

Contents at a glance

- 16.1 Classification of functional foods
- 16.2 Health benefits of functional foods
- 16.3 Examples of functional foods

Learning objectives :

Students will be able

- 1) To identify functional food products .
- 2) To critically analyze the health claims made on the labels of these products.
- 3) To learn and give examples of functional foods.
- 4) To learn the classification of functional foods.



Fig. 16.1 : Food as medicine

“Let your food be your medicine” said Hippocrates. Today food has become important beyond its basic nutrition, cultural pleasure of feeding a family and greeting friends in a social meeting. Products intended to cure diseases are medicinal products and not foods. But on the other hand, a healthy diet consisting of foods with

functional properties can help to promote well-being and even reduce the risk of developing certain disorders like obesity, hypertension, heart related diseases, etc. World Health Organization (WHO) stresses the importance of a healthy diet in preventing non-communicable diseases. Healthy diet is not just about limiting certain components of concern such as saturated or trans fatty acids or simply delivering nutrient intake. It also includes those elements that may provide an extra benefit.

Need of functional food :

In the fast moving modern world of today, which is rapidly progressing towards industrialization and urbanization, need of functional food has become apparent due to drastic changes in lifestyle.

Definition of functional food :

Functional food is any fresh or processed food claimed to have a health promoting and/ or disease preventing property beyond the basic nutritional function of supplying nutrients.

16.1 Classification of functional foods

Functional food has been classified into four categories: conventional foods, modified foods, medical foods, and foods for health use.

- 1) Conventional foods:** Conventional foods are the most basic of the functional foods because they have not been modified by enrichment or fortification. They are still in their natural state. Most whole fruits and vegetables fall into this category because they are rich in phytochemicals such as lycopene and lutein, fibre, as well as other beneficial compounds (vitamins, minerals and antioxidants) e.g. tomato is a functional food because it contains bioactive compound called Lycopene. Lycopene is associated with reduction of cancer. Traditional natural way of making curd in earthen pots gives probiotic effect.
- 2) Modified foods:** Modified foods are enriched, fortified, supplemented or enhanced with nutrients or other beneficial ingredients. Calcium-fortified orange juice, folic acid enriched breads and margarine supplemented with plant sterols are the modified foods. Omega-3 enriched bread (adding flax seed) is also considered as functional food. High fibre biscuits fortified with oat flakes are good for cancer and diabetic patients.
- 3) Medical foods:** These foods need a doctor's prescription and are not available over the counter to consumers but can be taken through medical representative. They are specially formulated foods given either orally or through tube feeding under medical supervision e.g. malted baby food, ORS preparations for diarrhea patients.
- 4) Foods for special dietary use:** Foods for special dietary use are similar to these medical foods, but they are available

commercially and do not require the supervision of a health care provider. These foods fulfill special dietary needs that are due to specific health conditions, such as celiac disease, lactose intolerance, obesity, anemic condition, etc. Gluten-free foods, and other foods designed to for weight loss are considered for special dietary use. Infant foods are also grouped in this category. Lactating mothers are advised to have *shatavari* extract to get easy flow of milk.

Few examples of functional foods available in Indian market (Table 16.1) are such as gluten free *atta*, probiotic yoghurt, fruit juices (natural, ayurvedic and smoothies), green tea (rich of antioxidant), vagen milk (lactose free), Omega-3 fatty acids in flax seed, fish oil enriched breads, plant sterol and stanol-enriched margarine, calcium-enriched milk, caffeine-enriched beverages like sports drinks. Some examples of functional foods with their health claims and active ingredients are illustrated in table-16.2

Do You Know ?

Dry pulses do not contain any ascorbic acid, while germinated/ sprouted green pulses do contain ascorbic acid which has a potential antioxidant property.

16.2 Health benefits of functional foods

Functional foods have numerous health benefits and disease preventive effects e.g. treatment of cancer, atherosclerosis and cardiovascular disease (CVD), anti- ageing, immune boosting as well as managing diabetes. The health promoting effect is because of the presence of bioactive constituents.

Functional foods offer great potential to improve health and/or help prevent certain diseases when taken as part of a balanced diet and healthy lifestyle.

Probiotics :

Probiotic bacterial are beneficial or friendly bacteria that are naturally present in some of our foods or are added to processed foods for their health benefits.

By probiotics, we mean beneficial bacteria like *Lactobacillus* species found in the intestine which combat harmful pathogens and provide additional health benefits.

Benefits of probiotics:

1. Reduce diarrhoea and irritable bowl syndrome
2. Reduce symptoms of colds
3. Improves digestion

Sources of probiotics:

Fermented milk products such as curd, yogurt and buttermilk.

Prebiotics :

Prebiotics are special indigestible soluble fibres present in plant foods that support the growth of probiotic bacteria without being affected by cooking or digestive processes.

Benefits of prebiotics:

Indirectly prebiotics confer numerous health benefits.

1. Reducing prevalence of infectious diseases
2. Reduces antibiotic associated diarrhea.
3. Reduces risk of CVD and colon cancer.
4. Prebiotics provide satiety, reduce weight and thus helps in prevent of obesity.

Sources of prebiotics:

Whole grain specially oats, wheat bran, soyabean, flax seeds, carrots, citrus fruits, etc.

Table 16.1 : Functional foods available in Indian market.

Name of the product	Health claim	Examples
Gluten free atta/Low gluten atta	Good for patients with gluten protein allergy or celiac disease	Brown rice, jowar, wheat free atta flour
Probiotic drinks	Improves digestion, immunity gives longer life	Live bacteria of <i>lactobacillus</i> species.
Multigrain cereals	Cholesterol management	Rich in fiber, bran and resistant starch
Vegan milk e.g almond, soya	Weight management	Rich in protein and calcium
Beverages like green tea and smoothies	Good for nervous system, Rich in vitamin and minerals	Green tea, fruit, rich source of mineral, vitamins, antioxidant and polyphenols.



16.3 Examples of functional foods :

Some examples of functional food are presented in table 16.2

Do You Know ?

To treat gastro-intestinal health complaints probiotics and prebiotics foods are well known options.

Table 16.2 : Foods with functional component along with their potential health benefits.

Functional food	Functional component	Potential health benefits
Tomatoes, watermelon	Lycopene (as antioxidant)	Lower risk of prostate cancer
Citrus fruits	Flavanones (as antioxidant)	Reduced risk of some cancers
Soy-based foods	Isoflavones (as polyphenols)	Lowers LDL, total cholesterol and triglycerides, and improves HDL
Cranberries	Proanthocyanidins (as antibacterial agent)	Lower risk of urinary tract infection
Fatty fish	Omega-3 fatty acids Polyunsaturated fatty acids	Reduced risk of cardiovascular disease
Whole grain foods/ multigrain foods	High bran/fiber	Reduced risk of cardiovascular disease, cancer, and mortality from all causes, diabetes and constipation patients
Ginger	Gingerol and shogaol (as antioxidant, antibacterial agent)	Reduces throat infection.
Turmeric	Curcunin (as antioxidant, antibacterial, natural colourant)	Reduces skin diseases and used in cosmetics

Points to remember

- Functional foods provide additional health benefits that may reduce disease risk and promote optimal health.
- Examples of functional food might include many fruits and vegetables, enriched bread, calcium-fortified orange juice, oats (lower cholesterol), fatty fish (omega-3 fatty acids), margarines with plant stanols and special foods for allergies or health conditions etc.
- Conventional foods are unmodified whole foods, including fruits, nuts and vegetables
- Modified foods are modified through fortification, enrichment or enhancement, such as calcium-fortified orange juice, folate-enriched bread, margarines with plant stanols or sterol esters
- Medical foods are used under physician supervision for a specific medical condition, e.g. special dietary formulas for diabetes or liver conditions
- Special dietary foods are used for specific conditions, such as infant formulas, allergies, gluten free and lactose free.
- Some benefits of functional foods are to reduce the risk of certain diseases, lower cholesterol, risk of heart disease and may help with weight control.

➤ Probiotics are beneficial bacteria found in the intestine which combat harmful pathogens and provide additional health benefits.

➤ Prebiotics are special indigestible soluble fibres present in plant foods that support the growth of probiotic bacteria without being affected by cooking or digestive processes.

Exercise

Q.1 a) Select the most appropriate option:

- i. Conventional foods is a type of _____ food.
(functional, junk, fast)
- ii. _____ has been enriched, fortified, supplemented or enhanced with nutrients or other beneficial ingredients.
(modified, medical, conventional)
- iii. _____ is an example of modified food.
(Tomato, omega-3 fatty acid enriched bread, plain bread)

(b) Match the following:

A		B	
i.	Watermelon	a.	Flavanones
ii.	Citrus	b.	Omega-3 fatty acids
iii.	Fatty fish	c.	Lycopene
iv.	Curd	d.	Prebiotic
v.	Oats	e.	Probiotic
		f.	Antioxidant

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

- i. Functional food have health promoting properties.
- ii. Lycopene lowers the risk of cancers.
- iii. Prebiotics are not at all useful.
- iv. Medical food has to be given under the supervision of a physician.

Q.2 Answer in brief

- i. Name the classification of functional foods
- ii. Modified foods

Q.3 Short answer questions

Define

- i. Functional foods
- ii. Conventional food
- iii. Probiotics
- iv. Prebiotics

Q.4 Long answer question

- i. Explain the classification of functional foods in detail

❖ Project :

- i) Classify functional foods in different way (enriched foods, modified foods, health claims, etc.)
- ii) Prepare a recipe for breakfast rich in probiotics and lunch enriched with prebiotics and healthy functional dinner.
- iii) Choose one particular type of functional food sold in your local supermarket. Find two other products in that range and describe the information that is on the label for consumers. Use the computer to help you list and compare the nutritional information on a chart. Do any of these foods have 'warning' statements?



Glossary

Absorption: The uptake of the end products of digestion through the cell membrane of digestive tract into blood and lymph circulation

Acceptability: Able to be accepted

Adulteration: Addition of substance resulting in a poorer quality

Aerobic: Reaction in presence of oxygen

AGMARK: A standard mark on agricultural products ensuring their quality, purity and wholesomeness

Anaemia: Reduction in number of red blood cells or circulating haemoglobin resulting in paleness

Anaerobic: Reaction in absence of oxygen

Antioxidant: Substance which retards rancidity and deterioration from exposure to oxygen

Appetizers: Substances which increase hunger pangs

Balanced diet: Diet supplying all the nutrients in adequate amounts

BMR: Basal Metabolic Rate

Beri-Beri: Disease affecting the nervous system due to thiamine deficiency

BIS: Bureau of Indian Standards

Blanching: Dipping food in boiling water for a few minutes

Braising: Method of cooking where two different medias are used

Caramelization: Formation of a caramel on application of dry heat to sugar

Carbohydrate: Organic compound containing carbon, hydrogen and oxygen

Cluster: A group of food industries formulated by government

Coagulation: Chemical irreversible change in protein due to effect of heat, light or change in pH

Cooking: Use of heat to bring about desirable changes in food

Crystallization: Process of crystal formation.

CVD: Cardiovascular disease

Dehydration: Removal or loss of large amount of water from a substances or a body.

Denaturation: Physical reversible change in protein due to effect of heat, light or change in pH

Dextrinisation: A process in which on application of dry heat to foods containing starch, starch granules break into dextrin resulting in a brown colour, a typical flavor and a sweet taste.

Disaccharide: Carbohydrate consisting of two monosaccharide units.

Discoloration: Loss of colour

Emulsifiers: Substances which help in preparation of an emulsion

Emulsion: A dispersion of two immiscible liquids.

Fats: Esters of fatty acid and glycerol

Fermentation: Decomposition of dietary substance with or without oxygen where CO₂ is formed.

Fibre: Component of dietary plant material that cannot be digested by enzyme in the human intestinal tract.

FIFO: First in first out

Flavour: Combined effect of taste and smell sensation produced by food.

Fortifiers: substances added to improve the nutritive value.

FPO: Fruit Product Order-A standard mark on fruits and vegetable products to ensure their quality.

Food: Solid, semi solid and liquid material which can be consumed to sustain body and keep it healthy.

Food additives : Substance added intentionally in small quantity to improve the functional, physical and sensory properties of food.

Food pyramid : Food group based structure used in planning of balanced diet.

FSSAI: Food Safety Standard Authority of Indian, 2006

Gel: A semi solid which has a particular shape

Gelatinization: A process in which when starch granules are heated in water swell up resulting in thickening.

Germination: Development of sprout in grain.

Gluten: Protein present in wheat which gives elasticity to dough.

GLV: Green leafy vegetable

Goiter: Enlargement of thyroid gland due to iodine deficiency.

Grilling: Directing heat downward for cooking food.

HDL : High density lipoprotein.

Homogenization: Processing of milk to break the fat globules into uniform size.

Hygroscopic: A substance which easily absorbs water.

Identity of grain: Grain do not lump together and remain separate.

Inversion: Hydrolysis of sucrose into equal amount of glucose and fructose due to action of acid or enzyme.

ISI: Indian Standard Institute-an act formulated in 1952

Kwashiorkor: Disease due to deficiency of protein in children.

LDL : Low density lipoprotein

Maillard reaction: Non-enzymatic browning due to sugar – amino acid reaction.

Malting: Germination under controlled conditions

Marasmus: Disease due to deficiency of protein and calorie in children showing emaciation

Monosaccharides: One carbohydrate unit.

Myoglobin: Red colour pigment in muscle of meat.

Nutrient: A chemical substance in food essential for maintain the functions of the body.

Nutrition: Scientific study of nutrients

Obesity: When the body weight is more than twenty percent of the ideal body weight

Oedema: An excess of watery fluid in the cavities of tissues of the body

Oils: Lipids liquid at room temperature

ORS: Oral Rehydration Solution

Osteomalacia: Weakening of the skeletal system in adults due to deficiency of vitamin D, calcium and phosphorus.

Oxidation: Reaction involving combination of oxygen.

Palatability: Acceptability of food in terms of flavor, taste, texture, colour and temperature of food by human sensory organs.

Pasteurization: Mild heat treatment to kill pathogenic bacteria.

Pectin: Cementing substances in cell walls of fruits.

Pellagra: Deficiency disease of niacin affecting digestive system, nervous system and skin.

Perishable: Which spoils easily.

Pesticides: Substance for destroying insects or pests.

PFA: Prevention of Food Adulteration Act-a food law formulated in 1954.

Polysaccharides: Carbohydrates consisting of more than two monosaccharide units.

Prebiotics: Special indigestible soluble fiber present in plant foods which stimulate the growth and/or activity of bacteria in our digestive system.

Precursor: A compound that can be used by the body to form an essential nutrient.

Preliminary treatment: Special treatments before cooking the food.

Preservatives: Substance which increases the shelf life of food.

Probiotic: Probiotic bacterial are also known as beneficial bacterial or friendly bacteria and are naturally present in some of our foods or are added to processed food for their health benefits.

Protein: Complex organic nitrogenous substances.

QA: Quality analyst

REE: Resting Energy Expenditure

Rickets: Deficiency disease of vitamin D associated with skeletal malformation

Sauteing: To fry quickly in a small amount of fat

Sensory: Related to sensation or the five human sense (touch, smell, taste, hearing and sight)

Scurvy: Vitamin C deficiency leading to swelling, bleeding of gums and prone to internal haemorrhage.

Serving: Amount of food served to a person at a time e.g. one medium size chapatti.

Shortening: Addition of fat to dough to make the product crisp.

Tannins: Phenolic substance responsible for enzymatic browning in vegetable and fruits.

Taste: Sensory property evaluated by tongue (sweet, sour, salty and bitter)

Texture: The feel, appearance or consistency of food.

UHT: Ultra high temperature

Vitamin: Vital organic substances necessary in small amounts for growth, reproduction and maintenance of health.

Viz. : Namely

Some important abbreviations :

Abbreviations		Approximate Weight
Cupful	C	150 gm or ml
Tablespoon	T/tbsp	20 ml or gm
Teaspoon	t/tsp	5 gm or ml
Kilogram	Kg.	1000 g
Litre	Lt./lit.	1000 ml
Gram	g.	1000 mg
Millilitre	ml.	1000 μ l

Bibliography

1. Bennion M, Introductory Foods, Macmillan Publishing Co. New York, 1980
2. Charley Helen, Food Science, John Wiley and Sons. 1971
3. Crosby N.T. Food Packaging Materials, Applied Sc. Publishers Ltd. London, 1981
4. Desrosier N. W. Elements of Food Technology, Te AVI Publishing Company, 1984
5. Fitch and Francis, Food and Principles of Cookery, Prentice-hall, Inc, 1959
6. Fox B.A. and A.G. Cameron, Foods Science a chemical approach, Hodder and Stoughton Educational, 1982.
7. Frazier and Westhoff, Food Microbiology, Tata McGraw Hill Publishing Company Ltd. New Delhi II ed. 2006
8. Gaman P.M. and K.B. Shrrington, The Science of Food, Pergaman Pres, 1977
9. Gates June C., Basic Foods 2nd Edition, New York, Holt Rinehart and Winston 1981
10. Gopalan C., B.V. Ramasastry and S.C. Balasubramanian, Nutitive Value of Indian Food, NIN Hyderabad, 2004
11. Gurr M.I., Role or Fats in Food and Nutrition, Elsevier Applied Science Publishers, 1984.
12. Jacom Thankamma, Food Adulteration, Macmillina Company of India Ltd. New Delhi, 1976
13. King M.H., King M.F. et al. Nutrition for Developing Countries: The English Language Book Society and Oxford University Press, 1980.
14. Lowe Belle, Experimental Cookery, John Wiley and Sons, New York, 1966.
15. Malik R.K. and K.C. Dhingra, Handbook of Food Industries, Small Industry Research Institute, 1975-76
16. Manay Shakuntala and Shadaksharaswamy, Foods-Facts and Principles, Wiley Eastern Limited, 1987.
17. Mc Williams, Food Fundamentals, John Wiley and Sons, 1974
18. Meyer L.M., Food Chemistry, CBS Publishers, 1987.
19. M. Shafiur Rahman, Handbook of Food Preservation, Marcel Dekker, Inc, NY, First Indian Reprint, 1999
20. Srilakshmi, B., Nutrition Science, Fourth Revised Edition: 2012, New Age International Limited, New Delhi, 2012

21. National Institute of Nutrition, Dietary Guidelines for Indians, A Manual, 2nd Edition, 2010.
22. Nuffield Advanced Science, Food Science-a Special Study, Penguin Books Limited, 1971.
23. Paul P.C. and H.H. Palmer, Food Theory and Applications, John Wiley and Sons, New York, 1972.
24. Potter N.N., Hotchkiss J.H. Food Science, Fifth Edition, CBS Publishers & Distributors, 4596/1 A, 11-Daryaganj, New Delhi.
25. Pyke Mangnus, Food Science and Technology, William Clowes and Sons Ltd. 1964.
26. Raina Usha and Others, Basic Food Preparation: A complete Manual, 3rd Edition, 2007.
27. Roday S, Food Science and Nutrition, Third Edition, Oxford University Press, New Delhi, 2018
28. Rao, S Narasinga, Y.G. Deosthale and K.C. Pant Nutrient Composition of Indian Foods NIN ICMR Hyderabad, 1991.
29. Sadarangani K, Mannuru C, Kukade S, Food Science, Neel kanth Books, Pune, 2006
30. Sharma Avantina, Textbook of Food Science and Technology, CBS Publishers and Distributors Pvt. Ltd. New Delhi, 2017
31. Srilakshmi, B., Nutrition Science, Fourth Revised Edition: 2012, New Age International Limited, New Delhi, 2012
32. Srilakshmi, B., Food Science, Sixth Multi-colour Edition, New Age International Limited, New Delhi, 2016
33. Swaminathan B., Essentials of Food and Nutrition (Volume II), Ganesh and Company, Madras 1974
34. Vaclavik Vicki and Christiana Elizabeth, Essentials of Food Science, Food Science Text Series, Kluwer Academic/Plenum Publishers New York II ed., 2003