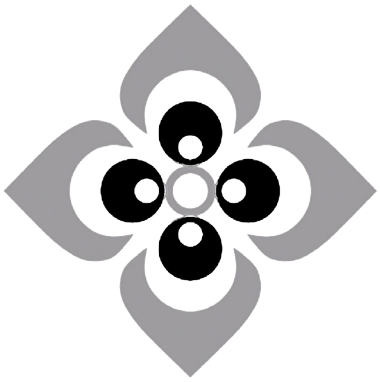

Consortium for Educational Communication

Module on

Composition and nutritional value of fruits and their products.

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Introduction to Fruits

Broadly, the term fruit botanically refers to the mature ovary of a plant, including its seeds, covering and any closely connected tissue. The fruit is the developed ripened ovary or ovaries of a single flower. It may include other parts of the same flower which are also modified in nature and ripen with the ovary . It may also develop from the whole inflorescence. It functions to protect the seeds and ensure their distribution for propagation. Fruits are produced only by flowering plants (angiosperms). As related to food, fruit refers to the edible part of a plant that consists of the seeds and surrounding tissues. This includes fleshy fruits (such as blueberries, cantaloupe, peach, pumpkin, tomato and dry fruits, where the ripened ovary wall becomes papery, leathery, or woody as with cereal grains, pulses (mature beans and peas) and nuts

TYPES OF FRUITS

Fruits can commonly be grouped into several major divisions, depending principally upon botanical structure, chemical composition and climatic requirements. The major categories discussed are as follows

Climacteric fruits: These fruits ripen faster after harvesting; have higher respiration rate, high respiration quotient (volume of CO_2

evolved/ volume of O_2 consumed) produce large ethylene and have low shelf life. e.g Peach, plums, apricot, apple, pear and mango.

Non climacteric fruits: These fruits ripen at lower rate after harvesting; have lower respiration rate, low respiration quotient and more shelf life. e.g Lemon, lime, orange and sweet lime.

True fruit: These fruits are derived from the gynaecium only e.g tomato

False fruit: These fruits are developed from the gynaecium and other floral parts e.g apple and strawberry.

Simple fruit: Such fruits are formed of single or syncarpous ovary (single flower) e.g fennel, capsicum.

Aggregate fruit: Such fruits develop from apocarpous gynaecium e.g staranise. Composite fruit: These fruits are formed from the whole inflorescence of the flower, e.g figs, strawberry, long pepper. Berries: Berries are fruits with layers of pericarp (fruit coat) which are often homogenous, except for the skin on the outside. The pericarp layers are pulpous and juicy, and contain seeds embedded in the pulp mass. The fruits have fragile cell structure that is damaged by rough handling or freezing. e.g. strawberry, raspberry etc

Citrus fruit: These fruits belong to the genus Citrus which contain about 16 species of evergreen aromatic shrubs and trees mostly with thorny branches distributed throughout the tropical and subtropical regions of the world. The common citrus fruits are orange, lemon and lime. The bright colour, pleasing flavour and sweetness make them a favourite fruit. They are served as juice and can be eaten raw

Drupes: Drupes are edible fruits with a thin skin, and juicy flesh enclosing a single seed (Stone). Apricots, cherries, peaches and plums belong to this group.

Melons: Melons belong to the same family as cucumbers (Cucurbitaceae). Melons are commonly eaten raw. Their flesh consists of about 94% water and only 5% sugars. The seeds stripped of their hard coats may be eaten and also yield an edible oil.

Pomes: Pomes are fruits of apple and pear trees. The receptacle, surrounds the ovaries in the flower, enlarges to become edible and juicy, and encloses the cells containing the seeds.

Fruits particularly citrus varieties and guava are a good source of vitamin C. Yellow fruits like mango and papaya contain carotene. Banana is a good source of carbohydrate and hence energy. Fruits

are a poor source of protein and fat with the exception of avacado. Fruits also contain fibre and minerals such as sodium, potassium and magnesium. Dry fruits and watermelon contribute appreciable amounts of iron.

COMPOSITION AND NUTRITIONAL SIGNIFICANCE OF FRUITS

Fruits are an important part of human diet. It has been widely reported that diets rich in fruit and vegetables reduce the risk of chronic disease such as cancer and cardiovascular disease. Although most people do not consume an adequate amount of fruits and vegetables, it is interesting to note that in the United States more processed fruit and vegetables are consumed than their fresh counterparts. The primary source of vitamin A in fruits is in the form of its precursor, β-carotene. The carbohydrates in fruit have a moderate energy value. Fruit contain protective vitamins and minerals, and dietary fiber but very little protein. They are practically fat-free except for avocado and olive, both of which contain up to 15%of fat. Fruit vary widely in their carbohydrate content (between 1.5% and 26 %). Ripe fruit contain no starch; the main sugars are fructose and glucose which are often present

in equal proportions. Apple and pear contain more fructose, while apricot and peach also contain sucrose. Like vegetables, fruit also contain dietary fiber. Various organic acids in unripe fruit produce the typical sour taste. During ripening concentration of these acids falls and that of sugars rises. Vitamin C is present in all fresh fruit, but strawberry, citrus fruit and particularly kiwifruit are outstanding sources of this vitamin. For example, one kiwifruit or medium-size orange supplies the normal daily requirement for adults. Apple and peach provide moderate amounts of vitamin C and can contribute substantially to the diet when consumed in sufficient quantity. Most fruit also supply varying amounts of ß-carotene and the B-complex vitamins. Yellow fruit, such as cantaloupe and apricot, are good sources of vitamin A, whereas plum and dried fruit (those not treated with sulphur dioxide) are the best sources of thiamin. Although the amounts are not sufficiently high to significantly increase intake of these nutrients in a mixed diet, under certain circumstances they may be very valuable. Fruit contribute appreciable amounts of iron and calcium. Calcium is found in small amounts in citrus fruit; the whole fruit contains double the amount contained in an equal quantity of juice. Strawberry and dried figs also contain calcium. Sodium, magnesium, and potassium, which account for the alkaline ash of

fruit when metabolized by the body, are also present in varying amounts in most fruit. As in the case of vegetables, careful preparation and storage are essential to retain the maximum nutritive value of fruit. Some of the nutritive value is lost during cooking, drying, and canning, but the losses are not as high as they were once supposed. Frozen fruit compare favourably in vitamin content with fresh ones. Bruising and cutting of fruit, and exposing fruit and fruit juices to air cause considerable loss of vitamin C.

Table 1. Mean chemical composition of fresh fruit (content per 100 g)

	minerals	Vitamins	energy
Water(g) 80-95 Protein(g) 0.5-1.5 Fat(g) 0.1-1.0 Carbohydrate(g) 1.5-16.0 Dietary fiber (g)0.2-6.4	Ca(mg) 6-50 Fe(mg) 0.3-1.0 K(mg) 110-450	β-carotene(mg) -٠,٢ ٢,٠ C(mg) 10-90 B6(mg) 0.03-0.35	(Kcal) 6-66 (Kj) 25-276

MAJOR CONSITUENT OF FRUITS

Water

Fruits have a high percentage of water that ranges from 80% to 95% of the eatable part of the fruit. For this reason, they are together with vegetables, a very good source of water in the diet within the solid foods. The content of water in a fruit may be greatly affected by the processing technology, and in fact, some technologies used to increase the shelf life of fruits do so through the reduction of their water content. It is important to bear in mind that the water content of a fruit also changes during maturation, therefore the optimum degree of maturation of a fruit for a given processing technology may be different than for another processing technology. This will also affect the water content in the final product.

Water plays two fundamental roles as a nutrient:

- Protective and regulatory, by being a substrate of biological reactions or acting as the matrix or vehicle in which those reactions take place, and
- An essential role as the temperature and pH regulator in the human body. Water also has a plastic function through the maintenance of the cell and tissue integrity. Around two-thirds of the human body is composed of water, and in general, the higher the metabolic activity of a given tissue, the higher its

percentage of water. Most of the body water is found within three body compartments: 1, intracellular fluid, which contains approximately 70% water, (2) extracellular fluid, which is the interstitial fluid, and (3) blood plasma. These two compartments contain 27% water. The body controls the amount of water in each compartment by controlling the ion concentrations in those compartments. Therefore, gains or losses of electrolytes are usually followed by shifts of fluid to restore osmotic equilibrium. The body has three sources of water: (1) ingested water and beverages, including fruit juices, (2) the water content of solid foods, and (3) metabolic water.

Carbohydrates:

After water, carbohydrates are the main component of fruits and vegetables and represent more than 90% of their dry matter. The main monosaccharides are glucose and fructose. Their concentration may change depending on the degree of maturation of the fruit. The relative abundance of glucose and fructose also changes from one fruit to another. For instance, in peaches, plums, and apricots, there is more glucose than fructose and the opposite occurs in the case of apples or pears. Other

monosaccharides, such as galactose, arabinose, and xylose, are present in minimal amounts in some fruits, especially orange, lemon, or grapefruit. Fruits such as plums, pears, and cherries also contain the sugar alcohol sorbitol, which acts as a laxative because of osmotic transfer of water into the bowel. Sucrose is the most abundant oligosaccharide in fruits; however, there are others such as maltose, melibiose, raffinose, or stachyose that have been described in grapes, and 1-kestose in bananas . Other oligosaccharides are rare in fruits. Starch is present in very low amounts in fruits, since its concentration decreases during maturation. The only exception is banana that may have concentrations of starch higher than 3%. During food processing, carbohydrates are mainly involved in two kinds of reactions: on heating they darken in color or caramelize, and some of them combine with proteins to give dark colors known as the browning reaction.

Carbohydrates present in fruits are the main source of energy in the human diet. In general, the carbohydrates present in various fruits are mainly classified into three groups: monosaccharides, oligosaccharides, and polysaccharides. Monosaccharides include pentoses (arabinose, xylose, and ribose) and hexoses (glucose, fructose, and galactose). Oligosaccharides include sucrose,

maltose, lactose, raffinose, and stachyose. Polysaccharides include starch (composed of amylose and amylopectine, both polymers of glucose), glycogen, and other polysaccharides, which form part of fiber.

The energy produced from carbohydrate metabolism may be used directly to cover the immediate energy needs or be transformed into an energy deposit in the body in the form of fat. Carbohydrates also have a regulatory function, for instance, by selecting the microflora present in the intestines. Fructose has been known to increase plasma urate levels due to rapid fructokinase mediated metabolism to fructose 1-phosphate. This increase in plasma urate levels seems to cause an increase in plasma antioxidant capacity in humans.

The recommended dietary allowance (RDA) for carbohydrates is 130 g/day, except in the cases of pregnancy (when it is 175 g/day) and lactation (210 g/day). With respect to the total energy consumed per day, carbohydrates should represent 45–65%.

Fiber:

Fiber is often referred to as unavailable carbohydrate. This definition has been a controversy for years. Fiber is a generic term that includes those plant constituents that are resistant

to digestion by secretions of the human gastrointestinal tract. Therefore, dietary fiber does not have a defined composition, but varies with the type of foodstuff. Perhaps we can say that fiber may not be a carbohydrate and it may be available. Fiber has mainly a regulatory function in the human body. The role of fiber in human health has been the subject of many studies. In most of these studies, the results have suggested important roles of fiber in maintaining human health.

The major components of dietary fiber are the polysaccharides celluloses, hemicelluloses, pectins, gums, and mucilages . Lignin is the other component that is included in most definitions of fiber but it is not a carbohydrate. Fiber may be classified as water soluble and insoluble. Gums, mucilages, some hemicelluloses, and pectins are part of the soluble fiber. Celluloses, hemicelluloses, and lignins are insoluble fibres. Fruits are good sources of both classes of fibres, especially soluble fiber. Dietary fiber is present in fruits in amounts that may be as high as 7% of the eatable part of the fruit. Within fiber, the most common components in fruits are celluloses, hemicelluloses, and pectins. Pectins are important in the technological process, since they may be deeply modified and this modification not only has an influence on the nutritional value of the final food, but also has an impact on the texture and

palatability of the product.

Fiber, together with vitamins, is the main nutritional reason for using fruits for a balanced diet. There are several fiber-associated substances that are found in fruit fiber, which may have some nutritional interest. Among them are phytates, saponins, tannins, lectins, and enzyme inhibitors. Saponins, which are mainly present in some tropical fruits, may enhance the binding of bile acids to fiber and reduce cholesterol absorption. Tannins are polyphenolic compounds widely distributed in fruits, which can bind proteins and metals and reduce their absorption. Lectins, which are present in bananas and some berries, are glycoproteins that can bind specific sugars and affect the absorption of other nutrients.

The RDA for fiber is 25–30 g/day, depending on age and sex, except in the case of children from 1 to 3 years, in which case it is 19 g/day.

Proteins:

The importance of protein in the diet is primarily to act as a source of amino acids, some of which are essential because the human body cannot synthesize them. From the 20 amino acids that are part of the structure of proteins, almost half of them are considered to be essential, including isoleucine, leucine,

lysine, methionine, phenylalanine, threonine, tryptophan, and valine. The RDA for proteins is 34– 56 g/day, depending on age and sex, and in the case of pregnancy and lactation, it is 71 g/day. With respect to the total energy consumed per day, carbohydrates (proteins) should represent 10–35%. Proteins are essential structural components of all cells and are needed by the human body to build and repair tissues, for the synthesis of enzymes, hormones, and others. They are also involved in the immune system, coagulation, etc. Therefore, proteins play both regulatory and plastic roles in the human body.

Nitrogenated (proteins) compounds are present in fruits in low percentages (0.1–1.5%). From a quantitative point of view, fruits are not a good source of proteins; however, in general berries are a better source than the rest of the fruits. Cherimoya and avocado also present higher levels of proteins than other fruits. There are some free amino acids that may be characteristic of a certain fruit. This is the case of proline which is characteristic of oranges but cannot be found in strawberries or bananas.

Fats:

Fat has three important roles as a nutrient: it is a highly concentrated source of energy, it serves as a carrier for fat-

soluble vitamins and there are some fatty acids that are essential nutrients that can only be ingested with fat. Fat also serves as a carrier for some of the bioactive compounds present in fruits such as phytoestrogens and carotenoids that are lypophylic.

Fatty acids are also needed to form cell structures and to act as precursors of prostaglandins. Fatty acids are part of triglycerides, which are the principle form in which fat occurs. Fatty acids may occur naturally with various chain lengths and different numbers of double bonds. They may be saturated (butyric, caproic, caprylic, capric, lauric, palmitic, stearic, and myristic acids), monounsaturated (oleic and palmitoleic acid), and polyunsaturated (linoleic, linolenic, and arachidonic acids) also known as PUFAs. Linoleic and linolenic acids cannot be synthesized in the body and are known as essential fatty acids. They are needed to build and repair cell structures, such as the cell wall and, notably, tissues in the central nervous system, and to form the raw material for prostaglandin production. Inflammatory and other chronic diseases are noted for exhibiting a deficiency of polyunsaturated fatty acids in the bloodstream. Fatty acids that contain double carbon bonds can exist in either of two geometrically isomeric forms: cis and trans. Trans-fatty acids are produced in the hydrogenation process in the food industry and may play a role in atherosclerotic vascular

disease. In general, fat should represent between 20% and 35% of the total energy consumed per day in order to reduce risk of chronic disease while providing intakes of essential nutrients. This fat should include 10–14 g/day of linoleic acid and 1.2–1.6 g/day of linolenic acid. Fat content in fruits is in general very low. However, in cherimoya (1%) and avocado (12–16%), the lipid levels are higher. In avocado, the most abundant fatty acids are palmitic, palmitoleic, stearic, oleic, linoleic, and linolenic acids, but the amounts may change a lot with the variety, maturity, processing, and storage conditions.

Phytochemicals:

Natural antioxidants such as flavonoids, hydrolysable tannins, coumarins, xanthones, phenolics, terpenoids, ascorbic acid, carotenoids and proanthocyanins are found in various plant products, including fruits, leaves, seeds, oils, and juices. Regular consumption of fruits has been consistently shown to be associated with reduced risk of chronic diseases such as cancer and cardiovascular disease. Among all fruits, apples are commonly consumed and are the major contributors of phytochemicals in human diets. Epidemiological studies have linked the consumption of apples with reduced risk

of some cancers, cardiovascular disease, asthma, and diabetes. Apples contain a variety of phytochemicals, including quercetin, catechin, phloridzin and chlorogenic acid, all of which are strong antioxidants. Apple peels have high concentration of phenolic content. Consumption of grapes as fresh or in processed form has been shown to suppress platelet aggregation, lower cholesterol level in blood and anticarcinogenic. A variety of antioxidant entities, such as phenolics, anthocyanins and proanthocyanidins are present in grapes. Similarly, in guava, antioxidant nutrients include ellagic acid derivatives, myricetin and apigenin. Papaya fruits are rich in antioxidant agents which protect against colon cancer and heart diseases. These antioxidant components include carotene, vitamin C, vitamin B, flavonoids, folate, pantothenic acids, minerals such as potassium and magnesium. Pineapple fruits being rich in phenolics provide a good source of antioxidant. Pineapples contain flavonoids phenolic compounds, namely, the quercetin, flavones-3-ol, flavones, p-coumaric acid and ferulic . Vitamin C is also present in it. Pomegranate is an important source of anthocyanins, 3-glucosides, 3,5-diglucosides of delphinidin, cyanidin, and pelargonidin. Both total polyphenols and flavonoids are major contributors to the total antioxidant ability in mango fruit. The content of phenolic compounds ranged from 48.40 to

208.70 mg/100 g, total carotenoids from 1.91 to 2.63 mg/100 g, beta-carotene from 661.27 to 2 220 µg/100 g and total ascorbic acid ranged from 9.79 to 77.71 mg/100 g. Majority of fruits are rich in vitamin C, carotenoids and polyphenolic compounds, especially berry fruits are rich in this regard. Among berry fruits, the content of particular substances with antioxidant activity is rather diverse, some are rich source of vitamin C, the other contain huge amount of phenolic compounds. Fruits and their seeds are found to be rich sources of vitamins C, E and beta-carotene, proanthocyanidins, anthocyanins. Antioxidants mostly present in plums are as neochlorogenic acid and the anthocyanins components were cyanidin-3-O-glucoside or –rutinoside. While in strawberries, flavonoids and phenolic acids, such as hydroxycinnamic acids, ellagic acids, Xavan-3-ols, Xavonols, and anthocyanins are present. Black berries contain phenolic compounds, such as ellagic acid, tannins, quercetin, gallic acid, anthocyanins, and cyanidins. Citrus contains a well-balanced fatty acid and antioxidant profile that provide protection against harmful substances especially free radicals. Limonene, a major component in many citrus essential oils, exhibited chemopreventive and therapeutic effects. Citrus fruits (grape fruits, oranges, lemons) are rich in antioxidants due to high content of vitamin C (40–

50 mg/100 g) and phenolic compounds among which flavanones (naringenin, hesperidin) dominate. Pink grape fruits are supposed to be rich source of lycopene. Ascorbic acid, the most important antioxidant in citrus fruit juices protects from oxidative stress. Avocado fruits, also known as Alligator Pear, are widely consumed throughout the world. Avocado fruit is known to contain more than 25 chemopreventive phytochemicals including alkanols or aliphatic acetogenins (e.g., persin, persinone A and B), flavonoids (e.g., catechin, epicatechin, luteolin, apigenin, quercetin), carotenoids (e.g., zeaxanthin, lutein, β-carotene), terpenoid glycosides and coumarins. Mangosteen fruit, also known as 'queen of fruits', is widely grown in tropical countries. The fruit contains dark purple or reddish pericarp with white, soft and juicy edible pulp. Mangosteen fruit contains more than 50 xanthone derivatives, which have been isolated from pericarp and pulp of mangosteen fruit. Examples include garcinone, mangostenone, euxanthone, cudraxanthone, calabaxanthone, and demthyl calabaxanthone.

Table 2. Phytochemical composition of different fruits.

Fruits	Antioxidants
Strawberry fruits	Vitamin C, phenolic compounds, anthocyanins, ellagic acid, polyphenols
Tomatoes	Lycopene, polyphenol compounds, flavonoids, Quercetin
Citrus fruits	Vitamin C, phenolic compounds, flavanones, Lycopene
Berry fruits	Vitamin C, carotenoids, polyphenolic compounds
Apple peel	flavonoid, anthocyanins
Wild edible fruits	
Blackcurrant	Vitamin C, carotenoids, phenolic compounds

MICRONUTRIENTS

All vegetables and fruits contain important minerals, such as potassium, calcium, magnesium, phosphorus, iron, and zinc. Minerals are basic components in secondary metabolic pathways that produce valuable phytochemicals for normal human health. The contents of minerals in vegetables are variable. Green vegetables have higher amounts of calcium and iron than root vegetables. Calcium is not only associated with preventing osteoporosis, but it also appears to have protective effects in some types of cancer, most recently colon cancer.

Vitamin C:

Antioxidants have important roles in cell function and have been implicated in processes that have their origins in oxidative stress, including vascular processes, inflammatory damage, and cancer. L-Ascorbic acid (L-AA, vitamin C, ascorbate) is the most effective and least toxic antioxidant. Vitamin C may also contribute to the maintenance of a healthy vasculature reduce atherogenesis through the regulation of collagen synthesis, prostacyclin production, and nitric oxide. The second US National Health and Nutrition Examination Survey reported that a low intake of vitamin C is associated with blood concentrations of vitamin C = 0.3 mg/dl, whereas blood concentrations in well-nourished persons fluctuate between 0.8 and 1.3 mg/dl. An increase in intake of vitamin C is associated with health status. Vitamin C is an essential nutrient for humans; unlike most mammals, we cannot synthesize vitamin C, and therefore must acquire it from the diet. For adults, dietary needs are met by a minimum intake of 60 mg/day. However, the preventative functions of vitamin C in aging related diseases provide compelling arguments for an increase in dietary intakes and RDAs. Men and women who daily consumed four vegetable and fruit servings had mean vitamin C intakes of 75 and 77 mg, respectively. Men and women who consumed five daily vegetable and fruit servings averaged 87 and 90 mg vitamin C, respectively.

The primary contributors to daily vitamin intake are fruit juices (21% of total), whereas all fruits together contributed nearly 45% of total vitamin C intake. Relatively high amounts of vitamin C are found in strawberries and citrus fruits, although the availability of vitamin C within these food sources will be influenced by numerous factors. Virtually all of the vitamin C in Western diets is derived from fruits and vegetables. In general, fruits tend to be the best food sources of the vitamin. Especially rich sources of vitamin C are blackcurrant (200 mg/100 g), strawberry (60 mg/100 g), and the citrus fruits (30–50 mg/100 g). Not all fruits contain such levels, and apples, pears, and plums represent only a very modest source of vitamin C (3–5 mg/100 g).

Processed products:

Dehydrated fruits attract attention because they can be easily produced, can be stored and transported at relatively low cost, have reduced packing cost, and their low water content avoids the development of some microorganisms responsible for deterioration of fresh food. Because of the presence of numerous antioxidant and anti-inflammatory phytochemicals, dried fruits can be excellent natural resource for preventing cancer. Since oxidative stress and chronic inflammation play important roles in cancer development,

dried fruits with antioxidative and anti-inflammatory properties hold promise for cancer chemoprevention. The antioxidant, anti-inflammatory and chemopreventive activities of dried fruits are largely attributed to their polyphenols and vitamins. Dried fruits contain adequate amounts of bioactive principles, such as anthocyanins, acetogenins, catechins, coumarins, phenolic acids, terpenes, xanthones, and others. Since numerous health beneficial phytochemicals in fruits are conserved even after processing, regular intake of dried fruits can help prevent cancer. The antiinflammatory, antioxidant, and chemopreventive activities of dried fruits are largely attributed to their polyphenols and vitamins. Despite the processing-oriented loss certain active ingredients, dried fruits retains considerable amount of bioactive phytochemicals, such as anthocyanins, acetogenins, catechins, coumarins, phenolic acids, terpenes, xanthones, and others. Freeze-dried mangosteen fruit peel, rind and arilparts also contain high content of phenolic acids, such as hydroxybenzoic acid derivatives (e.g., p-hydroxybenzoicacid, protocatechuic acid, vanillic acid), hydroxycinnamic acid derivatives (e.g., p-coumaric acid, caffeic acid, ferrulic acid), and other phenolic acids (e.g., benzoic acid, cinnamic acid, p-hydroxyphenylacetic acid). Prunes are dried plums which belong to the Rosaceae family that

originated in the Caucasus region of Western Asia. It was reported that the antioxidant capacity of prunes extracts was the highest among dried fruits. Although carotenoids in fresh plums undergo degradation during processing into prunes, adequate amount of lutein, β-carotene and α-carotene were detected in prunes. Dried prunes also contain β-carboline alkaloids and phenolic compounds, such as chlorogenic acid, neochlorogenic acid, hydroxycinnamates and oligomeric proanthocyanidins. Prunes may have protective effect against colorectal carcinogenesis. Fig fruit is widely used both as a food and as medicine in the Middle East. The dried fig have been reported as an important source of vitamins, minerals, carbohydrates, sugars, organic acids, phenolic compounds, high amounts of fiber and polyphenols. Moreover, higher concentration of organic acids and phenolic compounds, such as chlorogenic acid, catechin, epicatechin, kaemferol- 3-O-glucoside and luteolin-8-C-glucosides were also detected in either sun-dried or oven-dried figs as compared to fresh figs. Thus, dried figs may be utilized for the prevention and therapy of cancer. Raisins contain higher amount of phenolics than fresh grapes. Major phenolic compounds of raisins are phenolic acids and flavonols. However, drying process leads to the loss of vitamin A, C and K in raisins and procyanidins and flavonols are decomposed during processing of

raisins. However, the presence of adequate amount of isoflavones, such as diadzein, genistein and chlorogenic acid in raisins suggest the cancer chemopreventive potential of these dried fruits.