are very important socially as well as scientifically. Socially foods are defined as "Foods are the materials, in raw, processed or formulated form, which are consumed orally by humans or animals for their growth, health, and satisfaction or pleasure.

Scientifically foods are defined as "Foods are mainly composed of nutrients such as carbohydrate, protein, fat, water with small amount of minerals and organic compounds. Minerals in the form of salts and organic substances are present in food as vitamins, emulsifiers, acids, antioxidants, pigments, polyphenols, or flavours.

1.2 Definition of food science and technology:

Food Sciences and Technology is an interdisciplinary subject which deals with different disciplines.

Food science can be defined as the application of the basic science and engineering to study the fundamental physical, chemical, and biochemical nature of food and the principles of food processing.

Food technology is the use of the information generated by food science in the selection, preservation, processing, packaging and distribution as it affects the consumption of safe, nutritious and wholesome food by application of techniques.

With the right knowledge, understanding and application of the science, the food scientist can bring about desirable changes in food and control or eliminate the undesirable changes.

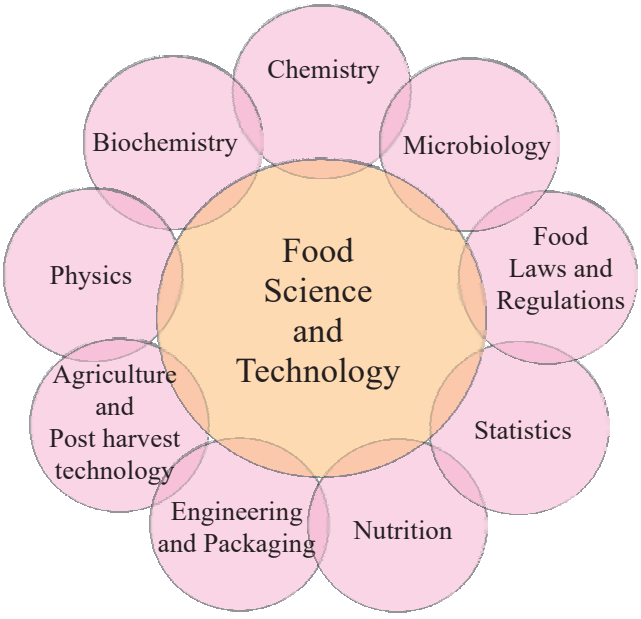

Fig. - 1.1 Components of food science and technology

1.3 Some terms used in food science and technology:

Some technical terms are very important to understand food science and technology such as food chemistry, food analysis, food microbiology, food processing, food engineering and packaging, food additives, food fortification, food fermentation, functional food, food safety and regulations, etc.

Food chemistry: Food chemistry covers the basic composition, structure, properties and changes occurring during processing and utilization.

Food analysis: Food analysis deals with the principles, methods and techniques necessary for qualitative and quantitative physical and chemical analysis of food products and ingredients. The analysis should be related to standards and regulations as per the Government regulatory agencies. (FSSAI)

Food microbiology: Food microbiology is the study of the microbial ecology related to foods, the effect of environment on food spoilage, the physical, chemical and biological destruction of microorganisms in food, the microbiological examination of food stuffs, public health safety and sanitation microbiology.

Food processing: Food processing covers general characteristics of raw food material, principles and methods of food preservation, factors which influence quality, packaging, waste management, good manufacturing practices, sanitation procedures, etc.

Food engineering and packaging: Food engineering involves study of engineering concepts and unit operations used in food processing such as thermodynamics, fluid flow, heat and mass transfer, food packaging aspects etc.

Food additives: Food additive is defined as a substance added intentionally to food, generally in small quantities to improve its functional, physical and sensory properties such as appearance, colour, flavour, texture, acceptability, taste and storage behaviour also.

Food fortification: Food fortification is defined as the process whereby nutrients are added to enrich foods in relatively small quantities to maintain or improve the nutritional quality of the diet.

Food fermentation: Fermentation is a biological process that breakdown organic materials, which is carried out by micro-organisms such as bacteria, yeast and mold to a desirable end products.

Functional food: 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 person's health, physical performance or state of mind, in addition they check number of health disorders.

Food safety and regulation: Food safety and regulation is related to food sanitation, safety and hygiene to food item, public health and regulations. The Food Safety and Standards Authority of India **(FSSAI)** has been established under the Food Safety and Standards Act, 2006.

Do You Know ?

Mandate of FSSAI 2006 Act: Laying down science based standards for article of food and to regulate their manufacture, storage, distribution, sale and import to ensure availability of safe and wholesome food for human consumption.

1.4 Objectives of the study of food science and technology:

To understand the nature and composition of foods: The nature of the food like colour, texture, consistency and keeping quality depends on the constituents present in it. Hence, it is important to study the composition of different foods in order to understand the nature of these foods e.g. perishable food have a low keeping quality due to its high moisture content.

To study the changes that occurs in food during storage, preparation and processing: Food is exposed to different conditions during storage, preparation and processing which may bring about different changes in the nature and composition of food. These change may be desirable or undesirable e.g. preparation of curd is desirable change whereas curdling of milk is an undesirable change.

To learn ideal methods of food preparation, processing and storage, to conserve the nutritive value and increase sensory and aesthetic properties: Food gradually undergo deterioration of spoilage since the time they are harvested, slaughtered or manufactured. The knowledge of these changes will enable us to develop and use ideal method of food preparation, storage and processing which will retain the nutrients to its maximum along with increasing the acceptability e.g. addition of spinach or fenugreek in the dough of paratha that will make it more nutritious and will increase the acceptability and palatability of the product.

To improve the digestibility of food: Composition of food, processing and method of preparation affects the digestibility of food. Fermentation improves digestibility e.g. *dhokla* or *idli*, whereas fried foods or foods high in fats are more difficult to digest. Cooking increases the access of enzymes and improves digestibility.

To maintain the quality and safety of food: Food should be handled carefully while processing, storing and cooking. This will minimize food spoilage and maintain the quality of food to make it 'safe' for consumption. Government Certification like FSSAI/ISI/BIS, Agmark, FPO, etc. ensures the quality and safety of food.

To learn to avoid food wastage and minimize food cost: Generally optimum quantity of food should be bought and cooked according to the needs of the family. In each meal, quantity of food to be eaten should be according to the individual's need.

Even on special occasions like weddings, parties, festivals and meetings, quantity and variety of food should be prepared and served according to the requirement. Too much variety preparation may lead to unnecessary expenditure and wastage of food.

To understand the meaning of food:

Study of the food science which enables us to understand the importance of food in life. Food performs different functions. It, not only satisfies hunger and fulfill the physiological requirements of the body but also satisfies the sociological and psychological needs of the human beings.

1.5 Acceptability of food:

The acceptability of different food preparations varies from person to person. However, it depends on various factors that are depicted in figure 1.2.

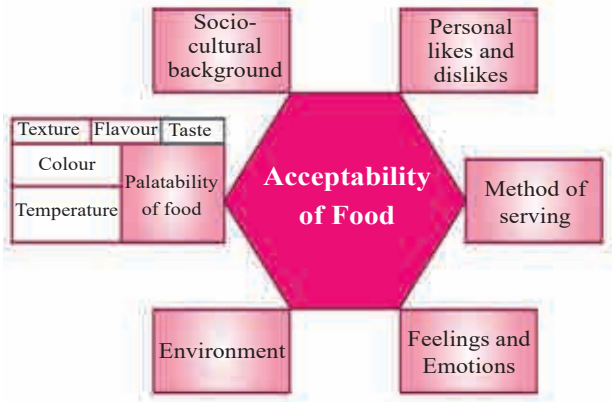

Fig. 1.2 Acceptability of Food

Factors affecting acceptability of food:

I. Palatability: The palatability of food is a composite of taste, flavour, texture, colour and temperature.

i) Taste: Sweet, sour, salty, and bitter are the basic tastes. When piece of food is placed in the mouth cavity specific stimuli is produced to the taste buds on the tongue. Higher the number of taste buds (Papillae) will give us more accurate taste response. The sense of taste is more highly developed in some individuals than in others. Foods may be too salty for one individual and just right for another. The four types of taste as sweat (tip of tongue), sour (just behind but both sides of tongues, salty (behind the sour taste buds) and bitter taste (near the esophagus).

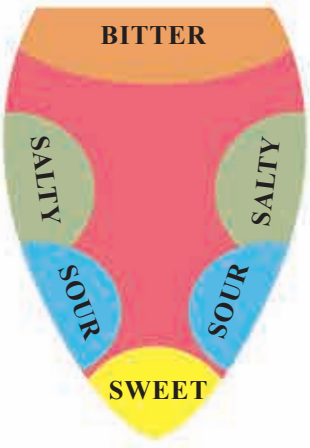

Fig. 1.3 Basic taste on the tongue

Improvement of taste in food products: Different types of tastes can be developed in food preparations by addition of ingredients like sugar (sweet), vinegar, tamarind, lemon juice (sour), common salt (salty), caramel, coffee (bitter). When necessary ingredients are added in correct proportion, food becomes tasty (combination of all tastes).

ii) Flavour: Food may be accepted because of their aromas, or rejected due to their repulsive odours. Flavour is a blend of taste and smell sensation evoked by a substance in the mouth cavity. Each food has a characteristic flavour due to the presence of varied constituents in different amounts. (aldehydes and ketone)

Improvement of flavour of food products:

- **Cooking:** Cooking enhances or brings out the natural flavour of food e.g raw rice, *dal* or vegetable have a mild flavour which is improved appreciable due to cooking.

- **Addition of natural flavouring compounds:** Spices such as pepper, clove, cinnamon, cumin seed and mustard seed are added in whole form in food preparation like *pulav, masala* rice*, and* seasoning *for* vegetable *pachadi.* Spices can also be added in preparation in powderd form. Different spices are combined together to *sambar masala, pav bhaji masala, garam masala* and others.
- **Addition of artificial flavouring agent:** Artificial essence such as cardamom, nutmeg, vanilla, rose etc. are used in preparations such as ice-creams, puddings, beverages, cakes and sweets.

iii) Texture: The texture of food is an important factor in its acceptance and chewability. Structural component of food confers on them a wide range of properties referred collectively as texture. Each food has a characteristics texture associated with it. Table 1.1 shows different texture with some food products associated with them.

The texture of food depends on the ingredients used, their proportion, method of preparation, time and temperature used during preparation, and storage.

Table 1. 1 Texture of Food Products

Sr. No.	Texture	Food Products
1.	Crunchy	Biscuits, *Shankarpale*, *Chiwada*
2.	Crispy	*Khakara*, Wafers
3.	Soft, Smooth, Velvety	Custard, *Shrikhand*, Ice Cream
4.	Spongy	Cake, *Dhokla*, *Idli* & Bread
5.	Brittle	*Chikki*

iv) Colour: Acceptability of food depends upon its colour. Natural and synthetic colour improves the colour of food products. Preserving the natural colour of food by optimum cooking of food is also essential to retain the natural colour of the food products.

Improvement of colour of food products: Colour of food preparation can be improved by :

- **Preserve the natural colour of foods:** This can be achieved by optimum cooking of food. Overcooking may result in a highly unpalatable, pale or dark coloured food.
- **Use of foods containing natural colour:** To make the preparation more attractive, natural, certain bright colours can be added to food preparation like green, yellow, red, white and other colours.

  [Natural colour of Saffron (orange), Turmeric (yellow) and Spinach (green etc.]
- **Use of spices:** Spices like turmeric, chilli powder and saffron are used in food preparations to improve the colour.
- **Use of synthetic colours:** Synthetic colour are added to beverage, ice-cream, sweets, cakes, *biryani*, etc. to improve the colour thereby increasing physical quality and the palatability of food preparations.

v) Temperature: Hot and cold sensations contribute to the composite flavor of a food like coffee, soup and ice-cream etc. Acceptability of food is highly influenced by temperature.

II. Socio-cultural background: Food is an integral part of the social cultural life of the people. The circumstances under which one eats food are largely determined by his culture e.g. use of mustard oil for cooking is common practice in North-India whereas

coconut oil is commonly used in Kerala. Hence socio-cultural background has to be kept in mind while serving food in order to see that it is acceptable and liked by everyone.

III. **Personal likes and dislikes:** People belonging to same geographical area or same socio-cultural background may have similar eating patterns, but acceptance for food may vary from person to person. Personal likes and dislikes are also noticed within the members of the same family. Hence, while preparing a meal, a judicious selection of foods and dishes is necessary, considering the likes and dislikes of all family members.

IV. **Method of serving**: The use of the right type of crockery, cutlery and other serving utensil in the dining area appreciably improves the acceptability of food. Each community has a particular traditional way of serving food e.g. Maharashtrian Thali.

Similarly, continental dishes should be served in proper crockery with appropriate cutlery like knives, forks, spoons and bowls.

Fig. 1.4 Traditional Maharashtrian style of service

Fig. 1.5 Continental style of serving

V. **Feeling and emotions:** Feeling and emotional state of an individual affects the acceptability of food. In a happy state of mind an individual consumes more food, whereas in stress a person may overeat or avoid food.

VI. **Environment:** Cleanliness of the area, serving utensils and person who is serving food affects the acceptability of food. Clean, hygienic and pleasant environment increases the acceptability of food. Well-ventilated and well-lit eating area is necessary. The food that is served with love and affection is more acceptable.

1.6 Functions of food:

Food nourishes our body and keeps it healthy. Food performs many different functions hence it is much more than a substance supplying nutrients for health. It is sum of man's culture and tradition, a means of communication, status, pleasure and relief from stress. Functions of food are classified as follows:

Physiological functions: Food is essential for maintaining specific body functions (Figure 1.6)

- **Energy:** We need energy for performing various voluntary activities such as walking, running, sitting, standing and involuntary activities like beating of heart, circulation of blood, digestion of food etc. Energy is provided by carbohydrates, proteins and fats.
- **Body building and growth:** Food rich in protein are called body building foods. Growth of the body right from birth to adulthood is due to consumption of protein rich foods along with other nutrients required for growth. During pregnancy and lactation, the food rich in proteins are required for proper growth of foetus and neonate.
- **Repair and maintenance:** Each cell in the body has a definite life span. During injury, infection, surgery or old age, cells are damaged which need to be rejuvenated for maintaining health. This function is carried out by proteins present in food.
- **Protection:** Food performs various important functions such as preventing infections. Person consuming a well balanced diet, hardly falls ill and has good resistance against infections.

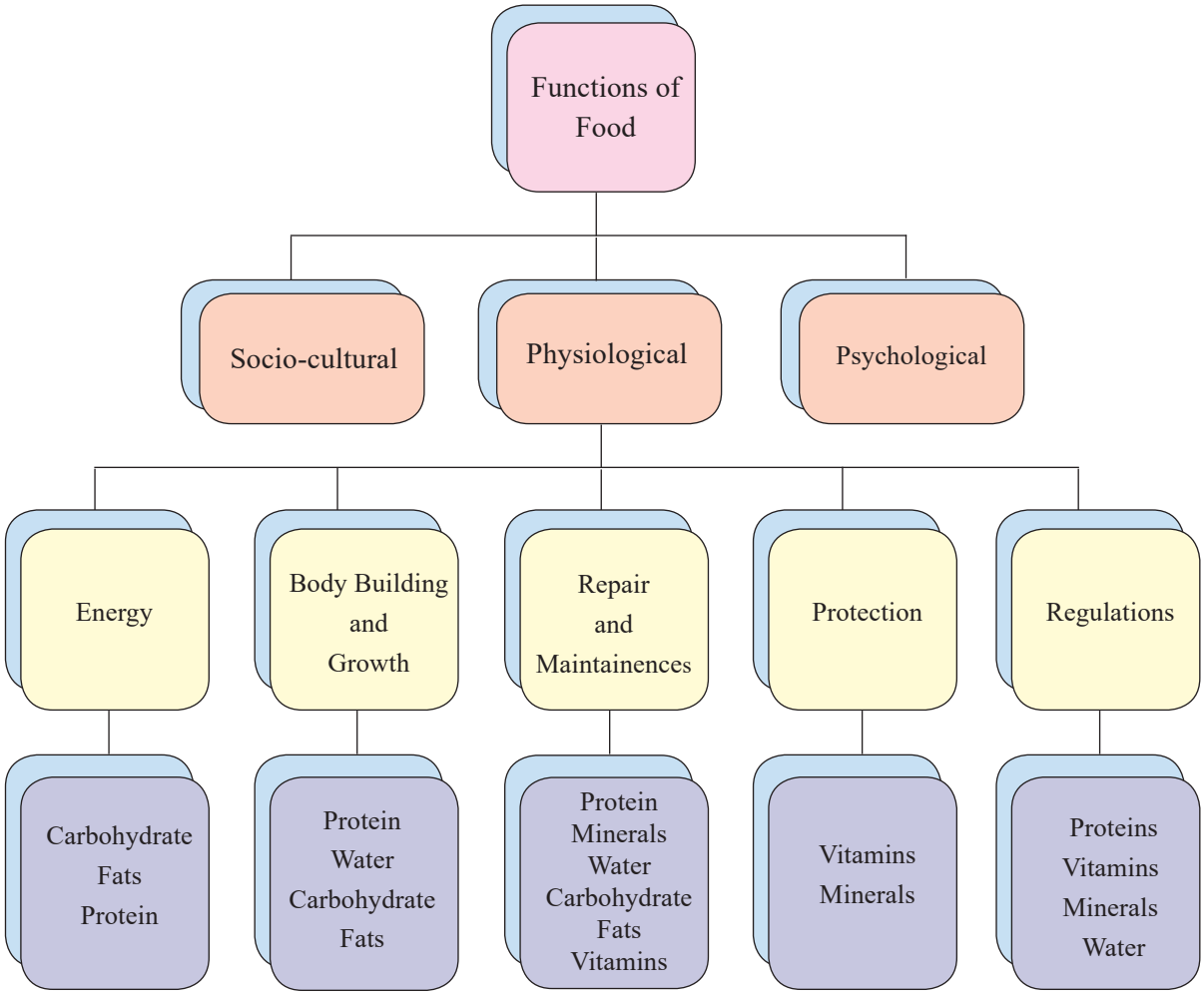

Fig. 1.6 Functions of food

➢ **Regulatory function:** Important functions like maintaining the heart beat, water balance, temperature are performed by foods rich in proteins, vitamins, minerals and water.

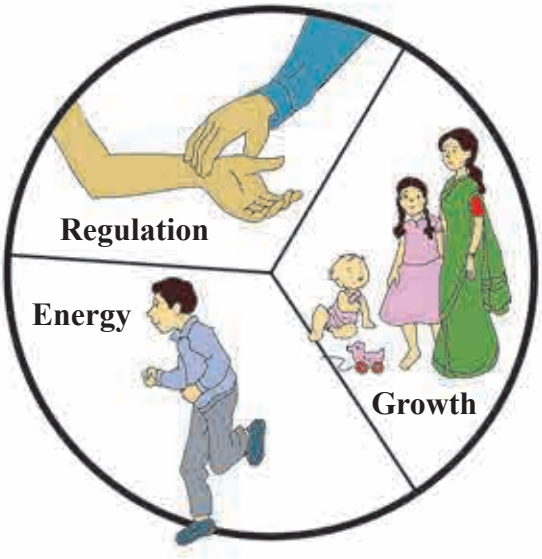

Fig. 1.7 Physiological functions of food

Socio-cultural functions: Food is a symbol of hospitability and friendship throughout the world. We express our hospitality to a guest through an offer of food or a drink. Offering a cup of coffee or tea is a symbol of friendship. In times of disaster or sorrow, food is offered to the affected persons. In schools, colleges or even in offices, people share their tiffins amongst groups as a token of friendship and affection. (Figure 1.8)

In a country like India many festivals are celebrated throughout the year. In celebration of festivals, food is a center of attraction. Not only in festivals, but also in joyous occasions like marriage, birthday, serving of food becomes an integral part of the celebrations. In professional meetings and business meetings, food is served to create a relaxed atmosphere.

Fig. 1.8 Socio-cultural functions of food

In religious rituals, food plays a significant role. In various *poojas,* we offer various seasonal fruits or coconut and *prasad* (*pedha* or *burfi*) to god. Specific sweets are prepared and distributed to devotees as *prasad* on various religious occasions e.g. *modak, sheera* and others. On specific festivals, specific dishes or food preparations have a very significant role e.g. on the occasion of *Diwali*, food preparations like *chiwada*, *chakli*, *ladu*, *karanji* and *anarsa* are prepared and on the occasion of *holi*, *puranpoli* is mandatory.

Psychological functions: Food is often used as a tool to express one's feeling. At home, mother shows her love and affection by preparing her child's or husbands's favourite dishes. It gives them a sense of security. A child readily accepts food eaten by his friends or by people whom he admires.

Food is also an outlet for emotion. For some people, loneliness and boredom are relieved by continuous nibbling on food. Anxiety of examination in some children leads to overeating or very less intake of food.

Points to remember

- Socially foods are defined as "foods are the materials, in raw, processed or formulated form, which are consumed orally by humans or animals for growth, health, and satisfaction or pleasure.
- Scientifically foods are defined as "Foods are mainly composed of nutrients such as carbohydrate, protein, fat and water with small amount of minerals and organic compounds. Minerals in the form of salts and organic substances are present in food as vitamins, emulsifiers, acids, antioxidants, pigments, polyphenols, or flavours.
- Food is also reffered to as anything solid or liquid which when consumed, digested and absorbed by the body, promotes growth, supply energy and regulates different body process.
- The study of food science deals with the composition of food and the changes that occur during its processing, cooking and storage.
- The sensations like taste, flavor, texture, colour and temperature of food decides its palatability
- Palatability, individuals socio-cultural background, personal likes and dislikes and method of serving, feelings and emotions and environment decide acceptability of food.
- Food serves physiological, sociological and psychological functions.

Exercise

Q.1 a) Select the most appropriate option:

i. Body building and growth is a …… function of food.

(Psychological, Physiological, Social)

ii. Method of serving is a cofactor affecting …… of food.

(Palatability, Acceptability, Nutrition)

iii. Sharing the food with others is ……..function of food.

(Socio-culture, Mental, Physical)

iv. …….. ensures the quality and safety of food.

(SBI, Agmark, Food Mark)

b) Match the following

A		B	
i.	Regulatory function	a.	*Prasad*
ii.	Protective function	b.	2006
iii.	Nutrient	c.	Favorite dish
iv.	Colour	d.	Palatability
v.	Psychological function	e.	Water balance
vi.	Religious occassion	f.	Fat
vii.	FSSAI	g.	Acceptability
		h.	Prevent infection

c) State whether the following statements are true or false:

i. To improve the digestibility of food is an objective of studying food science and technology.

ii. Bodybuilding is a Socio-culture function of food.

iii. *Chikki* has brittle texture.

iv. Functional food provides health benefits beyond the nutrient contribution.

v. Food additives is defined as a substance added intentionally to food.

Q.2 Answer the following

i. Name any three objectives of studying food science and technology.

ii. Name the physiological function of food.

iii. Define the social defination of food.

iv. Define the scientific defination of food.

Q.3 Write short notes on the following

i. Socio cultural functions of food

ii. Method of serving as a factor affecting acceptability of food

iii. Texture as a factor affecting palatability of food

iv Components of food science technology.

Q.4 Long Answer Questions

i. Discuss in details the factors affecting palatability of food

ii. Explain all the functions of food

❖ Project

Prepare charts on functions of food