UNIT 4 OTHER FOODS

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4.0 OBJECTIVES

After reading this Unit, we shall be able to:

- differentiate what are the 'other foods' apart from the foods we commonly eat;
- describe each category of other foods;
- explain the importance of these foods in the present scenario; and
- comprehend safety concerns about these foods.

4.1 INTRODUCTION

Apart from the foods from plant and animal sources, there is a range of upcoming foods and traditional foods that are acquiring an important place in

our lives due to various reasons such as health, convenience, paying capacity, etc. Some of these are health foods, nutraceuticals, ayurvedic products, organic foods, etc. A large number of processing industries are diversifying in these products. Let us know more about these products.

4.2 COMFORT FOODS

Comfort foods are foods that give comfort, pleasure and calmness and make a person happy. Many people eat comfort food for familiarity, emotional security, or special reward. The reasons a dish becomes a comfort food are diverse but often include pleasant associations with childhood or specific time and space. Small children often seem to demand a specific food or drink like chocolate, cola drink and will repeatedly request it in high stress situations. Adults indulge in comfort food for a sense of continuity and mood making. For example, many people take stimulating items like coffee or alcohol when they are tired, depressed or want to get into a mood of happiness and celebration. Besides, some of these comfort foods have sociological and societal significance. Chewing of *'Paan'* (betel leaves with arecanut and spices in Indian subcontinent) also is an example of consuming comfort food. There is a wide range of foods that can be classified as comfort foods, but we will examine here only few and important ones. Let us take them one by one.

4.2.1 Energy Foods/ Drinks

There is a wide variety of energy foods and drinks available in the market today. These provide instant energy, proteins, carbohydrates, minerals and fluids to the body. That is why they are commonly used by sports persons. Different types of energy foods are energy bars, protein bars, nutritional bars, electrolyte replacement drinks, etc. They give the consumer a burst of energy. These products often include caffeine, B-vitamins, taurine and ginseng. Some contain high levels of sugar, while most brands also offer a sugar free version.

4.2.1.1 History

It all started in Japan, when Taisho Pharmaceuticals released a drink called Lipovitan-D in 1962. It contained a mix of B_1, B_2, and B_6 vitamins, along with niacin and taurine, all of which are metabolic agents intended to boost energy and concentration. "Tonic Drinks" soon grew in popularity in Asia and, in 1987 an Austrian named Dietrich Mateschitz took the concept, added caffeine and sugar, and formulated Red Bull, which quickly became popular in Europe.

4.2.1.2 Composition

Energy drinks commonly contain caffeine, guarana (exract from guarana plant or taurine and various forms of ginseng, maltodextrins, inositol, carnitine, creatine, etc. The main ingredient in most energy drinks is caffeine. Energy bars mainly contain carbohydrates, protein (often soy) as well as vitamins and minerals. Flavours are also added. They usually taste like baked foods.

4.2.1.3 Examples

Energy drinks market in India is at its emerging stage. At present, such products available in the Indian market are mostly imported ones. Markets abroad have a much wider variety to choose from – Arizona, Red Bull, Blue Ox, Guru, Whoop Ass, Power bar, Clif bar, etc. Recently, some energy drinks have been launched in India. (For example, the energy/sports drink `Stamina').

4.2.1.4 Safety Concerns

Not much details or clarity about the special ingredients used in these energy drinks is available. This is a problem. One of the most common ingredients in energy drinks is caffeine. Caffeine, especially in large quantities, is harmful as it induces high blood pressure and host of other problems.

Some of the other common ingredients in energy drinks are lesser known and understood. We are just beginning to learn of the problems associated with these ingredients, especially when mixed with items like drugs and alcohol.

To give you an example, guarana is a common ingredient in many energy drinks. It is a stimulant of the central nervous system. Consuming these drinks and subsequent chance mixing with drinks containing diet pills can be dangerous. Another popular ingredient in energy drinks is taurine, which is actually something that we naturally get from foods that contain vitamin B_6. We normally get more than enough taurine in our diet and the extra amount that we get from these energy drinks, depending on how much we consume, can become toxic in our systems. Common symptoms of toxicity have been electrolyte disturbances, nausea and vomiting, and heart irregularities.

The US Food and Drug Administration (FDA) has admitted that many of the ingredients in popular energy drinks have not been fully tested as to their degree of safeness. It is common knowledge that most energy drink consumers are not casual users, but consume significant quantities of these drinks. The consumption of these drinks in such quantities is risky.

4.2.1.5 Regulations

In India, declaration of the full list of ingredients and pesticide content, if any, on the product labels is not yet mandatory. The Health Ministry decides whether the Prevention of Food Adulteration (PFA) Act should be made applicable to such items of consumption.

4.2.2 Stimulating Drinks

In this category, we shall learn about beverages that have a stimulating effect on our body. These include tea, coffee, cocoa and cola drinks. Let's take them one by one.

4.2.2.1 Tea

Tea (*Camellia sinensis*) is an evergreen shrub native to China and India. There are about 45 species of Camellia of which *Camellia sinensis* is the important one. The important tea growing countries are India, China, Japan, Sri Lanka and Kenya. In India, the two main tea-growing regions are hilly districts of Assam and West Bengal and Western Ghats of Kerala, Tamil Nadu and Karnataka. Tea leaves are usually plucked by hand. Usually the terminal bud and two terminal leaves are plucked which give the best quality.

Composition: The important ingredients that impart the flavour to tea are caffeine, polyphenols and essential oils. Analysis of fresh tea leaves gives the following values-polyphenols- 22.2%, protein- 17.2%, caffeine- 4.3%, crude fibre- 27.0%, starch- 0.5%, ash- 5.6%. Fresh tea also contains carotenes, B-vitamins and ascorbic acid.

The maximum amount of caffeine is present in the bud and the first two tea leaves. Small quantities of theophylline, theobromine, xanthine and hypoxanthine, are also present. These are all related to caffeine. The important polyphenols present in tea are catechins and gallocatechins. Tea leaves also contain alcohols, aldehydes, phenols and some fatty acids. Tea has no nutritive value. It is mainly consumed for its stimulating value.

Processing: Tea is processed and marketed in four main commercial forms: Black tea, Green tea, White tea and Oolong tea. Black tea has been fully fermented during processing. The Green Tea and White Tea are not fermented at all. Oolong teas are somewhere in the middle.

The Black Tea gives a fairly strong decoction because of the fermentation. It is generally consumed by adding milk or lime with or without sugar. The Green tea, White tea and Oolong tea brew are consumed without adding any modifying agents.

Fig. 4.1: Picking Tea Leaves

For processing into black tea, the freshly picked tea leaves are subjected to 'withering', 'rolling', 'fermentation', 'drying', 'grading' and 'packing'. Withering is done by spreading tea leaves thinly on racks and shelves to dry the leaves partially. It is done till the water content of the leaf is lowered by about 40%. Then they are rolled to break open the cells and release the juices and enzymes. After this, leaves are spread out thinly on platforms and fermented for 2-6 hours between 21^{o} to 27^{o} C. During this process, the enzymes induce oxidation of polyphenols present in the juices and change the colour of the leaves from green to reddish copper.

When the desired colour is achieved, leaves are dried to stop the fermentation process. Drying is done by passing fermented leaves through a chamber of hot air. At the entrance of the chamber, the temperature is kept at 93^{o} C and it slides down to 49^{o} C towards the exit. Drying is done for 30-40 minutes to leave a 3-4% moisture content in the processed leaves. Drying also further darkens the colour of the leaves, turning them black. The dried product is graded on the basis of the size of the leaves and packed in plywood boxes lined with aluminum foil and parchment paper.

The 'Green tea' is made in the same manner as 'Black tea', but the withering and fermentation steps are omitted. The leaves are heated, rolled and dried. Green tea gives a light yellow beverage. It is popular in China, Japan and parts of India.

White Tea also comes from the *Camellia sinensis* plant. But the leaves are picked and harvested before the leaves open fully, when the buds are still covered by fine white hair; and hence the name. White Tea is similar to green tea, in that it's undergone very little processing and no fermentation. But there is a noticeable difference in taste. Most green teas have a distinctive 'grassy' taste to them, but white tea does not. White tea is originally a specialty of the

Chinese province Fujian. Now it is significantly produced in other parts of China and Japan. The Darjeeling region of India also produces some fine white teas. White tea contains more polyphenols, the powerful anti-oxidant. A study at Pace University in 2004 showed white tea had more anti-viral and anti-bacterial qualities than green tea.

Oolong tea is an intermediate between Black and Green Tea in colour and has a characteristic taste. Here, light withering and fermentation are done before drying.

Benefits: We drink tea for its aroma, flavour and stimulating effect. Research has shown that polyphenols present in the tea are good for health. Tea contains antioxidants that reduce the risk of various diseases like heart problems, cancer and hypertension. All three varieties of tea have antibacterial, antioxidant, antiseptic and detoxifying properties that make tea effective in treating infectious dysentery as well as easing inflammatory bowel disease. It has been used to treat infection for many years. Tea also guards against tooth decay.

Risks: Although all tea varieties possess far less caffeine than both coffee and cola, it can induce insomnia and nervousness in individuals who drink tea in excess. It should also be noted that the tannins present in tea extracts reduces the ability of humans to utilize dietary iron. Thus people who are prone to anaemia should avoid excessive intake of tea. Higher fluoride levels in tea might be a health risk factor.

4.2.2.2 Coffee

Coffee (*Coffea*) is an evergreen shrub native to central Africa and Asia. There are many species of coffee but three species are commercially important- *Coffeea Arabica*, which has the largest and best quality beans, *Coffeea robusta* that gives beans of lower quality and *Coffeea liberica*, whose beans are of still lower quality. *Coffee Arabia* is native to Ethiopia. It was introduced into Indian through Arabia. It is mainly cultivated in Karnataka, Kerala and Tamil Nadu.

Fig. 4.2: Coffee Fruit

The structure of coffee cherry is shown in Fig. 4.2. The coffee berry has two beans covered by a thin parchment like hull that is surrounded by pulp. Both the pulp and hull are removed before coffee beans are roasted.

Composition: There are three types of constituents in coffee that make a good beverage- flavour substances, bitter substances and caffeine. Caffeine is responsible for the stimulating effect of the beverage. The caffeine content in a cup of coffee (150 ml) is about 100 mg. Thus when we consume 3 cups of coffee in a day, we take 300 mg of caffeine. This can affect our health adversely. We will learn about these later. The composition of roasted coffee (*Coffeea arabica*) is: Moisture- 0.63%, protein – 11.23%, fat- 13.59%, sugar- 0.43%, dextrose- 1.24%, ash- 4.56%, caffeine- 0.82%, chlorogenic acid- 4.74%.

There are several organic acids in coffee like chlorogenic acid, acetic acid, formic acid, mallic and citric acid. They provide astringency to the beverage. Many substances give flavour to coffee. We call these 'cofffeol'. These include volatile compounds and low boiling sulphur compounds. Tannins are responsible for the bitterness of coffee.

Processing: Coffee processing consists of removing the skin, pulp, parchment and sliver. Two methods can be used for processing- dry method and wet method. In dry method, beans are sun dried by spreading them on drying floors. The coverings are removed by hulling.

In the wet method, ripe fruits are squeezed in a pulping machine which removes the outer pulp and a slippery mucilaginous layer is left behind. Mucilage is removed by fermentation. The seeds are then washed and dried to a moisture content of about 12%. The wet method gives a better quality coffee, called as 'green coffee'. The seeds are then graded and packed.

Raw or green coffee has no aroma and has an unpleasant taste. It is roasted, powdered and brewed for use as a beverage. During roasting, many physical and chemical changes occur in the bean. Colour of the seed darkens and turns black, beans swell in size and typical coffee flavour develops. Flavour of the coffee depends on the manner of roasting. Freshly roasted coffee has the best flavour and aroma. Flavours are lost as the coffee stales.

Benefits: Coffee appears to reduce the risk of Alzheimer's disease, Parkinson's disease, heart disease, diabetes, cirrhosis of the liver and gout. Antioxidants of coffee prevent free radicals from causing cell damage. Thus, studies have shown that coffee may prevent various types of cancer.

Risks: Excessive use of caffeine causes adverse effects on mental and physical health. It is a health hazard just like alcohol and nicotine. Chronic caffeine intoxication causes 'caffeinism'. Its symptoms are sleeping disturbance, frequent urination, muscular tension, jitteriness, anxiety, etc. These effects can be reduced by decaffeinating the coffee. Decaffeination decreases the caffeine content without affecting the aroma and taste.

4.2.2.3 Cocoa

Cocoa (*Theobroma cocoa*) is a small tree native to America. The chief cocoa producing countries are Ghana, Nigeria, Ivory Coast and Brazil. In India, Cocoa is grown in Kerala, Karnataka and Tamil Nadu. Cocoa pods, when mature are yellow or red. The seeds are embedded in a white or pinkish pulp. Seeds are used to produce cocoa powder and chocolate.

Composition: The analysis if cocoa beans gives following values; moisture, 2.13%; fat, 54.68%; total nitrogen, 2.16%; starch, 6.14%; pentosans, 11.19% and tannins, 6.15%. Cocoa is a natural source of theobromine (about 2.8%). Cocoa also contains caffeine (about 0.6%). Cocoa butter is a valuable by product of cocoa industry. It is used in manufacturing chocolates.

Processing: After harvesting, cocoa pods are cautiously opened. The beans and mucilage are scooped out and subjected to natural fermentation for about 5-10 days. At the end of the process, the pulp breaks down and colour of the seed changes to brown. The beans are then dried to 6-8% moisture content. Dried beans are then roasted to get its characteristic flavour. While roasting, the beans are passed through corrugated rollers which break open the shell.

The remaining part of the seeds, cotyledons are called 'nibs' which are used for the manufacture of cocoa powder and chocolate. The nibs are ground using stone mills or other suitable mills to make fine liquor or paste. During this, cocoa fat also melts due to the heat produced during grinding process. This suspension of melted fat with cocoa particles is called a cocoa mass, chocolate liquor or bitter chocolate. This cocoa mass is pressed to remove fat and cocoa powder is made from pressed cake. Cocoa used for beverage should have 20% cocoa fat.

Benefits: Cocoa is an energy food and a stimulant. It is used in preparing health drinks and diet supplements. It is also added to infant foods and malt based food products. Cocoa is a rich source of copper and has nitric oxide which improves blood flow and controls blood pressure. Flavonoids that reduce clogging of the arteries are also present in it. Cocoa and chocolates are mood enhancers and also help reduce pain and anxiety.

Risks: It is pointed out that much of the benefits that we discussed relates to pure cocoa. The chocolate we consume contains milk, butter, hydrogenated oils, sugar, corn syrup, etc. Actual cocoa content in chocolate is much less. These ingredients are also very rich in calories. Thus, chocolates in excessive quantities could mean high calories and lesser low in nutrition. Cocoa butter contains high amount of saturated fats. Milk fat also increases cholesterol level in blood. Sugar can contribute to heart disease, diabetes, dental caries, obesity, etc.

4.2.2.4 Carbonated Non-Alcoholic Beverages/ Soft Drinks

Soft drinks are generally sweetened, flavoured, acidified, coloured, artificially carbonated, and sometimes chemically preserved. Soda is an example of carbonated drink. The major ingredients of carbonated soft drinks are water, carbon dioxide, sugar, flavourings, colour, and acids. Non-nutritive sweeteners like Saccharin, Cyclamate and Aspartame are used instead of sugar to make them sugar free or of low calorie. (e.g. Diet Cola drinks). Soft drinks are prepared by carbonation. Syrup is prepared with sugar/substitutes and water. Acids, colours and flavours as required are added to this syrup. . The components are blended. Then, a suitable volume of this is taken and mixed with carbonated water and bottled.

Benefits and Risks: There is hardly any health benefit associated with the soft drinks. These are used to impart taste while quenching the thirst. Cola is a sweet carbonated drink, usually with caramel coloring and containing caffeine. Cola drinks may also act as stimulant as they contain some amount of caffeine from alternate soruces. Being carbonated, colas are acidic (carbonic acid is formed when carbon dioxide dissolves in water), and so can react violently with basic chemicals, such as baking soda. Many colas also contain phosphoric acid and/or citric acid, which further increases the acidity

There are many risks associated with soft drinks. Soft drinks provide 'empty calories'. Thus drinking soft drinks regularly may pose the risk of obesity, diabetes and heart diseases. Many studies have shown that children and adolescent girls and boys prefer soft drinks over other nutritious beverages like fruit juices, milk shakes and milk. This leads to reduced levels of calcium, iron and other essential nutrients in the body. This may increase the risk of diseases like iron deficiency anaemia in adolescents and osteoporosis in old age.

Alcoholic Beverages: We have studied about various comfort foods like energy foods and beverages like tea, coffee and soft drinks. Another category of beverages that can be classified under 'comfort foods' is- 'Alcoholic drinks'.

We all know about alcoholic beverages. Potable alcohol is the byproduct of yeast action on carbohydrates and sugar. The microorganism used in fermentation for alcohol making is *Saccharomyces ellipsoideus.* The reaction is:

$$\underset{\text{(Glucose)}}{C_6H_{12}O_6} \xrightarrow[\text{yeast enzymes}]{} \underset{\text{(alcohol)}}{2C_2H_5OH} + \underset{\text{(carbon dioxide)}}{2CO_2}$$

Production and consumption of alcoholic beverages is as old as human civilization. In many civilizations and cultures, making alcohol was a form of preservation and utilization of bountiful harvests. For instance, good harvests of grapes and other fruits were converted into wine for later use. Wine is consumed as a comfort food, often as a course of the meal intake. Alcohol also plays an important role as a stimulating celebration food. However, it has addictive affect on many individuals who consume it. To check such ill effects, many communities have imposed restrictions on alcohol consumption.

There are three classes of alcoholic beverages: Fermented alcoholic beverages (wines, *palm toddy*, beer, etc.), distilled alcoholic drinks (whisky, brandy, rum, *arrack*, etc.) and liqueures/digestives in which distilled alcohol is added to provide preservative and stimulating effect (Cointreau, Grand Marnier).

Wine is made by fermentation of grape juice. In making red wine, both skin and juice are used whereas only juice is used in white wines. Thus we can get white wine from black grapes by taking only juice. Beer is made by fermentation of malted barley. The microorganism used is *Saccharomyces cerevisiae.*

Distilled alcoholic drinks are spirits isolated from the fermented juices/worts. For instance, like Whiskey, Brandy, Rum, Vodka, etc. are made by distilling fermented wort (mix of water, yeast and pounded fruit, grain or tuber) of the specified fruit /grain/tuber for the specific liquors. Whiskey is made from cereal grains (like barley, corn, rye), brandy from grape or apple wine and rum from fermented sugarcane juice or molasses. Vodka is made by diluting the wort of wheat grain or potato.

Liqueures/Digestives are blends of fruit juices/herbal extracts/spices with specific distilled alcohol. The added alcohol also acts as a preserving agent in these concoctions. These are consumed for their flavour/medicinal properties and mild alcoholic stimulation.

India is a major producer and consumer of alcoholic beverages. The practice of drinking a beverage with a meal, or wine and food matching, is not traditional or common in India. The country has many traditional alcoholic/narcotic beverages, including palm wine, fenny, *bhang* and Indian beer. However, the bulk of the alcohol production and consumption is based on the Indian Made Foreign Liquors (IMFL) distilled from molasses, a byproduct of the sugar industry. The white alcohol obtained from molasses distillation is suitably coloured and flavoured to sell as whisky, brandy, gin, vodka, etc. in the domestic market. However, trading in IMFL is blocked by other alcohol importing countries on the issue of the source material molasses. India is also a

major importer of alcoholic beverages from other countries, despite the official policy of restricting the imports inflow through tariff barriers.

Benefits and Risks: Because of its stimulating effect, human societies from time immemorial had treated alcohol as comfort and celebration food. It is also a mood enhancer. Recent medical findings indicate that intake of alcohol in moderate quantities is beneficial to health. These studies also caution that consumption of alcohol in large quantities can ruin health and bring in host of mental and social miseries. Red wine is rich in antioxidants. Studies have shown that red wine can prevent cancer and heart problems if taken in moderate amounts. But all other alcoholic beverages are taken only for their stimulating/comfort effect. Alcohol consumption in larger quantities over a long period can affect liver functioning. It also increases the risk of cardiovascular diseases. For a certain percentage of its consumers, alcohol is a highly addictive and ruinous. Crudely produced and unrefined alcoholic beverages may contain residues that are injurious to health. Alcohol provides 7 K.cal/ g (29.2945/9). Thus regular drinking can increase the total calorie intake and enhance the chances of obesity.

4.3 HEALTH FOODS

Health foods are items that complement the regular diet, provide nourishment for the body and fight disease. They can be in the form of herbs, cereals, fruits, concoctions or any other blend of natural ingredients. Health foods not only provide complete nourishment but also have healing and rejuvenating properties. They provide all necessary nutrients, keep us fit and add to our overall well-being. There are many health foods available in the market. Many of them are new for us. The demand for health foods is growing. We will now learn a little bit about some of the health foods.

Spirulina: Spirulina is a highly nutritious form of algae. Japanese scientists call it *'panacea'* for various health conditions and as a solution to world's hunger problem. Research is also being conducted on its use as food supplement for astronauts. United Nations' World Food Conference has declared spirulina as the "best food for tomorrow". Food and Drug Authority of the USA has approved sale of spirulina as a natural food.

Seaweeds are extensively used as food by coastal people, particularly in East Asia. Seaweed is an algae. Seaweeds do not belong to the plant kingdom. They do not have a specialized vascular system (an internal conducting system for fluids and nutrients), roots, stems, leaves, and enclosed reproductive structures like flowers and cones. Because all the parts of a seaweed are in contact with the water, they are able to take up fluids, nutrients, and gases directly from the water, and do not need an internal conducting system. Like true plants, seaweeds are photosynthetic; they convert energy from sunlight into the materials needed for growth. Within their cells, seaweeds have the green pigment chlorophyll, which absorbs the sunlight they need for photosynthesis. In India, seaweeds grow abundantly along the Tamilnadu and Gujarat coasts and around Lakshadweep and Andaman and Nicobar islands. Rich seaweed beds are found around Mumbai, Ratnagiri, Goa, Karwar, Varkala, Vizhinjam and Pulicat in Tamilnadu and Chilka in Orissa.

Seaweed is used in ice cream production and sushi. The nutritional value of seaweeds is undisputed. They are rich in minerals, vitamins, trace elements and

bioactive substances. In fact, seaweeds have been aptly called the medical food of 21st century.

The food industry exploits the gelling, water-retaining, emulsifying and other physical properties of these hydrocolloids. Agar is used in foods such as confectionery, meats and poultry products, desserts and beverages and moulded foods. Carrageenan is used in preparation of salad dressings and sauces, dietetic foods, and as a preservative in meat and fish products, dairy items and baked goods.

Ginseng: Ginseng is the single most famous and widely used herbal food supplement. It is grown in China, Siberia, Korea and North America. Ginseng is said to have aphrodisiac properties and aid longevity. Research has indicated that it also acts as a stress reliever. It increases immunity and reduces anxiety problems. Indian companies manufacture *ashwagandha*, or the Indian ginseng due to its similar properties.

Wheatgrass: If there is a power drink, it must be wheatgrass juice. With chlorophyll, beta carotene, more than 80 minerals, 18 amino acids and many vitamins, research has shown that 1kg of wheatgrass matches the nutritional value of 22 kg of ordinary garden vegetables. Wheatgrass is generally consumed as juice which is a complete food with regenerative and protective qualities. Its regular use improves perception and increases mental and emotional calmness. It aids in digestion, prevents greying of hair, skin diseases, asthma, arthritis and diabetes. In fact, because of its blood purifying qualities, wheatgrass is used in the treatment of leukemia and some other forms of cancer.

Alfalfa: The Herbalist Almanac of the Indiana Botanic Gardens, USA, says of alfalfa: "We believe no other single plant in the vast vegetable kingdom contains so many health giving properties as are contained in the alfalfa herb—the richest land-grown source of nutritional trace minerals." Alfalfa is rich in potassium, calcium, phosphorus, magnesium, chlorine and silicon—all perfectly balanced. It also contains vitamins A, B, D, E and G, proteins and some important amino acids without any fat content. It is supposed to strengthen the heart muscles, relieve arthritis, lower blood pressure and provide complete nutrition for the body. Its ability to build up the body's immune system is quite phenomenal. It is also rich in iron and calcium.

Tofu: Also known as bean curd, soy cheese or ‘soy paneer’, tofu is low in cholesterol and calories, and high in protein and vitamins. It is a complete food supplement that can be consumed without any worry of side effects, unlike cottage cheese. It is prepared by soaking soy beans overnight and then steaming and grinding the cooked in the beans of boiling water. This soya milk is then coagulated with salts (calcium sulphate, magnesium chloride & calcium chloride); acids (glucono-delta-lactone); or enzymes (pepain and other proteases). The coagulum is then strained & allowed to firm in a mould. It is in alternative of cheese for people who are lactose intolerant.

Muesli: A compact food package, muesli is made from various combinations of oats, barley, corn or wheat with nuts, fresh berries, honey and milk along with some other edibles for taste. Since it contains both oats and wheat, it is a rich source of soluble as well as insoluble fibers. Oats lower blood cholesterol level, benefit diabetics, control weight and prevent constipation and gastro-intestinal disorders. And wheat helps in digestion, reduces risks of colon cancer and prevents heart problems.

Corn Flakes: Corn is a staple diet in many countries. Corn is high in phosphorus, zinc, fat and carotene. Corn flakes, a blend of corn, sugar, malt extract, salt, vitamins, iron and anti-oxidants, is a widespread breakfast food. Corn can improve concentration, beat fatigue and prevent anaemia.

Honey: Honey helps in lower the blood pressure, acts as a sedative, and if taken with hot milk, cures constipation and prevents coughs and colds. Since it has almost all the necessary minerals as well as vitamins in ideal proportions, honey is an extremely nutritious food. It also kills bacteria more effectively than any antibiotics. Honey aids in digestion, purifies the blood, increases immunity and improves stamina. Honey mixed with water is also the best drink for relieving fatigue and has a calming effect. We shall learn more about honey later in this unit.

Brahmi: Brahmi *(Bacopa monnieri)* is known for its memory enhancing properties. However, it is also the most important rejuvenating herb in Ayurvedic system of medicine. Brahmi increases intelligence and promotes longevity, fortifies the immune system and is also a powerful blood purifier. *Brahmi* is beneficial in chronic skin diseases, including leprosy and syphilis, as well as eczema and psoriasis. *Brahm*i makes a good nerve tonic when mixed with milk. Drinking tea prepared with *Brahmi* rejuvenates the body.

4.4 NUTRACEUTICALS

Food carries out two types of functions- primary and secondary. Primary function of food is to provide basic nutrition. Secondary function is to give taste, flavour, texture, colour; sensory aspects that are important for food acceptance. These days, one more function has been added- tertiary function. The tertiary function is the role of food components in preventing diseases by modulating physiological systems e.g. Anti-carcinogenicity (anti-cancer), anti-ageing, and anti-oxidative activity. In recent years, industries have been trying to develop food with tertiary functions. Such foods having tertiary functions are regarded as 'Nutraceuticals'. **Nutraceutical** is a combination of "nutrition" and "pharmaceutical" and refers to foods claimed to have a medicinal effect on human health. The name was coined by Dr. Stephen Defelice in 1989.

Nutraceutical can be defined as, "a food (or part of a food) that provides medical or health benefits, including the prevention and/or treatment of a disease." Nutraceuticals are also known as functional foods, designer foods, health foods, special foods. The term includes phytochemicals, antioxidants, probiotics, etc. Examples of some of the nutraceuticals are- red wine, as an antioxidant, broccoli, as a cancer preventive agent and soyabean for its various health benefits. These foods may help prevent disease, reduce the risk of developing disease, or enhance health. Consumer interest in functional foods increased during the late twentieth century because of growth of public awareness and interest in achieving and maintaining good health. Nutraceuticals or functional foods are considered to be new and revolutionary in western world. On the other hand, they have been a part of eastern cultures for centuries.

4.4.1 Types of Functional Foods and their Health Benefits

There are a number of functional foods or nutraceuticals available .You know about most of them and their benefits too. Many of these foods are sold in the

market and certain claims are made about their benefits to health. Let's have a look at them in the Table 4.1:

Table 4.1: Functional Foods and their Health Benefits

Functional Food	Potential Health Benefit	Labelling Claim
Whole Foods		
Oats	Reduces cholesterol and constipation, reduces risk of heart disease	May reduce the risk of heart disease
Soyabean	Reduces cholesterol, reduces risk of osteoporosis, certain cancers, and heart disease	May reduce the risk of heart disease
Fruits and vegetables	Reduces risk of certain cancers and heart disease; reduces hypertension	May reduce the risk of some cancers; May reduce the risk of heart disease
Fish	Reduces cholesterol and triglycerides	None
Garlic	Reduces risk of heart disease and certain cancers, reduces cholesterol	None
Grapes/grape juice	Reduces risk of heart disease	
Flaxseed	Reduces risk of heart disease and certain cancers; reduces triglycerides; increases blood-glucose control	None
Nuts	Reduces risk of heart disease	None
Enriched Foods		
Grains	Reduces risk of certain cancers, heart disease, and nutrient deficiencies	May reduce the risk of some cancers; May reduce the risk of heart disease
Fortified Foods		
Juices with calcium	Reduces risk of osteoporosis, reduces hypertension	Helps maintain healthy bones and may reduce risk of osteoporosis

Functional Food	Potential Health Benefit	Labelling Claim
Grains with folic acid	Reduces risk of heart disease and neural tube birth defects	May reduce risk of brain and spinal cord birth defects
Infant formulas with iron	Reduces risk of iron deficiency	None
Grains with added fiber	Reduces risk of certain cancers and heart disease; reduces cholesterol and constipation; increases blood-glucose control	May reduce the risk of some cancers; May reduce the risk of heart disease
Milk with vitamin D	Reduces risk of osteomalacia and osteoporosis	Helps maintain healthy bones and may reduce risk of osteoporosis
Juices with added fiber	Reduces risk of certain cancers and heart disease; reduces cholesterol, hypertension, and constipation	May reduce risk of some cancers
Enhanced Foods		
Dairy products with probiotics	Reduces risk of colon cancer and candidal vaginitis; controls inflammation; treatment of respiratory allergies, diarrheal disorders, and eczema	
Beverages and salad dressings with antioxidants	May support overall health	Structure/function claim
Foods and beverages containing herbal preparations	Varies with ingredients	Structure/function claim
Sports bars	Varies with ingredients	Structure/function claim
Spreads with stanol esters	Reduces cholesterol	Structure/function claim
Foods containing sugar alcohols in place of sugar	Reduces risk of tooth decay	May reduce risk of tooth decay

Functional Food	Potential Health Benefit	Labelling Claim
Eggs with omega-3 fatty acids	Reduces risk of heart disease	Structure/function claim

(Structure/function claim means they help in overall growth, development and proper functioning of body)

4.4.2 Concerns and Regulations Regarding Nutraceuticals

Labelling of nutraceuticals is a big issue. Nutraceuticals are neither defined as food nor as drug. But companies marketing these products make curative or functional claims on their labels. These claims, currently, are not subjected to any scrutiny by the authorities before they are allowed to be marketed. With increasing number of products entering the market with claims to cure even serious ailments like diabetes, hypertension, arthritis, osteoporosis, etc, regulatory control on their manufacture and marketing is bound to come in. In India, nutraceuticals are being brought under the Prevention of Food Adulteration Act. If it is claimed that a key ingredient in a nutraceutical product has a curative value for a disease, that claim needs to be examined and approved before the marketing permission is given. Such a product has to be then classified as a drug and not as a dietary supplement. Experts have demanded that nutraceuticals should be allowed to make therapeutic claims only if it has been proved by performing clinical trials. Some ingredients used in these could have serious public health risks. Apart from this, it is important to look into the Good Manufacturing Practices (GMPs), standardization of the product, bioavailability and clinical studies.

Check Your Progress Exercise 1

Note: a) Use the space below for your answer.
b) Compare your answers with those given at the end of the unit.

1) What are comfort foods? Discuss any two types of comfort foods briefly.

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2) Give examples of any five functional foods.

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3) Enumerate the steps in the processing of black tea. How is it different from green and oolong tea?

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4) How does wheat grass improve health?

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4.5 AYURVEDIC MEDICINAL FOODS

Ayurvedic medical system is the ancient healing and health care system that is native to the Indian subcontinent. It is presently in daily use by millions of people in India, Pakistan, Nepal, Bangladesh and Sri Lanka. It has also a major influence on Unani (Greco-Arabic), Chinese and Tibetean medicines. Ayurveda is made up of two words- 'Ayuh' (meaning life) and 'Veda' (meaning science). Thus "AYURVEDA' in totality means 'Science of life'. It incorporates all aspects of life whether physical, psychological, spiritual or social.

4.5.1 History

Documented references to the precise timing of the origins of Ayurveda are not available. It is believed that it was first compiled as a text by Agnivesha, in his book *Agnivesh tantra*, which was written during Vedic times. The book was later revised by Charaka, and renamed as Charaka Samhitā (encyclopedia of the physician Charaka). Other early texts of Ayurveda include the *Charaka Samhitā* and the *Sushruta Samhitā*.

4.5.2 Composition

Ayurveda operates on the principle that various materials of vegetable, animal, and mineral origin have some medicinal value. The medicinal properties of these materials have been documented by the practitioners and have been used for centuries to cure illness and/or help maintain good health. Ayurveda also brought in a food classification system that categorized any item as ***saatvic***, ***raajsic*** *or* ***taamsic***. Each was deemed to have a powerful effect on the body and the mind. There are also Ayuvedic restorative tonics like *"Chyavanprash"* and "Liv-52 liver rejuvanator" that are getting international attention. Ayurvedic medicaments are made from herbs or mixtures of herbs, either alone or in combination with minerals, metals and other ingredients of animal origin. The metals, animals and minerals are purified by specified processes before being used for medicinal purposes. About 600 medicinal plant products, 52 minerals and 50 animal products are among the commonly used. Ayurvedic medicines are marketed in various forms. The main ones are tablets, pills, powders, fermented products *(Asva-arishta)*, decoctions, medicated fats (*Ghrita* and *Tel*), drops, creams, lotions, liniments and ointments. Dried plant extracts in capsule form are also in use presently.

4.5.3 Safety Concerns

Ayurvedic medicines evolved at a time when modern clinical tests were absent. Some evidences have come up to indicate that using some ayurvedic preparations, especially those having herbs and metals, involve serious risks, including toxicity. In a study done in the U.S.A., 20 per cent of the Ayurvedic herbal medicines manufactured by 27 companies (26 Indian and one Pakistani)

were found to contain heavy metals such as lead, mercury and/or arsenic. Besides, some of the products contained metals such as gold, silver and tin in unsafe levels for human body. Therefore, there is a need for rigorous scientific studies and clinical trials for many of the ayurvedic products.

India introduced regulations on heavy metal content in Ayurvedic formulations in 2005. The notification of October 14, 2005, made testing for arsenic, lead, mercury and cadmium mandatory for export purposes. Permissible limits for arsenic, lead and cadmium are as per the recommendations of the World Health Organisation (WHO) and, in the case of mercury, the permissible limit is one part per million (ppm). The regulations now require that the container of Ayurvedic drugs to be exported must display the words "Heavy Metals within Permissible Limits". This is not mandatory for sale within the country. The government has also sent order to the State licensing authorities to ensure strict compliance to Good Manufacturing Practices (GMP) and cancel the licenses of those who do not comply.

4.6 TRADITIONAL INDIAN FOODS

Food is an important part of Indian culture, playing a role in everyday life as well as in festivities. India is a vast country of sub-continental dimension and uninterrupted continuity of civilization. It has tremendous diversity of agro-climatic conditions, food resources, ethnicity and food systems. This provides the strong base for what is popularly referred to as Indian food or Indian cuisine. The genesis of Indian cuisine can be traced to the Indian civilizations of Harappa and Mohenjodaro. Since then, Indian food has been influenced by a number of factors and each of these has made the food of India. Many recipes first emerged during the initial Vedic period, when India was still heavily forested and agriculture was complemented with game hunting and forest produce.

As a land that has experienced extensive immigration and intermingling through many millennia, the subcontinent has benefited from numerous food influences. The diverse climate in the region, ranging from deep tropical to alpine, has also helped considerably broaden the set of ingredients readily available to the many schools of cookery in India. The multiple families of **Indian cuisine** are characterized by their sophisticated and subtle use of many spices and herbs. Each family of this cuisine is characterized by a wide assortment of dishes and cooking techniques.

Indian cuisine varies from region to region, reflecting the varied demographics of the ethnically diverse subcontinent. Generally, Indian cuisine can be split into four categories: North Indian, South Indian, East Indian, and West Indian. Despite this diversity, some unifying threads emerge in the art of Indian cuisine.

Traditional Indian food has a wide range. A typical Indian meal may consist of items like *Chapatti, Parantha, Bhatura, Rice, Pulao, Dosa, Idli, Uttappam, Curries, Dals,* and a variety of sweetmeats like *Rasogulla, Gulab-jamun, Baalushahi, Laddu, Halwa* and so on. *Namkeens, Papads, Chutney, Pickles* and *Snacks* like *Pakoras, Samosas* are also integral part of Indian cuisine, though they must have some influence from neighbouring countries.

Apart from a daily meal, Indians use a variety of traditionally processed/prepared foods. Traditional foods are different types of food

preparations with varying shelf life. These have been invented to overcome the monotony of the daily diets and to make meal more interesting and nutritious. Their preparation was based on *Pak Shastra* i.e. science of cooking. The guidelines for preparation have been passed from generation to generation. Many of these foods have also gained commercial success. Indian traditional foods based on cereals, legumes and fats or oil- both sweets and savouries, are innumerable in number. The important foods that are popular can be broadly categorized as; processed grain products, dehydrated foods, pickles, chutneys, sauces, spice mixtures, savouries, fried crispies, confections and sweet dishes and dairy products. There are regional variations to most of these items. For instance, a *'papad'* in state or region is different from the other in ingredients, spicing or size. The crispy, *'pakora'* is different in contents, taste and look from region to region. A generic item like *'halwa'* may acquire a specialty status and appeal as in *"Bikaneri Bhujia"* from Rajasthan or *"Thinnaveli Halwa"* from Tamil Nadu. Some of these items are getting the attention of multinational food companies because of the demand from Indian Diaspora. This would also involve scientific evaluation of traditional Indian food items and their adherence to international food safety and quality norms.

4.7 HONEY

Honey is a sweet and viscous fluid processed from the nectar of flowers by the honey bees. According to various international food regulations, honey stipulates a pure product that does not allow for the addition of any other substance, this includes water or other sweeteners.

Honey is significantly sweeter than table sugar and has attractive chemical properties for baking. Honey has a distinctive flavor that's why some people prefer it over sugar and other sweeteners.

Most microorganisms do not grow in honey because of its low water activity of 0.6. However, it is important to note that honey frequently contains dormant endospores of the bacteria *Clostridium botulinum*, which can be dangerous to infants as the endospores can transform into toxin-producing bacteria in the infant's immature intestinal tract, leading to illness and even death.

4.7.1 Composition

Honey is a mixture of sugars and other compounds. The composition of homey is- fructose, 38%, glucose, 31%, other sugars, 9%, water, 17%, ash, 0.17% and other substances, 3.38%. The main carbohydrates in honey are fructose and glucose making it similar to the synthetically produced inverted sugar syrup. Honey's remaining carbohydrates include maltose, sucrose, and other complex carbohydrates. Honey has trace amounts of several vitamins and minerals. It contains tiny amounts of different compounds like chrysin, pinobanksin, vitamin C, catalase, and pinocembrin that act as antioxidants.

4.7.2 Uses and Health Benefits

The main uses of honey are in cooking, baking, as a spread on breads, and as an addition to various beverages such as tea and as a sweetener in commercial beverages. Honey is also an important functional food. It is the main ingredient in the alcoholic beverage 'mead', also known as "honey wine" or "honey beer".

For at least 2700 years, honey has been used to treat a variety of ailments. The antiseptic and antibacterial properties of honey was scientifically proved only

recently. As an antimicrobial agent honey may have the potential for treating a variety of ailments.

Osmotic effect: Honey is primarily a saturated mixture of two monosaccharides. This mixture has a low water activity. Thus very less water is available to the microorganisms. This creates a poor environment for microbial growth.

Hydrogen peroxide: Hydrogen peroxide in honey is activated by dilution.

$$\text{Glucose (in honey)} + H_2O + O_2 \rightarrow \text{gluconic acid} + H_2O_2$$

When used topically (as, for example, a wound dressing), hydrogen peroxide is produced by dilution with body fluids. As a result, hydrogen peroxide is released slowly and acts as an antiseptic.

In diabetic ulcers: Topical honey has been used successfully in a comprehensive treatment of diabetic ulcers when the patient cannot use other topical antibiotics.

Acidity: The pH of honey is commonly between 3.2 and 4.5. This relatively acidic pH level prevents the growth of many bacteria.

Nutraceutical effects: Antioxidants in honey have been shown to in reduce the damage done to the colon in colitis.

Other medical applications: Some studies suggest that the topical use of honey may reduce odors, swelling, and scarring when used to treat wounds; it may also prevent the dressing from sticking to the healing wound.

Honey (especially when combined with lemon) is often taken orally by pharyngitis and laryngitis sufferers, in order to soothe them.

We have already discussed other health benefits of honey in section **4.3 Health Foods**.

4.7.3 Safety Concerns

Due to the natural presence of botulinum endospores in honey, children under one year of age should not be given honey. Adults and older children have developed digestive system which can destroy these spores. Honey produced from some flowers may cause honey intoxication. Symptoms include dizziness, weakness, excessive perspiration, nausea and vomiting. Sometimes, low blood pressure, shock, heart rhythm irregularities and convulsions may also occur with rare cases resulting in death. Honey intoxication is more likely when using "natural" unprocessed honey and honey from farmers who may have a small number of hives. Commercial processing, with pooling of honey from numerous sources generally dilutes any toxins. Thus, it is advisable to purchase honey from a reputed company.

Check Your Progress Exercise 2

Note: a) Use the space below for your answer.
b) Compare your answers with those given at the end of the unit.

1) What is the composition of Ayurvedic medicines? Give examples of some Ayurvedic medicines.

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2) India has a rich variety of traditional foods. Discuss.

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3) Why should children less than one year old not be given honey?

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4.8 GENETICALLY MODIFIED FOODS

Genetically modified (GM) foods are foodstuffs produced from genetically modified microorganisms (GMO) whose genome has been altered through engineering. Genetic modification is a special set of technologies that alter the genetic makeup of living organisms such as animals, plants, or bacteria.

GM foods have been modified in the laboratory to enhance desired traits such as increased resistance to herbicides or improved nutritional content. Traditionally, breeding was used to enhance quality of a plant but conventional plant breeding methods can be very time consuming and are often not very accurate. Genetic engineering, on the other hand, can create plants with the exact desired trait very rapidly and with great accuracy. For example, plant geneticists can isolate a gene responsible for drought tolerance and insert that gene into a different plant. The new genetically-modified plant will gain drought tolerance as well. Not only can genes be transferred from one plant to another, but genes from non-plant organisms also can be used. The best known example of this is the use the soil bacteria *Bacillus thuringiensis (Bt)* in improving a variety of crops like corn, cotton, soybean and tomato. Bt. is a naturally occurring bacterium that produces crystal proteins that are lethal to insect larvae. Bt. crystal protein genes have been transferred into corn, enabling the corn to produce its own pesticides against insects such as the European corn borer.

A majority of herbicide- and insect-resistant soybeans, corn, cotton, canola, and alfalfa have been developed. Others are rice with increased iron and vitamins, potato with increased vitamin C and so on. Studies are also being done on bananas and tomatoes that produce human vaccines against infectious diseases such as hepatitis B (such foods are called ‘edible vaccines’); fish that mature more quickly; cows that are resistant to bovine spongiform encephalopathy (mad cow disease); fruit and nut trees that yield years earlier, and plants that produce new plastics with unique properties.

In 2006, countries that grew 97% of the global transgenic crops were the United States (53%), Argentina (17%), Brazil (11%), Canada (6%), India (4%), China (3%), Paraguay (2%) and South Africa (1%).

4.8.1 Technology

The process of combining genes from different organisms is known as recombinant DNA technology, and the resulting organism is said to be "genetically modified," "genetically engineered," or "transgenic." In the process of producing a GMO used for GM Foods, DNA from one organism is taken, modified in a laboratory, and then inserted into the target organism's genome to produce new and useful traits. Other methods of producing a GMO includes increasing or decreasing the number of copies of a gene already present in the target organism, silencing or removing a particular gene or modifying the position of a gene within the genome.

4.8.2 Benefits

As the population is growing fast, ensuring an adequate food supply is going to be a major challenge in the years to come. GM foods promise to meet this need in a number of ways, with properties like pest resistance, herbicide tolerance, disease resistance, cold tolerance, and drought tolerance/ salinity tolerance, and tailored for better nutrition and therapeutic purposes.

4.8.3 Risks

Environmental activists, religious organizations, public interest groups, professional associations and other scientists and government officials have all raised concerns about GM foods for the risks associated with them. These risks are-

- **Allergenicity:** Many children in the USA and Europe have developed life-threatening allergies to peanuts and other foods. There is a possibility that introducing a gene into a plant may create a new allergen or cause an allergic reaction in susceptible individuals.
- **Unknown effects on human health:** There is a growing concern that introducing foreign genes into food plants may have an unexpected and negative impact on human health.
- **Increased antibiotic resistance**: Genetically modified organisms may have increased resistance to the antibiotics used in treatment of various diseases.
- **Unintended harm to other organisms**: It has been found that GM crop may kill other harmless organisms too. For example, Bt corn, which kills the insect larvae, also kills harmless butterfly caterpillars. Bt. toxins kill many species of insect larvae indiscriminately; it is not possible to design a Bt. toxin that would only kill crop-damaging pests and remain harmless to all other insects. This would affect the environment adversely and lead to loss of flora and fauna biodiversity.
- **Reduced effectiveness of pesticides:** Just as some populations of mosquitoes developed resistance to the now-banned pesticide DDT, many people are concerned that insects will become resistant to Bt. or other crops that have been genetically-modified to produce their own pesticides.

- **Gene transfer to non-target species:** Another concern is that crop plants engineered for herbicide tolerance and weeds will cross-breed, resulting in the transfer of the herbicide resistance genes from the crops into the weeds. These "superweeds" would then be herbicide tolerant as well. Other introduced genes may cross over into non-modified crops planted next to GM crops.
- **Access and intellectual property:** There could be domination of world food production by a few companies, increased dependence on industrialized nations by developing countries and biopiracy i.e.foreign exploitation of natural resources
- **Ethics:** People have raised ethical issues like violation of natural organisms' intrinsic values, tampering with nature by mixing genes among species, objections to consuming animal genes in plants and vice versa and stress for animal.

4.8.4 Regulations

India has not yet announced a policy on GM foods because no GM crops are grown in India on a large scale and no products are commercially available in supermarkets yet. India is very supportive of transgenic research. In Japan, the Ministry of Health and Welfare has announced that health testing of GM foods will be mandatory. Currently, testing of GM foods is voluntary. Some states in Brazil have banned GM crops entirely. Europe now requires mandatory food labelling of GM foods in stores. E.g. genetically modified or produced from genetically modified *'name of product'* or contains genetically modified *'name of product'*; contains *'name of product'* produced from genetically modified *'name of product'*, should appear in the list of ingredients or the package. Consumer interest groups wish that all GM foods manufacturing companies should consult FDA, so that all GM foods and food products must be approved by the FDA before being released for commercialization. In January 2000, an international trade agreement for labeling GM foods was established. More than 130 countries, including the USA, the world's largest producer of GM foods, signed the agreement. The policy states that exporters must be required to label all GM foods and that importing countries have the right to judge for themselves the potential risks and reject GM foods, if they want.

4.9 INFANT FOODS

Infant food is food processed and manufactured for nutritional health of children in their initial year, of their life. The food comes in multiple varieties and tastes, can be produced by many manufacturers, or may be table food that the rest of the family is eating, mashed up. A common trait of the many different baby foods is that they are designed for ease of eating; either a soft, liquid paste or an easily chewed food. This is due to the fact that infants lack teeth and experience in eating. Weaning (giving solid and semi-solid foods to baby) starts at the age of 4-6 months. After 4-6 months, many mothers don't have enough milk for the infant. Addition of other foods therefore becomes essential.

India has a wide variety of traditional infant foods. In most cultures, pastes of a grain and liquid were the first baby food. In the western world, until the mid 1900's baby food was generally made at home. The industrial revolution saw the beginning of the baby food market which promoted baby foods as

convenience items. Baby foods should be high in energy, easy to digest, semisolid in consistency, less viscous, fresh and clean, inexpensive and easy to prepare.

4.9.1 Traditional Infant Foods

Infant foods commonly used in India are porridge made with *suji*, broken wheat, roasted wheat flour, malted cereals, ground rice, *ragi*, millet, etc; with a little water or milk, sugar or *jaggery*, *ghee* or oil, *khichdi*, *dalia*, *suji kheer*, *upma*, *idli*, *dhokla, bhaat bhaji,* etc. There are some instant infant foods also e.g. *sattu* made from cereal or millet, pulse, groundnuts or gingelly seeds (white *til*). These are mixed with sugar or *jaggery* or are made into *halwa, burfi, upma, dalia*, etc. and given to the child.

Amylase Rich Food (ARF) is a recent advancement in the area of infant foods in poor countries. ARF is made from germinated cereals. It has active enzymes which decrease the viscosity of a gruel made from cereals. Thus nutritionists are promoting the addition of ARF to a weaning mix so as to make energy dense but less viscous food. Thus, ARF too can be an important ingredient of infant food.

4.9.2 Commercial Infant Foods and Formulae

Nowadays, various infant foods are manufactured and are available in the market. These are known as infant formulas, substitutes for mother's milk. Infant formula should contain protein, fat, linoleic acid, vitamins: A, C, D, E, K, thiamin (B_1), riboflavin (B_2), B_6, B_{12}, niacin, biotin, folic acid pantothenic acid, minerals: calcium, magnesium, iron, zinc, manganese, copper, phosphorus, iodine, sodium chloride and potassium chloride.

Infant formula is available in powder, liquid concentrate and ready-to-feed forms, which are prepared by the caregiver or parent in small batches and fed to the infant, usually with either a baby bottle or cup.

Highly specialized infant formula can also be synthesized from amino acids. This kind of formula is sometimes referred to as elemental infant formula or as medical food because of its specialized nature. It is very expensive but the formula is hypoallergenic and is sometimes used for babies with severe allergies to cow's milk and soy.

4.9.3 Concerns

People criticize infant foods and formulas for various reasons. Infant foods are very expensive. Many scientists believe that infant formula exposure increases the risk of several conditions including diabetes, asthma and eczema in the later life. Breast milk provides increased resistance to diseases thus bottle fed babies have lesser immunity. Bottle-feeding can be less successful than breastfeeding in promoting the natural bonding process of mother and child. Infant formulas can also be contaminated with bacteria or foreign objects. Besides, mothers have to be educated about clean methods of preparation, use of sterilized bottles and cups, spoons, storage conditions of the foods, etc.

4.9.4 Regulations

The 'Infant milk substitutes, feeding bottles and Infant foods rules' of the Government of India specify that all Infant foods containers should carry the statement- MOTHER'S MILK IS BEST FOR YOUR BABY. Organizations

donating infant formula to pregnant and lactating women should provide the information on importance of mother's milk, its benefits, nutritional value and hygiene. The container should convey things like hygienic methods of preparation, composition, storage conditions, expiry date, feeding chart and directions for use.

4.10 ORGANIC FOODS

Organic foods are foods that are grown by Organic farming. Organic farming is a form of agriculture which does not use synthetic fertilizers and pesticides, plant growth regulators and livestock feed additives. As far as possible, organic farmers rely on crop rotation, crop residues, animal manures and mechanical cultivation to maintain soil productivity, to supply plant nutrients, and to control weeds, insects and other pests. It enhances the health of ecosystems and organisms.

Organic crops are grown without the use of conventional pesticides, artificial fertilizers, human waste, or sewage sludge, and are processed without ionizing radiations or food additives. For animals, it means they are reared without the routine use of antibiotics and without the use of growth hormones. In most countries, organic produce must not be genetically modified. Increasingly, organic food production is legally regulated. A "certified organic" label is usually the only way for consumers to know that a processed product is "organic".

4.10.1 Advantages

Many surveys and studies have shown that organic farming is less damaging to the environment. Organic farms do not release synthetic pesticides into the environment — some of which have the potential to harm local wildlife. Organic farms are better than conventional farms at sustaining diverse ecosystems, *i.e.*, populations of plants and insects, as well as animals. Also, organic farms use less energy and produce less waste. Organically managed soil has higher quality and higher water retention. This may help increase yields for organic farms in drought years i.e., crop might be better even in drought conditions as there is more water in the soil.

It is well known that using pesticides affects health of the farmer also. Contact with pesticides may cause acute health problems such as abdominal pain, dizziness, headaches, nausea, vomiting, as well as skin and eye problems. There have been many other studies that have found pesticide exposure is associated with more severe health problems such as respiratory problems, memory disorders, dermatologic conditions, cancer, depression, neurological deficits, miscarriages, and birth defects. Organic farming protects farmers from these problems. Studies showed that organically grown foods consistently had much less pesticide residues that conventionally grown foods. Thus, organic diets are much safer than the normal ones. Several studies have also concluded that organic foods are better in taste and texture. Even nutrient content is also high in these as shown by some studies. However, all this is still under study and not proved conclusively.

4.10.2 Concerns

Cost is the major factor. Critics claim that organic food is more expensive than conventional food and not affordable to persons having lower income. Organic products typically cost 10 to 40% more than similar conventionally produced

products. This is because farmers who grow organic food have to meet stricter quality standards to have their products certified organic. More labour is required to achieve this, bringing up the cost.

Organic farming standards do not allow the use of synthetic pesticides, but they do allow the use of specific pesticides derived from plants. The most common organic pesticides, accepted for restricted use by most organic standards, include Bt, pyrethrum, and rotenone. Some organic pesticides, such as rotenone, have high toxicity to fish and aquatic creatures with some toxicity to mammals including humans. Thus they may not be absolutely safe.

4.10.3 Regulations

Increasingly, organic farming is defined by formal standards regulating production methods and final output. There are two types of standards-voluntary and legislated. Earlier, voluntary standards created by private producers were popular but since 1990s, a trend towards legislation of standards began, notably the EU-Eco regulation of the European Union. An international framework for organic farming is provided by International Federation of Organic Agriculture Movement (IFOAM). Legislated standards vary from country to country. In India, guidelines and standards for organic agriculture were announced in May 2001 and the National Programme on Organic Production (NPOP) is administered under the Ministry of Commerce. To be certified organic, products must be grown and manufactured in a manner that adheres to standards set by the country in which they are sold. Different countries put their organic seals on the products that confirm to the standards.In our country the certified organic products can be identified by a trademark “India Organic Logo”. The logo at Fig. 4.3 represents the trademark “India Organic” and is owned by the Government of India. The use of logo is regulated through accredited inspection and certification agencies. Only the inspection and certification agencies accredited by APEDA (Agricultural and Processed Food Products Development Authority) are authorized to use the India Organic Logo and grant the operator to use it for their product. The use of license is regulated under the Organic Products Certification Mark Regulation, 2002.

Fig. 4.3: India Organic

Check Your Progress Exercise 3

Note: a) Use the space below for your answer.
b) Compare your answers with those given at the end of the unit.

1) What are the risks associated with GM foods?

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2) Give examples of traditional infant foods of India.

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3) What is the technology behind GM foods?

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4) Discuss the benefits of organic foods.

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4.11 LET US SUM UP

We all eat food for growth, repair and maintenance of our body. Earlier, when food processing had just begun, food industries were concerned with producing food with good taste, colour, attractiveness and nutritional value. But now food industries are looking into other areas specify because of several reasons such as increased stress, work load, health problems, increasing population, food shortage, pollution, etc. Thus, production of a safe and wholesome food is not enough. Consumer demands foods that can meet other needs too. We want food that can provide us comfort, improve our health, prevent diseases and thus act as medicine. We have also understood the effects of food on environment. Thus we want food or methods of growing food that are environment friendly. We also want to increase food production. All these demands have given rise to a number of new foods. These are Comfort foods such as Energy drinks, Health foods such as Spirulina, Nutraceuticals or functional foods that have therapeutic value, GM foods that have improved nutritional value, increased disease resistance and that also act as edible vaccines, Organic foods that are grown without pesticides. We also are looking into our traditional foods that supplement our diet. Infant foods have also become an important area. Even ayurvedic foods have created a lot of interest in the food scientists as they use traditional system of medication but have raised a lot of concern in the west because of their supposedly high heavy metal content. An aspiring food expert has to understand all these concepts. Learning about the various foods that we have discussed in this unit, their composition, health benefits, risks or disadvantages and regulations would help a food scientist widen his or her vision.

4.12 KEY WORDS

Comfort Foods : Comfort foods are foods that give comfort, pleasure and calmness and make a person happy.

Withering : Plucking the leaf initiates the withering stage, in which the leaf becomes flaccid and loses water until,

from a fresh moisture content of 70 to 80 percent by weight, it arrives at a withered content of 35 to 40 percent, depending upon the type of processing. 50 to 70 ft long. The process takes about 16 to 18 hours of period and makes the leaf for next stage to facilitate rolling.

Health Foods : Health foods are items that complement the regular diet, provide nourishment for the body and fight disease.

Nutraceuticals : Nutraceutical is a combination of "nutrition" and "pharmaceutical" and refers to foods claimed to have a medicinal effect on human health.

Organic Foods : Organic foods are foods that are grown by Organic farming. Organic farming is a form of agriculture which does not use synthetic fertilizers and pesticides, plant growth regulators and livestock feed additives.

4.13 TERMINAL QUESTIONS

1) Discuss health benefits of nutraceuticals. What are the concerns regarding nutraceuticals?
2) Discuss various types of health foods and their importance in our life.
3) What is Ayurveda? What are the risks associated with ayurvedic medicines?
4) Conduct a survey of traditional foods available in the market.
5) Discuss the uses and health benefits of honey.
6) Discuss the benefits of GM foods.
7) What are the regulations regarding GM foods and Organic foods?
8) Discuss the processing of coffee and cocoa.
9) Discuss the composition and safety concerns about energy drinks.
10) What are infant foods? Comment on the traditional infant foods and commercial products. What are the risks associated with them and what are the legislation requirements?

4.14 ANSWERS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress Exercise 1

Your answer should include following points:

1) Comfort foods are foods which make a person happy, give pleasure and calmness. Many people eat comfort food for familiarity, emotional security, or special reward. Small children often seem to demand a specific food or drink like chocolate, cola drink and will repeatedly request it in

high stress situations. Adults eat comfort food for a sense of continuity. For example, many people drink alcohol when they are sad or are happy. Many of us have tea when we feel tired. (See 4.2). Examples- Energy drinks, stimulating drinks e.g. tea, coffee, alcoholic beverages.

2) Grains with folic acid, milk with vitamin D, juices with fibre, dairy products with probiotics, eggs with omega-3 fatty acids. (See section 4.4)

3) Withering, rolling, fermentation, drying, packaging.

4) Wheat grass contains chlorophyll, beta carotene, more than 80 minerals, 18 amino acids and many vitamins. It is generally consumed as juice which is a complete food with regenerative and protective qualities. Its regular use improves perception and increases mental and emotional calmness. It aids in digestion, prevents graying of hair, skin diseases, asthma, arthritis and diabetes. In fact, because of its blood purifying qualities, wheatgrass is used in the treatment of leukemia and some other forms of cancer.

Check Your Progress Exercise 2

Your answer should include following points:

1) Ayurvedic medicaments are made from herbs or mixtures of herbs, either alone or in combination with minerals, metals and other ingredients of animal origin. The metals, animals and minerals are purified by individual processes before being used for medicinal purposes. About 600 medicinal plant products, 52 minerals and 50 animal products are commonly used. Examples- Ashavgandha, Amla, Haritaki, Shilajeet, Suvarn Bhasm, Mulethi, Shankhapushpi (See section 4.5)

2) Briefly discuss various categories of traditional foods e.g. cereal foods, pulses mix, sweetmeats, savouries etc. Refer to section 4.6.

3) Due to the natural presence of botulinum endospores in honey, children under one year of age should not be given honey. Adults and older children have developed digestive system which can destroy these spores.

Check Your Progress Exercise 3

Your answer should include following points:

1) Allergenicity, Unknown effects on human health, Increased antibiotic resistance, Unintended harm to other organisms, Reduced effectiveness of pesticides, Gene transfer to non-target species Access and Intellectual Property, Ethics. (See section 4.8)

2) Porridge made with *suji*, broken wheat, roasted wheat flour, malted cereals, ground rice, *ragi*, millet etc with a little water or milk, sugar or *jaggery*, *ghee* or *oil, khichdi, dalia, suji kheer, upma, idli, dhokla, bhaat bhaji, sattu* made from cereal or millet, pulse, groundnuts or gingelly seeds (white *til*). (See section 4.9)

3) The process of combining genes from different organisms is known as recombinant DNA technology, and the resulting organism is said to be "genetically modified," "genetically engineered," or "transgenic." In the process of producing a GMO used for GM Foods, DNA from one organism is taken, modified in a laboratory, and then inserted into the target

organism's genome to produce new and useful traits. Other methods of producing a GMO includes increasing or decreasing the number of copies of a gene already present in the target organism, silencing or removing a particular gene or modifying the position of a gene within the genome. (See section 4.8).

4) Organic farming is less damaging to the environment. Organic farms do not release synthetic pesticides into the environment, better than conventional farms at sustaining diverse ecosystems, use less energy and produce less waste. Organically managed soil has higher quality and higher water retention. This may help increase yields for organic farms in drought years, organically grown foods has much less pesticide, better in taste and texture and nutritionally.

4.15 SOME USEFUL BOOKS

Manay, S. and Shadaksharaswami, M. (2002) *Foods-Facts and Principles*, New Age International Publishers.

Potter, N. and Hotchkiss, J. (1996) *Food Science*, 5th ed, CBS Publishers.

Sachdev, H.P.S. and Choudhary, P.(Ed) (1994) *Nutrition in children-Developing Country Concerns*, National update on Nutrition in Children, Maulana Azad Medical College, New Delhi.

Arihara, K. (2004) *Functional Foods In Encyclopedia of Meat Sciences*, Jensen, W., Devine, C. and Dikeman, M. (Eds) Elsevier Academic Press.

National Guidelines on Infant and Young Child Feeding (2004) Dept of Women and Child Development, Food and Nutrition Board, Govt. of India.

www.lifepositive.com, www.foodnavigator.com, www.wikipweida.org, www.ana-jna.org, www.immunesupport.com, www.pharmabiz.com, www.pjonline.com, www.fnbnews.com, www.indianmedicine.nic.in, www.ers.usda.gov, www.lookwayup.com