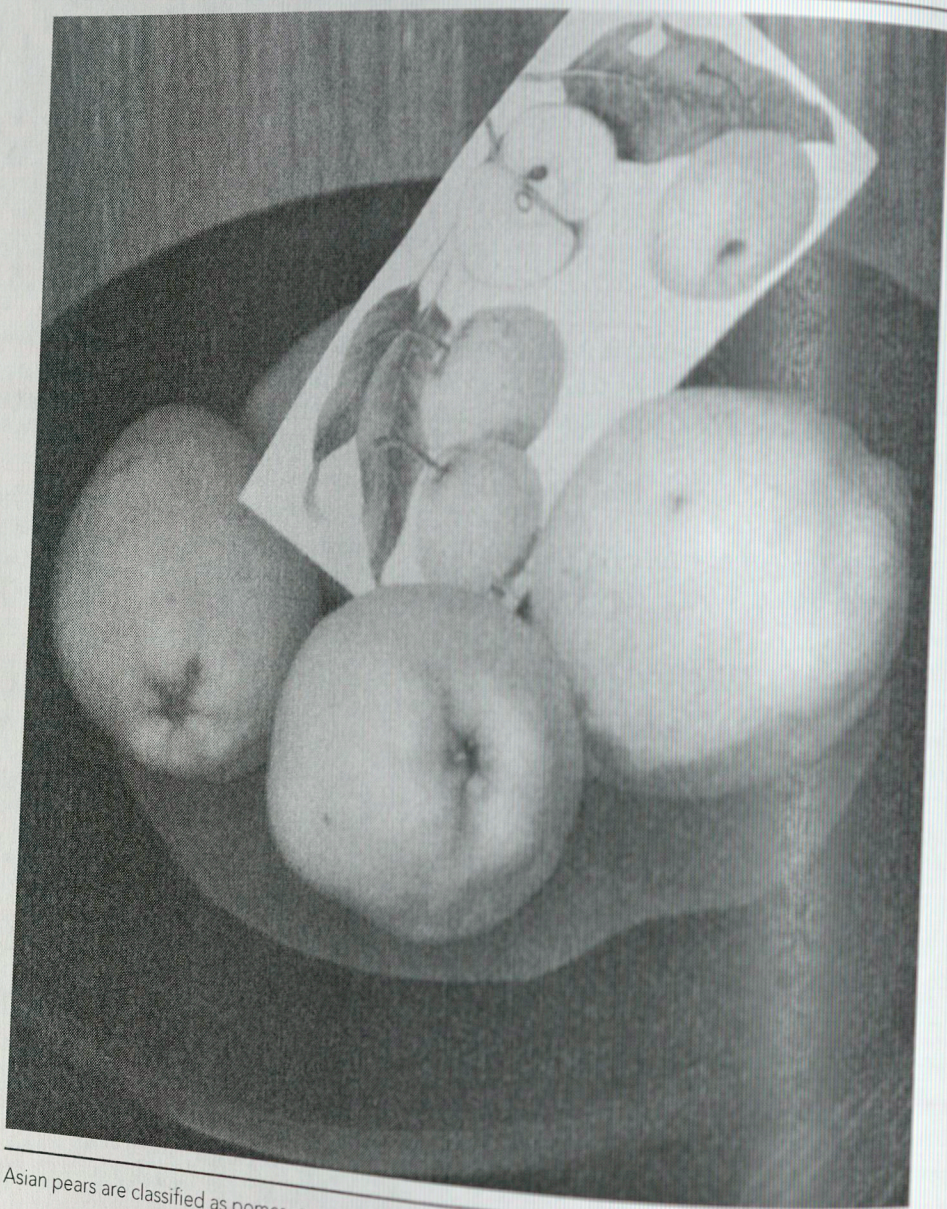




Asian pears are classified as pomes. Courtesy of Plycon Press.

6

Fruits

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Key Concepts

1. Fruits generally are more delicate and perishable than vegetables.
2. The varied types of fruits (berries, citrus, drupes, grapes, melons, pomes, and tropical and subtropical) provide not only good sources of vitamins and minerals but also a broad spectrum of colors, flavors, and textures.
3. Careful selection and storage of fruits will provide optimum quality of fresh, frozen, canned, and dried fruits.
4. Control of osmotic pressure is important when preparing fruits with fragile cells.

Fruits—fresh, frozen, canned, or dried—are favorite foods for many people. They are popular at all meals of the day and as snack foods, too, for they are often eaten raw and require little preparation except washing. Fruits have flavors tinged with sweetness and textures ranging from crisp to very soft to brighten any meal or snack. In contrast, vegetables require some skill and imagination to bring them to the table as a meal highlight. The challenge with fruits is to select those of high quality and then store them appropriately until they are prepared for simple or elegant service.

The array of fruits available to today's consumers throughout the year would have amazed even royalty 50 years ago, for wealth alone could not have bought items considered standard fare today. The secret of this difference is a combination of significant changes in shipping and marketing practices, plus agricultural innovations (Figure 6.1).

Summer is still the height of the fruit season, but even in winter the choices extend far beyond the traditional oranges, grapefruit, and apples of yesteryear. Not only are many fruits available, but choices must also be made among the fresh, frozen, canned, and dried fruits in the market. This chapter considers the fascinating array of fruits, their selection, nutritive value, care, and preparation.

CLASSIFICATION

Fruits are defined as being the edible, more or less succulent products of a tree or plant and consist of ripened seeds and adjacent tissues. Although a few fruits actually will end up classified as vegetables because of their use in the main course of a meal (tomatoes, for example), the majority will be used for salads, desserts,



Figure 6.1

Fruits in markets today often have traveled thousands of miles and yet are in excellent condition to broaden the spectrum of food choices. Courtesy of Plycon Press.

or as a flavor accent in combination with a savory because of their naturally sweet flavor. Some order can be made out of the many fruits by classifying them into groups or families on the basis of shape, cell structure, type of seed, or natural habitat. Commonly, fruits are categorized according to the following groups: berries, citrus, drupes, grapes, melons, pomes, and tropical and subtropical.

Berries

Berries typically are small fruits with a fragile, easily damaged cell structure. These fruits rely heavily on a high content of water within the cells to give the juicy plumpness associated with them. This high water content accompanied by thin cell walls causes berries to lose their notably juicy and slightly firm

character if they are frozen and thawed; the sharp ice crystals that form during freezing rupture cell walls and release the juice. Familiar members of the berry group include blackberries, blueberries, boysenberries, red and black raspberries, youngberries, cranberries, gooseberries, huckleberries, and strawberries. Less familiar berries that can be found occasionally are lingonberries (Figure 6.2), cloudberry (natives of the Arctic Circle), and dewberries.

As a group, berries often are used fresh as desserts, served simply in a bowl, or made into baked products, such as a fresh berry pie or other types of bakery goods. They also can be made into gourmet pies by preparing a glaze into which the fresh berries are stirred in preparation for filling a baked piecrust.

Raspberries, blueberries, and strawberries have a wide sale in the frozen food market. Blueberries are even marketed in blueberry muffin mixes. Pancakes and waffles become festive when they are topped with berries in the form of fresh fruit, syrups, or even jams and jellies. Cranberries earn their special place by being available in the fall when many other fruits have faded. They are unique among the berries in their diverse forms in cranberry sauce, jelly, and juice.

Citrus

Citrus fruits, including oranges, grapefruit, lemons, tangerines, limes, and temple oranges are a rich source of vitamin C. Nutritionists recommend serving a citrus fruit daily. The inability of the body to store vitamin C efficiently has been a boon to the citrus industry, for oranges and other citrus fruits are year-round crops and a comparatively inexpensive source of this essential, but somewhat elusive, vitamin. The menu need not be limited to these citrus sources of vitamin C.

Kumquats and citron are eaten only rarely, yet they also can provide this vitamin.

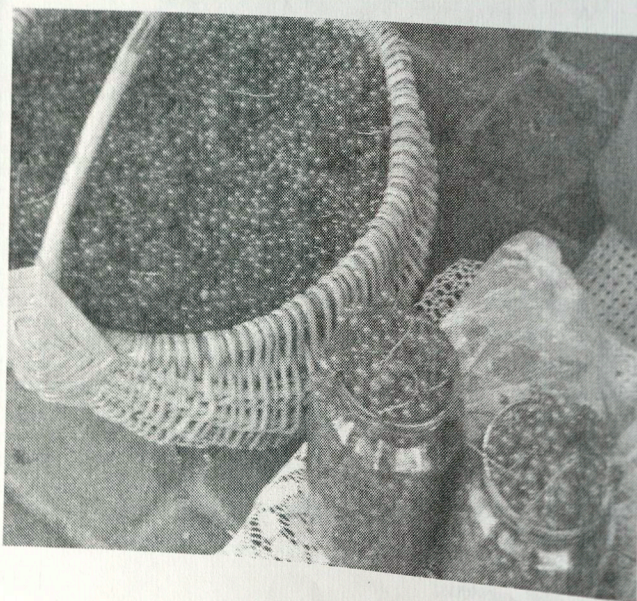
The two common types of orange in U.S. markets are Valencias and navels. Valencia oranges, preferred for juice, can be distinguished from navel oranges by examining the bottom of the orange. The bottom of the Valencia is smooth, whereas the bottom of the navel has a formation that is the beginning of an orange within an orange. Navels peel more easily than do the Valencias, are seedless, and slice readily; these attributes make navel oranges particularly popular for eating.

The popularity of oranges extends far beyond their role as a provider of vitamin C. The delightful flavor of oranges lends a pleasing accent to other foods; the bright color is yet another asset. Commercially, the production of orange juice to be marketed fresh (single-strength), canned, or as frozen concentrate is a big business, for this is a convenience food that is a welcomed time saver in many U.S. homes. Also of interest is the fact that the

Figure 6.2

Lingonberries are too fragile to ship from Scandinavia, so they often are made into jam for distant markets.

Courtesy of Plycon Press.



white (albedo) portion of the skins of citrus fruits is a major source of pectin, which is used in manufacturing jams and jellies.

The tangerine, another type of citrus, has the shape of a slightly flattened orange. Its particular virtue is the loosely fitting skin, which can be peeled off with almost no effort; on the other hand, the sections of flesh contain a number of seeds that have to be removed. Mandarin oranges, actually a type of tangerine, are utilized in the canned form frequently as a salad and dessert ingredient (Figure 6.3). A close relative is the tangelo, which is a hybrid between a grapefruit and a tangerine. Temple oranges are another result of breeding experiments by botanists. This very pleasing citrus fruit has the juiciness of oranges and the easy peeling of tangerines.

Grapefruit, the largest of the citrus fruits, is enjoyed not only in the United States but also from South Africa to Israel. The flesh may be either white or pink. Although grapefruit frequently are eaten simply cut in half, they are excellent also when broiled, perhaps topped with a bit of brown sugar and served hot. Southeast Asia is the source of the pomelo, a very large citrus that looks like a giant grapefruit with an excessively thick skin; its taste is less tart than grapefruit (Figure 6.4).

Lemons are a particular boon to people who are trying to follow weight-reduction diets because a squeeze of lemon juice or a bit of grated lemon rind can add an exciting flavor accent to many different foods without adding enough calories to mention. For instance, a touch of lemon on a green salad can replace a high-calorie salad dressing and give a pleasing flavor. Lemons can also be used in high-calorie preparations such as lemonade and lemon meringue pies, as well as in other desserts that rely on large quantities of sugar to compensate for the tartness of the lemon juice.

Two other citrus fruits are kumquats and citron. Kumquats, originally from China, now are grown in Florida and California. The fruit is only about an inch long and, because of its size, makes an attractive garnish when used raw, preserved, or candied. Citron, a fruit from the hot deserts of the Middle East and now grown in California and Florida, resembles a large avocado with a very thick peel. Citron is valued for its edible peel, which ordinarily is candied and used in fruit cakes and some holiday cookies.

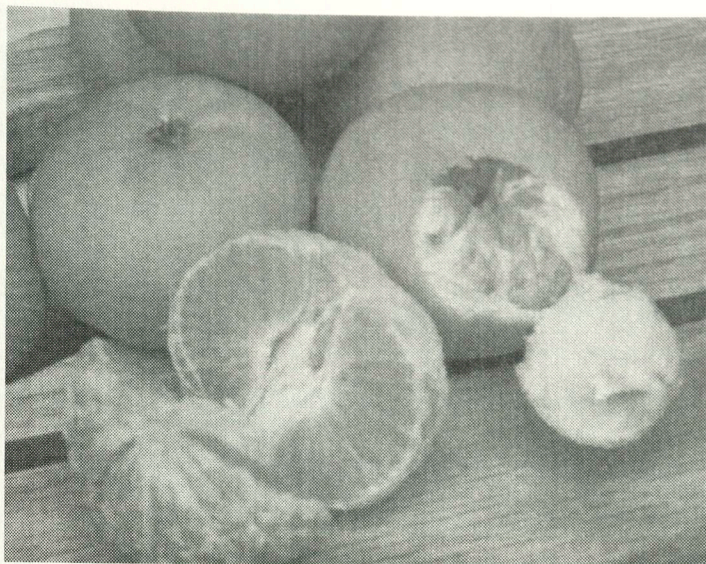


Figure 6.3

Mandarin oranges have a skin that peels easily and sections that separate readily, characteristics that make them an ideal snack.

Courtesy of Plycon Press.

http://www.hort.purdue.edu/newcrop/morton/mandarin_orange.html

—Information on mandarin oranges.

INDUSTRY INSIGHT

PRODUCTS AND BY-PRODUCTS

The food industry, of necessity, must focus attention not only on the principal product being prepared but also on potentially marketable by-products that might otherwise be discarded without generating income and actually cost money for disposal. Examples of successful ones from the citrus industry are numerous, including limonene for use in producing resins and soaps, as well as potential use in food flavorings; cold-pressed oils for flavoring juices, other beverages, and candies; essences to enhance juice flavors; pectin, a complex carbohydrate thickening agent; and molasses and dried pulp for animal feed.

Microbiological contamination of citrus products has to be monitored carefully and controlled to avoid possible health problems because the juice products, in particular, are very supportive of the growth of microorganisms that

thrive in cool, moist, and acidic environments. (The typical acidity of orange juice falls within the range of pH 3–4.) Consumers have been quick to accept single-strength (also called ready-to-serve or RTS) orange juice because of the freshness and quality. However, freshly squeezed juice has a limited shelf life unless extremely careful sanitary controls are exercised and temperature is controlled during production and marketing. Light pasteurization, which entails holding a liquid at 185–203°F (85–95°C) for 15–60 seconds, is a suitable means of helping to control microbiological growth during storage of RTS orange juice. Although this mild heat treatment alters the volatile flavoring compounds contained in the juice, the effect is quite minimal—certainly far less than the changes found in juice reconstituted from frozen concentrate.

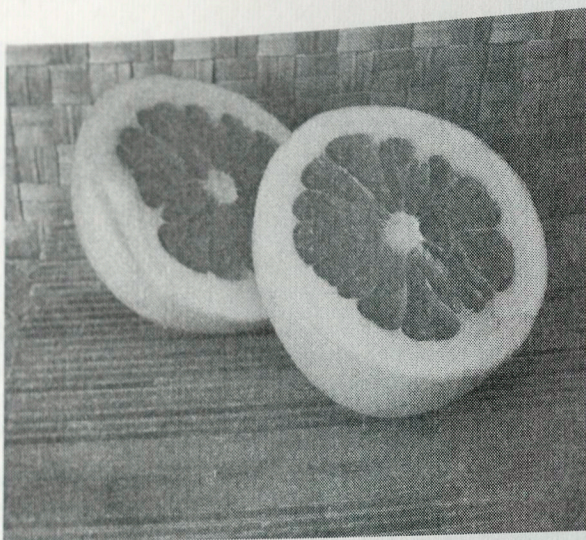


Figure 6.4

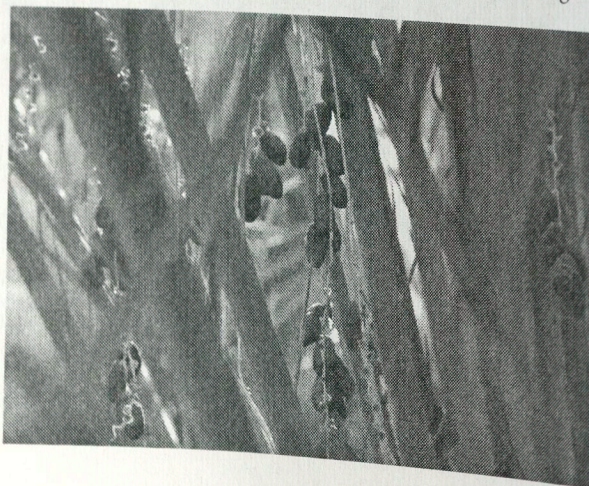
Pomelo is a citrus that looks like a giant grapefruit with an extremely thick rind and a sweeter taste. Courtesy of Plycon Press.

drupe Fruit with a single seed surrounded by edible pulp.

muskmelon One of two general subdivisions of melons; includes cantaloupe, honeydew, and other melons characterized by having a thick pulp surrounding a large central cavity full of small seeds.

Figure 6.5

Dates hanging in clusters from a date palm tree in Oman; they are classified as drupes because of the thick flesh surrounding a single seed. Courtesy of Plycon Press.



Drupes

Drupes are fruits that have a single large seed surrounded by edible pulp. Apricots, cherries, peaches, plums, and prunes are familiar drupes. These fruits are popular in many forms—fresh, frozen, canned, in jams and jellies, and sometimes even dried. A showy example of a drupe is the maraschino cherry, which is made by bleaching sweet cherries with sulfur dioxide and then adding food coloring. Prunes, apricots, and peaches are popular dried; apricots and peaches usually are sulfured to retain their familiar orange color.

Somewhat less common examples are mangoes and dates (Figure 6.5). Dates, formerly an exotic fruit from distant oases overseas, now are grown commercially in California. The three stages of ripening (*khalal*, developing of a yellow or red color; *rutab*, softening; and *tamar*, time for curing the fruit) culminate in the curing of dates high

in sugar content. Their sweetness makes them popular in baked products, salads, and confections as well as in milk drinks.

Grapes

Grapes are an important fruit crop in many parts of the world, valued both for the fruit itself and for the wine that can be made from certain varieties. Table grapes are available in such varieties as Thompson seedless, Flame Tokay, Emperor, Muscat, Malaga, and Concord. These stem from two basic types—the American grape with its round shape and the European grape, typified by an oval outline. The familiar blue Concord grape is an example of an American grape, and the Thompson seedless is classified as European.

Concord grapes are eaten fresh in season, but they also are the basis of many commercial products, including grape jelly, jam, preserves, juice, and frozen grape juice concentrate. Other grapes are used to make commercial products. Thompson seedless grapes are canned in fruit cocktail and are made into raisins by sun drying. Muscat grapes and currants are other popular dried products.

Melons

Melons, unlike most other fruits, generally are restricted to use as the fresh fruit. Preservation methods cause undesirable textural changes, with the exception of watermelon pickles. Even freezing presents problems; freezing damages the delicate cell structure, resulting in a slippery and slightly unpleasant texture when thawed.

Fortunately, melons can be grown over a rather wide geographic area from north to south, so the growing season for melons is fairly long. For instance, melons grown in the Imperial Valley of southern California are shipped to markets from the middle of May until early July, at which time northern California takes over the market, only to relinquish it again to the Imperial Valley for a fall crop.

The two general categories in the melon group are watermelons and muskmelons (Figure 6.6). **Muskmelons**, with their central cavity filled with seeds and thick, colorful pulp under a thin outer skin, are subdivided into several familiar varieties: cantaloupe, honeydew, Persian, casaba, honey ball, and Crenshaw.

Persian melons, noted for their thick, orange-colored flesh, are closely related to cantaloupe, while casaba has a soft flesh and creamy color. Persian and casaba melons were crossed to produce Crenshaw, a variety with a rich flavor

**Figure 6.6**

Watermelons are a type of melon that is enjoyed not only in Kenya but also in the United States and many other countries around the world.

Courtesy of Plycon Press.

and lovely salmon color. Both casaba and Crenshaw melons have excellent marketing characteristics, for they are best if picked green and ripened off the vine, which makes shipping comparatively easy. Cantaloupe and Persian melons present shipping problems; they are best when allowed to ripen on the vine. Honeydew melons provide a distinct contrast to other melons because of the very sweet flavor and delicate green color. Occasionally, honeyball melons are seen in markets. They have an exterior resembling honeydew, while the interior is similar to a mild-flavored cantaloupe.

Pomes

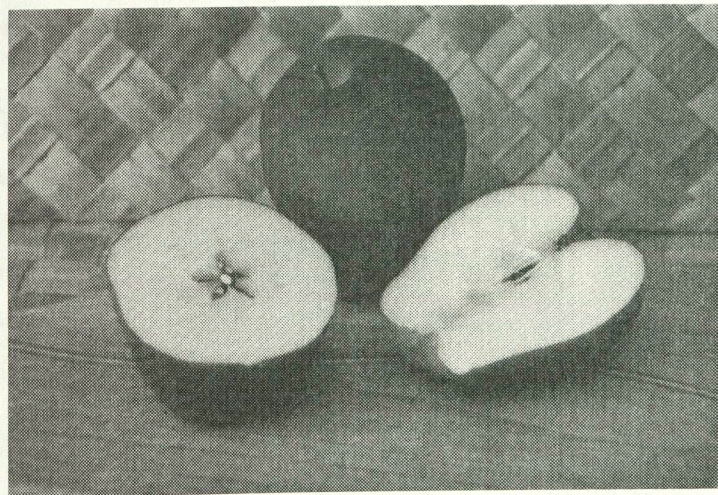
Pomes are fruits from the botanical family Malaceae, which is characterized by a central core containing five encapsulated seeds surrounded by a thick and fleshy edible layer. This core structure is characteristic of all of the fruits classified as pomes (Figure 6.7). Familiar pomes are apples, pears, and quince. Apples are particularly common in the American diet, due to their great versatility and their excellent keeping qualities. Commercially, apples are processed into juice, vinegar, jelly, apple butter, applesauce, and pie fillings. They may also be dried in slices or used in frozen pie fillings. In the home, baked apples, apple pie, fruit salads, and apple fritters are just some of the ways in which apples are incorporated into the diet.

Pears can be used in many recipes interchangeably with apples. For instance, pears can be used in fruit salads and in making a pear pie. The greater juiciness of pears makes it necessary to make some adjustments in some products, such as quick breads where liquid levels are particularly important. Bartlett pears are a rich yellow color when ripe; d'Anjou pears are still green in color but yield slightly to pressure when ripe; Bosc pears have a brown network on the skin, called russeting, which makes them appear rather brown when ready to use.

www.rainierfruit.com/consumers/wax.html

—Information about apples, cherries, and pears.

pome Fruit with a central core containing five seeds surrounded by thick, edible pulp; apples, quince, and pear are examples.

**Figure 6.7**

An apple is classified as a pome because it contains five seeds encapsulated within the core. Courtesy of Plycon Press.

www.itfnet.org

—International Tropical Fruit Network website; overview of many tropical fruit crops.

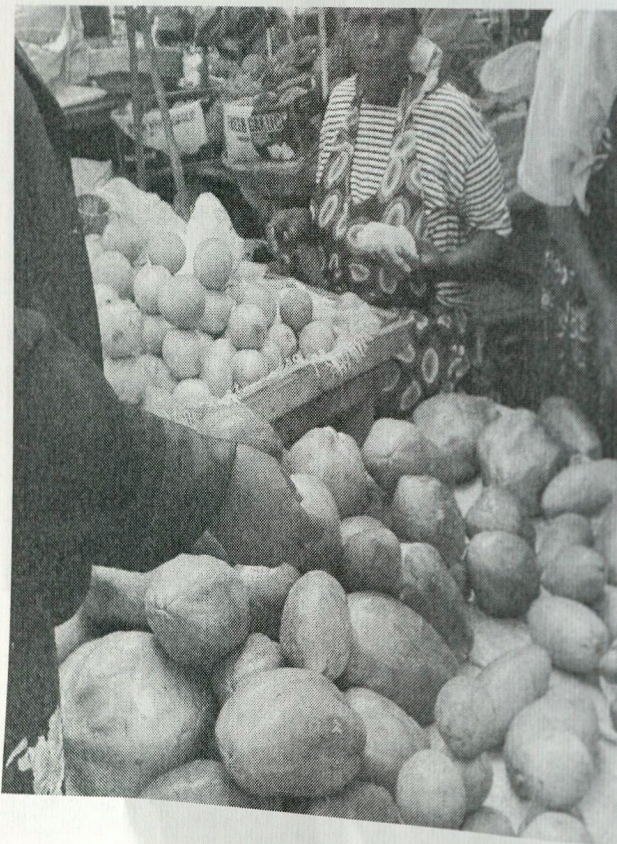
http://www.friedas.com/index.cfm?show=products_category&side=products&category=Fresh%20Specialty%20Fruits

—Information on tropical and other unusual fruits.

re-greening Reversal of color to green on some ripe oranges if chlorophyll becomes dominant over carotenoids.

Figure 6.8

A shopper pauses to buy papayas (left) and mangoes (right) in this tropical farmers' market. Courtesy of Plycon Press.



Tropical and Subtropical Fruits

Tropical and subtropical fruits usually are available throughout the year because of today's excellent transportation facilities. Although they may have to be shipped from distant ports, they still can serve as alternative sources of vitamin C in the diet. They also are important because of the interest they can add to menus.

Among the popular tropical and subtropical fruits are avocados, pineapples, papayas, mangos, bananas, figs, dates, and pomegranates. The avocado is unique among fruits because of its comparatively high fat content (about 13 percent) in contrast to other fruits having negligible levels of fat. Gros Michel is the variety of banana commonly used for eating and in salads and various baked products. Caribbean recipes call for another type of banana, the plantain, a starchy banana suitable for frying and baking, but not ordinarily consumed raw.

Figs were popular in the Mediterranean countries many centuries ago, but in the United States today they are best known as canned kadota figs or as the filling in Fig Newton® cookies. Now they are grown in California and can be shipped fresh from the tree in late summer. Although fresh figs have limited availability because they are quite perishable, dried figs (the usual form) can be purchased all year.

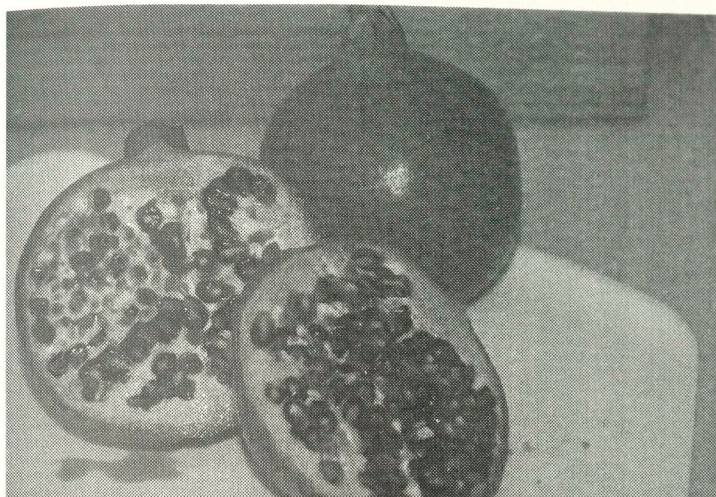
Pineapple, found originally in Central America, now is available on a large scale from Hawaii, with Puerto Rico and Florida also adding to the supply. In Hawaii, pineapple production and processing still represent a key industry, despite the fact that real-estate ventures are beginning to crowd out some of the land once devoted to raising this key tropical fruit. Nevertheless, a large volume of pineapple, in the form of juice, spears, rings, crushed, and chunks, is shipped regularly to the mainland.

Another important tropical fruit exported from Hawaii to the mainland and also from other tropical lands is the papaya (Figure 6.8). The delicate flavor and lovely orange color make this fruit a welcome addition to fruit salads or poultry salads; papayas are excellent when served alone, sometimes heightened by a squeeze of lime or lemon juice. Surprisingly, even the seeds of papayas can be used as food, for they can be ground and used in salad dressing. The papaya is a source of the enzyme papain, used in tenderizing less tender cuts of meat.

Pomegranates are unique fruits, for they are valued for the edible seeds, which contain a comparatively large amount of a flavorful, red juice (Figure 6.9). The juice may be extracted from the seeds to make grenadine and fruit juice combinations. In the home, the seeds are prized as an attractive red color accent in fruit salads.

PIGMENTS

The pigments found in fruits are classified in the same categories discussed in Chapter 5. As is true in vegetables, fruits contain a blending of pigments (some of which are considered to be phytochemicals potentially useful in protecting against certain chronic diseases). Oranges afford an excellent illustration of this. The rind (flavedo) of most oranges shows just a bit of chlorophyll in addition to the characteristic carotenoid pigments that gave this fruit its name. Oranges are susceptible to a process called **re-greening**, in which the chlorophyll may begin to dominate the carotenoids, often causing consumers to think (erroneously) that the re-greened oranges are not yet ripe. Other pigments also are found in oranges. The white area (albedo) just under the flavedo contains anthoxanthin pigments, while blood oranges contain anthocyanins in the pulp of the fruit.

**Figure 6.9**

Pomegranates, a subtropical fruit, are gaining in popularity because of their pretty reddish color and the anthocyanin and other phytochemicals in the juice from the seeds. Courtesy of Plycon Press.

Very few vegetables provide examples of anthocyanins, but fruits illustrate the range of anthocyanins clearly. Delphinidin is a blue anthocyanin found in Concord grapes; other fruits run the gamut of potential colors in the anthocyanin group, from the blue of the Concord grape through purples to a bright red. Examples of these pigments are found in Table 6.1.

Although color changes during cooking are not generally a problem in fruit cookery, there is considerable potential for problems when fruits containing anthocyanins are combined. The addition of an acidic juice such as lemon juice to an anthocyanin-containing fruit juice will heighten the red, which is usually acceptable. However, the juices containing anthocyanins may become blue when they come in contact with hard water or are otherwise brought to an alkaline reaction. The pigments in strawberries and cranberries are quite stable, which makes them useful as ingredients when a red color needs to be maintained in a fruit juice mixture.

Flavonoids (both anthocyanins and anthoxanthins) are capable of complexing readily with metal ions, causing undesirable color changes. Thus, fruits containing these pigments should be kept away from aluminum, iron, or tin.

COMPOSITION OF FRUITS

Most fruits have high water content, ranging between 80 and 90 percent, with watermelons and muskmelons at the upper end (about 92 percent moisture level). Even dried fruits are about 25 percent water. The carbohydrate levels in fresh fruits range generally from about 3 to 14 percent. Protein and fat are notably low in fruits (except the avocado). Table 6.2 provides information on the composition of some familiar fruits.

TABLE 6.1
ANTHOCYANIN PIGMENTS IN FRUITS

Anthocyanin Compound	Color	Examples in Fruit
Delphinidin	Blue	Concord grape
Cyanidins	Purple to deep red	Bing cherries, sour cherries, blueberries, raspberries, boysenberries
Pelargonidin	Red	Strawberries, red raspberries

TABLE 6.2
AVERAGE VALUES OBTAINED IN THE ANALYSIS OF SELECTED FRUITS^a

Fruit	Water (%)	Calories	Carbohydrate (g)	Vitamin A Value (IU)	Ascorbic Acid (mg)
Apples, 1 medium	84	81	21	73	8
Apricots, 3	86	17	55	3173	8
Avocado, 1/2 of 10 oz	73	50	2	174	2
Banana, 1 medium	74	109	28	96	11
Cantaloupe, 1c cubed	90	56	13	5158	68
Grapefruit, 1/2 medium	91	37	9	319	47
Navel orange, 1 large	87	62	15	269	70
Peach, 1 medium	88	42	11	524	6
Pear, 3" x 2 1/2"	84	98	25	33	7
Pineapple, 1c diced	87	76	19	36	24
Strawberries, 1c	92	50	12	45	94
Watermelon, 4" x 8" slice	92	92	21	1047	27

Source: United States Department of Agriculture.

^aAll values are for the raw fruits.

http://www.nal.usda.gov/fnic/foodcomp/Data/HG72/hg72_2002.pdf

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The type of carbohydrate found in individual fruits varies with the maturity of the fruit (Figure 6.10), but the total amount of carbohydrate remains relatively constant as the fruit develops from the green to mature state. Starch content, high in immature fruits, usually declines as ripening occurs, whereas the sugar level rises. This relationship in these two forms of carbohydrate reflects the gradual transition of starch into sugar with maturation, a change that can be detected in the sweet flavor of ripened fruits. Actually, there is a remarkable range in the sugar levels found in ripe fruits, from only about 1 percent for avocados to about 61 percent in dates. The types of sugars include fructose, invert sugar (an equal combination of glucose and fructose), sucrose, and glucose, all of which add a sweet taste to the fruits in which they are found.

Much of the structural material of fruits is other indigestible carbohydrates, commonly referred to as fiber or roughage. These structural components, so important to texture, occur in differing proportions in the various fruits.

Cellulose is one of the key constituents (Chapter 5), particularly in the dermal cells forming the protective skin in fruits. The vascular (those carrying food and water to the parenchyma cells) also contain cellulose in their cell walls. The parenchyma cells are the type of cell comprising most of the edible pulp in fruits, and these also have some cellulose in their walls.

In addition to cellulose, hemicelluloses add to the strength of cell walls, particularly in the parenchyma cells. The pectic substances are complex carbohydrates that help to cement the individual cells together in fruits. Changes in pectic substances are responsible in large measure for the change observed in the hard texture of green fruit to the mushiness of very ripe fruit.

Other important constituents in fruits are enzymes and organic acids. The enzymes are of interest because they are responsible for effecting changes in fruits during the ripening process, including softening of the fruit and development of sugar, as well as other flavor components of the ripened fruit. Unfortunately, sometimes enzyme action causes browning on the cut surfaces. Organic acids are of importance both because of contributions to flavor and to the role they play in preservation techniques, specifically in canning and in making jams and jellies (Chapter 19).



Figure 6.10

The blossom at the end and small bananas can be seen forming on the stalk projecting left from the banana tree (in front of the date palm tree at an oasis in Oman); starch in the bananas will gradually change to sugars as the fruit matures. Courtesy of Plycon Press.

NUTRITIVE VALUE

People have long been aware that fruits are important sources of nutrients, even though the specific nutrients in individual fruits may have remained a mystery to them. The actual contributions of the various fruits include a range of nutrients, but fruits, as a group, are important nutritionally primarily for their contributions of vitamins A and C, supplemental contributions of calcium and other minerals and vitamins, as well as their excellent fiber content. Fruits also are a good source of energy because of the sugar they provide in the diet.

As can be seen in Table 6.2, some of the yellow fruits (apricots, peaches, and cantaloupe, for example) are potential sources of vitamin A because they contain carotenes, which can be converted to vitamin A in the body. Several other fruits are outstanding sources of ascorbic acid or vitamin C, and most fruits contain at least some of this vitamin. Citrus fruits are abundant year round and are rich sources of vitamin C, while many of the tropical and subtropical fruits and also berries afford other outstanding sources of this vitamin.

Fruits also contribute to the day's total intake of minerals. Dried fruits are relatively good sources of iron. Some calcium is contained in oranges, with other fruits contributing minor amounts. Although oranges are useful in supplementing the calcium from milk, their level is inadequate as the primary source of this key mineral. However, commercially processed orange juice can be purchased with added calcium and vitamin D to approximate the levels of these in milk.

The need for fiber to help promote motility of the digestive tract is extremely important from the standpoint of good health, even though the fiber is not actually absorbed into the body

and used in the ways that nutrients are. Therefore, fruits are important foods in the diet, for they provide excellent amounts of cellulose, hemicelluloses, and pectic substances, all of which are components of fiber.

MARKETING ASPECTS

Since fruits often are produced far from the markets where they will be purchased by consumers (Table 6.3), shipping must be done quickly and economically to bring products to stores while they are still of excellent quality and high in nutrients. To do this, refrigerated trucks and freight cars are utilized. Control of humidity within vehicles and storage areas is vital, for too much moisture favors mold formation and too little causes dehydration and shriveling.

Deterioration during storage and shipping of fruits also can be retarded by controlling the carbon dioxide level in the storage area, for carbon dioxide gas inhibits yeast and mold growth as well as retards the ripening process. Unfortunately, too much carbon dioxide promotes the formation of alcohol in apples and pears. Use of carbon dioxide in storing fruits is not limited to commercial operations. Plastic containers specially designed with a tight cover and small openings to permit some entry of oxygen and to regulate moisture level are available for home use to aid consumers in controlling the ripening of immature fruits. In these containers, the carbon dioxide is produced by the fruits themselves and is trapped in the closed container, a system that functions rather efficiently.

Apples and citrus are particularly good fruits for long-term storage, due in part to their excellent dermal layer. Most other fruits have to move through the marketing chain comparatively rapidly after harvest, which results in close to a glut, with low prices at some times and only "greenhouse" or imported products at high prices during the remainder of the year.

Grapes are an especially perishable commodity because of their tendency to promote mold growth during shipping and storage. The use of sulfur dioxide gas in the storage environment is an aid in reducing problems due to mold.

Bananas and avocados are fruits that will continue to ripen after they have been harvested. This allows them to be picked green and shipped while they are still quite firm, thus reducing the damage incurred during shipping. On the other hand, pineapple, citrus fruits, and some melons (cantaloupe and Persian melons) fail to develop their full flavor potential when picked before becoming ripe.

Ethylene gas is a valuable adjunct to the marketing of some fruits because of its ability to promote ripening and the resultant color changes in fruits. Chlorophyll can be decomposed to

www.cffausa.org/us_con_index.htm

—Chilean fruit crops information.

TABLE 6.3
AVAILABILITY OF FRUITS FROM CHILE

Fruit	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Apples		X	X	X	X	X	X					
Blueberries	X	X	X	X								
Cherries	X										X	X
Grapes	X	X	X	X	X						X	X
Kiwifruit			X	X	X						X	X
Peaches	X	X	X		X	X	X	X	X		X	
Nectarines	X	X	X								X	X
Pears	X	X	X	X							X	X
Plums	X	X	X	X	X	X	X					X
Avocados	X			X								
Clementines												X
Raspberries	X	X	X	X	X	X	X		X	X	X	

reveal the desired carotenoid pigments in oranges when ethylene gas is present in the storage atmosphere. Although the flavor is not changed in these oranges, the enhanced color makes them very marketable. Oranges, bananas, and a few other fruits are ripened in storage by the use of ethylene gas.

Selection of fruit is based to a large extent on the visual message provided by the color and appearance. Since 1922, citrus fruits have been waxed to enhance their appearance. Carnauba wax (from palm fronds) is applied in an extremely thin film to apples, peaches, cantaloupe, and some other fresh produce in such a small amount that a gallon of the wax will coat 5 tons of apples! In the case of oranges, about six drops are applied to each orange, then buffed with brushes to add to the eye appeal. This wax also serves as a protective coating to reduce moisture loss and resultant shriveling and as a shield against decay. Thus, a wax coating helps to extend the period when quality of the fruit will be high.

SELECTION

Fresh Fruits

Select those that are an appropriate size for the intended use when buying fresh fruits. Be sure they are fresh and plump, free of bruises and blemishes, and at the desired degree of ripeness. Freshness can be seen visually by looking for plump, rather than limp, fruits. If at all possible, avoid blemishes and bruises, for these are the areas in which spoilage begins during storage.

When fruits are available in more than one size, the larger size almost invariably will be appreciably higher in price than the smaller one. If the fruit is to be displayed in an arrangement or to be served whole or as a garnish, the large size may be worth the price, but the small size might be used very satisfactorily in recipes at a significant saving.

Fruits often are graded according to federal grading standards, although consumers usually do not see the designation. The Agricultural Marketing Service of the U.S. Department of Agriculture is the agency charged with grading standards for fruits. At the wholesale level, grade is an important determinant of price, which ultimately is passed on to consumers. The federal grades established by the Agricultural Marketing Service are as follows:

- U.S. Fancy Premium produce
- U.S. No. 1 Chief trading grade
- U.S. No. 2 Intermediate quality range
- U.S. No. 3 Lowest commercially useful grade

Often only two of these grades may be used for a specific fruit. Any fruit undergoing federal grading will have its container marked with an official USDA grade shield or a label stating "Packed Under Continuous Inspection of the U.S. Department of Agriculture" or else "Packed by _____ Under the Continuous Federal-State Inspection."

Grade designations of fresh fruit are usually not displayed at the site of purchase, but consumers can make wise decisions by examining the fruit. Table 6.4 provides some information regarding factors to note when making selections in the market. By making mental notes regarding the quality of fruits selected, shoppers can gradually build up an ability to select wisely.

Sometimes choices must be made between varieties as well as within varieties of a fruit. Choice of the right variety depends upon the intended end use for the fruit. For example, Bing cherries and sour (pie) cherries may be available at the same time. The Bing cherries will give particularly good results in salads or simply for eating, while sour cherries are excellent for making cherry pie.

Several varieties of tangerines may also be on the market at the same time. If intended for a child's school lunch, the few seeds and easy peeling typical of Satsuma mandarins would make this a good choice, while the difficulty of peeling the Orlando tangelo and removing its many seeds would be a poor one. Of the tangerines, the Dancy is the variety found most commonly; its easy peeling and tart flavor help to compensate for the annoyance of removing so many seeds.

<http://www.ams.usda.gov/AMSV1.0/ams.fetchTemplateData.do?template=TemplateN&page=FreshMarketFruitStandards>
—Grading standards for fresh fruits.

www.hort.purdue.edu/fruitveg/nutrition_labels.pdf
—Federal guidelines on labeling fresh fruits.

www.rules.utah.gov/publicat/code/r068/r068-004.htm
—Grading regulations for fresh fruits and vegetables in Utah.

TABLE 6.4
A GUIDE TO THE SELECTION OF FRESH FRUITS

Fruit	Desirable Qualities	Characteristics to Avoid
		Overripe; soft and mealy; bruises
Apples	Firm; crisp; good color for the variety of apple	
Apricots	Uniform, golden color; plump; juicy; barely soft	Soft or mushy; hard; pale yellow or green color
Avocados	Firm; bright color; free from bruises	Bruises; discolored skin
Blueberries	Dark blue with silver bloom; plump; firm; uniform size	Bruises; discolored skin
Cherries	Dark color in sweet cherries; bright red in pie cherries; glossy; plump	Shriveling; dull appearance; soft, leaking juice; mold
Cranberries	Plump and firm; lustrous; red color	Soft and spongy; leaking
Grapefruit	Firm; well shaped; heavy for size; thin skin indicates juiciness	Soft and discolored areas; mold
Grapes	Plump; yellowish cast for white or green grapes; red color predominating for red grapes; stems green and pliable	Soft, wrinkled; bleached area around stem; leaking
Lemons	Rich yellow color (pale or greenish yellow for higher acid content); firm; heavy	Hard or shriveling; soft spots; mold; dark yellow
Limes	Glossy skin; heavy	Dry skin; decay
Melons		
Cantaloupe	Smooth area where stem grew; bold netting; yellowish cast to skin	Soft rind; bruises
Casaba	Yellow rind; slight softening at blossom end	Decayed spots
Cranshaw	Deep golden rind; very slight softening of rind; good aroma	Decayed spots
Honeydew	Faint odor; yellow to creamy rind; slight softening at blossom end	Greenish-white rind; hard and smooth skin
Persian	Same as cantaloupe	Same as cantaloupe
Watermelon	Slightly dull rind; creamy color on the underside	Cracks; dull rind
Nectarines	Slight softening; rich color; plump	Hard or shriveled; soft
Oranges	Firm and heavy; bright, fresh skin either orange or green tint	Light weight; dull skin; mold
Peaches	Slightly soft; yellow color between the red areas	Very firm, hard; green ground color; very soft; decay
Pears	Firm, but beginning to soften; good color for variety (Barlett, yellow; d'Anjou or Comice, light green to yellow green; Bosc, greenish-yellow with skin russeting; Winter Nellis, medium to light green)	Weakening around the stem; shriveled; spots
Pineapples	Good pineapple odor; green to yellow color; spike leaves easily removed; heavy for size	Bruises; poor odor; sunken or slightly pointed pips
Plums	Good color for variety; fairly firm	
Raspberries	Good color for kind; plump; clean; no caps	Hard or shriveled; poor color; leaking
Strawberries	Good red color; lustrous; clean; cap stem attached	Mold; leaking
Tangerines	Bright lustrous skin	Mold; leaking; large seeds
		Mold; soft spots

INGREDIENT HIGHLIGHT

GRÄPPLE®

Researchers have infused Fuji apples with grape flavoring and a bit of water to create a unique apple designated as a Gräpple (pronounced with a long a, as in grape, and a nod to the apple with the end of the name). The grape aspect is featured because the grape flavor of the apple is what makes eating a Gräpple a unique experience (Figure 6.11). Its nutritional value is comparable to Fuji apples, and its availability is the same.

Creation of the Gräpple is done using a patented process. This unique approach to creating a new fruit for the market

contrasts with fruits resulting from crossing two different fruits or with genetic modification. Luther Burbank (1849–1926) conducted countless breeding experiments on many plants at his experimental farm in Santa Rosa, California, and is credited with developing numerous varieties of various fruits. To identify just a part of his fruit varieties, he created a remarkable 113 varieties of plums and prunes, 10 apples, 8 peaches, 5 nectarines, and 16 blackberries, plus several other kinds of fruits.



Figure 6.11

Fuji apples infused with grape flavor are marketed as Gräpple®. Courtesy of Plycon Press.

Varieties of apples in the market vary greatly from one part of the country to another, and new ones continue to be developed by researchers. Some are particularly well suited to eating raw and in salads, while others may be used to good advantage in such cooked preparations as sauce, coddling or poaching, baking, and in pies or other baked products. Table 6.5 provides a partial guide to the use of various apples in food preparation.

The seasonal nature of many fruits limits their use in the fresh form to a rather short time period (Figure 6.12). Knowledge of the usual times when each of the fruits may be expected to be available is an aid in menu planning. Generally, the quality of fruits will be the best and the price will be lowest when the fresh fruit is at the height of its season. At such times, generous use of fresh fruits can add considerable interest as well as nutrients to the diet. Of course, many fruits can be obtained frozen, canned, or dried at any time of the year.

Canned and Frozen Fruits

The Agricultural Marketing Service of the U.S. Department of Agriculture is responsible for the federal standards used for grading frozen and canned fruits. The top grade, U.S. Grade A or

www.grapplefruits.com

—Information about
Gräpple®, a grape-flavored
Fuji apple.

TABLE 6.5
SUGGESTED USES FOR SELECTED VARIETIES OF APPLES^a

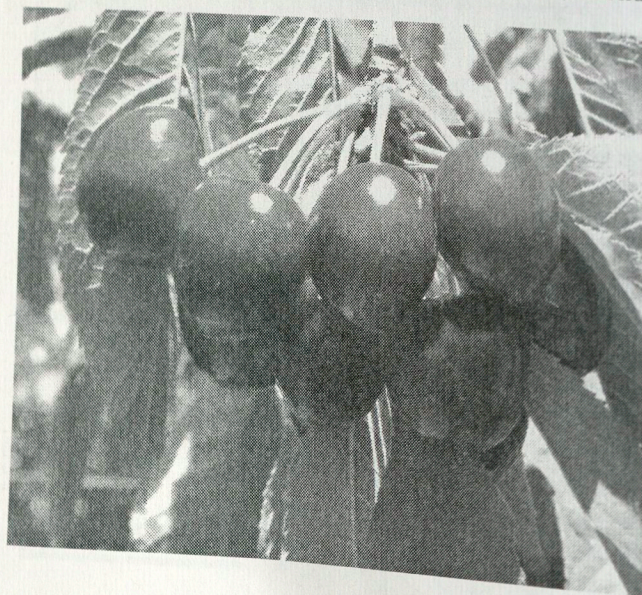
Variety	Use			
	Fresh and Salads	Pie	Sauce and Coddling	Baking
Delicious				
Red	Excellent			
Golden	Excellent	Excellent	Good	Good
Fuji	Excellent	Good	Good	Good
Gala	Excellent	Good	Good	Good
Granny Smith	Good	Excellent	Excellent	Good
Gravenstein	Good	Good	Good	Good
Jonathan	Good	Good	Excellent	Good
McIntosh	Excellent	Excellent	Good	
Newtown Pippin	Good	Excellent	Good	Good
Northern Spy				Good
Rhode Island Greening		Excellent	Excellent	Good
Rome Beauty	Good	Good	Excellent	Excellent
Stayman	Good	Good	Good	Good
Wealthy	Good	Good	Good	
Winesap	Excellent	Good	Excellent	Good
Yellow		Excellent	Good	

^aNo recommendation indicates the variety is not well suited to that use.

Figure 6.12

Cherries are ready for picking in early summer.

Courtesy of Brian Jung.



Fancy, is characterized by fruit of excellent color, uniform size, optimum ripeness, and few or no blemishes. When canned or frozen fruits are being used in fruit plates, as a baked or broiled accompaniment to an entrée, or served alone as a simple dessert, this grade is the best choice and will provide optimum eye appeal. U.S. Grade B or Choice is used to designate fruit that is somewhat less perfect than this grade, but certainly fine for use in molded gelatin products and in fruit mixtures where perfect, large pieces are not needed. The lowest grade available to consumers is U.S. Grade C or Standard; such fruits are wholesome and nourishing, but they will have uneven

pieces and occasional blemishes. These are well suited to making sauces, jams, cobblers, or other products where individual pieces are not of great importance.

Consumers are aided in picking frozen and canned fruits because of labeling requirements. This is fortunate, for the packages usually obstruct the view of the fruit inside, which makes grading or other labeling information essential. Required information includes the following:

1. Common or usual name of the fruit.
2. Form (whole, slices, halves, pitted) if not visible in the container.
3. Variety or color, in the case of some fruits.
4. Syrups, sugar, or liquid used in packing. Canned fruits may be packed in syrups of varying viscosities (extra heavy, heavy, light, extra light) or simply in a water pack. Frozen fruits usually are packed in sugar.

5. Net weight of contents in ounces (also in pounds and ounces or pounds and fractions of pounds for containers between 1 and 4 pounds).
6. Ingredients, including spices, flavoring, coloring, and any other additives.
7. Any special type of treatment.
8. Packer's or distributor's name and place of business.

Nutrition labeling is another feature that must conform to federal requirements for such labels. The Food and Drug Administration monitors nutrition labeling. If the fruit has been canned or frozen under continuous inspection by the U.S. Department of Agriculture, the USDA grade shield can be printed on the label.

Gradually, definitions are established for processed fruit products. For instance, various orange juice products have been defined by the U.S. Department of Agriculture as follows:

<i>Orange juice drink blend</i>	Product containing 70–95% orange juice
<i>Orange juice drink</i>	Product containing 35–70% orange juice
<i>Orange drink</i>	Beverage containing 10–35% orange juice
<i>Orange-flavored drink</i>	Beverage containing more than 0% but less than 10% orange juice

CULTURAL ACCENT FRUITS FROM AFAR

Various tropical fruits are found in many markets today, adding greatly to the dining adventures available. Of course, bananas and pineapples have become commonplace on menus; several others are beginning to gain favor with diners. Cherimoya is a tropical fruit with a medium green, rather intriguing exterior that bears a very slight resemblance to an artichoke (Figure 6.13). The similarity ends there, for the interior has a number of large dark seeds embedded in a smooth, soft flesh that has a slightly sweet, mild flavor. Mexico is the source of many of the cherimoyas sold in this country, but California also grows and markets some.

Carambola, often called starfruit because of its sculpted shape (Figure 6.14), is an intriguing tropical fruit originally from Sri Lanka. It is oblong and has a waxy yellow skin with deep ridges terminating at its end. The texture of carambola is rather crisp, and the flavor is mild and slightly sweet. Cross-sectional slices are in the shape of a star, the points being formed by the ridges of the fruit. These yellow stars make attractive garnishes. This fruit rewards the eye more than the palate of the diner.

Breadfruit is best known to many because of its famous trip from the Philippines in *Mutiny on the Bounty*. Apparently the Spanish deserve credit for bringing this tree

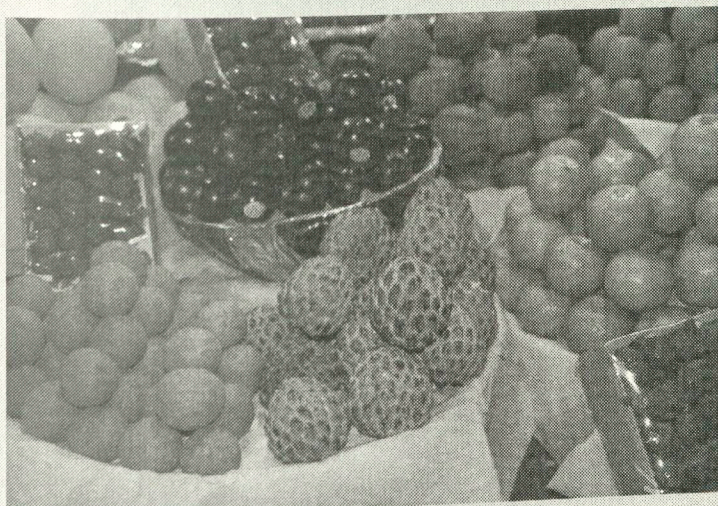


Figure 6.13

Cherimoyas (center front) are surrounded by kiwi, plums, and tangerines.

Courtesy of Plycon Press.

(Continued)

(Continued)

crop to Central America and the West Indies after they encountered it in the Philippines. This large fruit sometimes grows to 18 inches long, a size appropriate to a tree that may be as tall as 85 feet. When still green, the interior is fibrous, white, and quite starchy. It softens a bit and begins to develop a slightly sweet taste as it matures, and the flesh changes to a yellowish color. Breadfruit is a familiar food in the Caribbean.

Dragon fruit, the red fruit of a cactus, has such a dramatic appearance with its scales that it is even used in floral arrangements (Figure 6.15). When it is cut in half, it is evident that the brightly colored skin is fairly thin and encloses a rather mushy pulp containing countless small, edible seeds. The flavor is delicate and reminiscent of

kiwifruit. It is popular in Vietnam and other countries in Southeast Asia, and it is now beginning to enter markets in the United States.

Durian is a rather round, large fruit (about 12 inches long) that is covered with sharp spines all over its rough surface. This fruit is the butt of many jokes because it exudes an aroma reminiscent of rotting cheese when it is cut open. Despite its hostile exterior and the stench, durian is enjoyed throughout Southeast Asia because of its sweet flesh and balsamic aftertaste.

Similarly, jackfruit is a huge fruit (commonly weighing between 10 and 60 pounds) that has a dreadful, rotting smell. Its redeeming feature is the flavor of the pulp, combining overtones of banana and pineapple.

Figure 6.14

Starfruit is appealing to the eye because of its appearance, but its flavor and texture do not live up to the promise. Courtesy of Plycon Press.



Figure 6.15

Dragon fruit has a thin red skin and white flesh surrounding numerous small seeds. Courtesy of Plycon Press.



Since the various definitions provide a wide range in quantity of orange juice, the label must indicate to the nearest 5 percent the percentage of juice actually included in the beverage.

Dried Fruits

Since federal grading standards are rarely applied to dried fruits, selection must usually be based on prior experience and color if the fruit can be seen through the packaging material. Fruits should be firm, yet pliable. Regardless of the type of dried fruit, prices in the market parallel size of the fruit, with prices increasing as the fruits progress through small, medium, large, and extra large.

Dried apples usually have a creamy color, which has been retained through the use of a dip in acidic fruit juice or ascorbic acid prior to drying. Similarly, dried pears are treated to help retain the desired, somewhat yellow color.

Apricots, peaches, and golden seedless raisins ordinarily are exposed to sulfur dioxide fumes while drying so that the desired orange color will not give way to a drab brown. Raisins, prunes, and currants become a deep brown when they are being dried.

Most of the world's dates are grown in hot desert regions in the Middle East and North Africa, but some varieties are also produced in the California desert (Figure 6.16). Some are sold fresh, but many are dried for the retail market.

Sun drying has been the method for preserving certain fruits for thousands of years, but newer methods have evolved and now include freeze-drying, dehydration, and vacuum drying. The moisture levels, regardless of the technique used, are brought to below 25 percent. The exception to this practice is in the case of prunes, some of which are marketed in special packages that inhibit mold development even though the moisture level is above 25 percent. This comparatively high moisture level results in prunes that are soft and pliable, having the advantage of being easily rehydrated by stewing.

STORAGE IN THE HOME

The length of time fruits can be stored successfully in the home depends on the type of fruit and the condition when purchased. When fruits are ripe at the time they are purchased, they need to be consumed as soon as possible and stored at the appropriate temperature, usually in the refrigerator, until served.

Berries of all types are particularly susceptible to spoilage, necessitating a short storage period. Because of their fragile nature and their problems with mold formation, berries should be sorted before they are stored to be sure that any spoiling berries are removed. If this is not done, the spoiled areas will spread quickly throughout the container. Since high moisture promotes molding, berries are not washed when being prepared for storage; instead, they are washed when being prepared and served. Other fruits only need to be inspected before being stored if they were not checked when being selected at the market.

Some tropical and subtropical fruits retain their quality better if they are stored at a cool room temperature rather than refrigerated. Bananas, pineapples, and melons are best held at room temperature unless they are fully ripe. Then they need to be refrigerated to retard the ripening process. However, banana skins will develop a startling brown color at refrigerator temperatures. Citrus fruits ideally are stored just above the temperature in the refrigerator, a difficult condition to provide in most homes. Consequently, refrigerator storage often may be necessary.

Peaches, plums, pears, apricots, and similar fruits frequently are rather green when purchased at the store. These should be kept at room temperature until they achieve the desired degree of ripening. Then, they should be refrigerated and served rather soon.

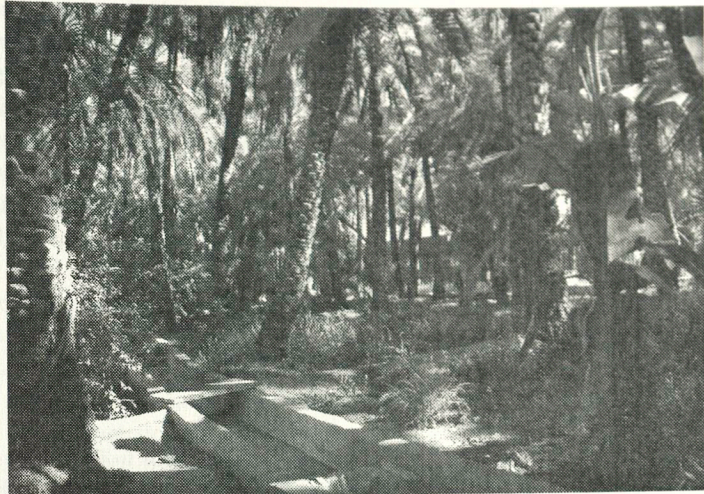


Figure 6.16

Date palm groves in the United Arab Emirates and other hot desert countries ordinarily have a system for irrigating the trees as needed. Courtesy of Plycon Press.

<http://www.fao.org/docrep/006/y4360e/y4360e00.htm>

—FAO report on dates and date palms around the world.

<http://www.palmwonders.com/content/about-dates/>

—Background about dates and date palms in the Arabian Peninsula.

If fruits are likely to be eaten without being washed after they are taken from the refrigerator, the fruit should be washed and wiped dry before being placed in the refrigerator. Exceptions to this recommendation are berries, cherries, and grapes, for these are fruits that tend to mold even during refrigerator storage if their moisture content is high.

Fresh fruits in the refrigerator should be in the hydrator drawers where the small volume of cold air limits the moisture loss and helps to retain high quality. Dried fruits, because they should have low moisture content, can be stored in sealed plastic bags or unopened packages in a cupboard. Unopened canned fruits retain their nutrient levels best if stored in a dark, cool cabinet for less than a year.

PREPARATION

Raw Fruits

Preparation of fresh fruits often is as simple as washing the fruit and serving it raw (whole or sliced) or in salads or as a dessert (Figure 6.17). Both appearance and nutritive value need to be kept in mind when preparing raw fruits. In particular, attention should be directed to retaining vitamin C, which is easily oxidized or dissolved in water. Fortunately, the acidic nature of most fruits is helpful in retaining vitamin C. The key problems to remember in trying to keep vitamin C levels high are the possibility of oxidation by exposing cut surfaces to air and loss by placing in water for soaking. Fruits that are good sources of vitamin C should be prepared as close to serving time as possible and by coating cut surfaces with a solution of ascorbic acid or an acidic fruit juice (lemon, orange, or pineapple works well). These same practices will help to retain vitamin A levels, too.

Fruits have tremendous potential for beautifying a meal when served and arranged artistically. Attractive slices of fruit arranged in a pleasing style may be slightly less nourishing than uncut fruit, but the appealing appearance may tempt people to eat more of it than they would otherwise, with the result that more nutrients actually are consumed. For example, an orange that has been sliced and arranged carefully on a plate is more approachable than is an unpeeled orange. Melon balls, pineapple chunks, ellipses of bananas, and peach slices are some of the variety of shapes available when fruits are cut creatively. The design element of line can be very important when arranging fruits. The beauty that can be created more than compensates for the extra time required to arrange fruits attractively.

Browning of cut surfaces can be a problem in certain raw fruits, such as apples, avocados, peaches, and bananas. This color change is caused by action of oxidative enzymes, especially phenol oxidase, on catechin, leucoanthocyanins, and some other flavonoid compounds. Since this change requires oxygen, the enzyme cannot cause this oxidative change unless the fruit has been cut to expose the cut surfaces to air. The key to avoiding this problem

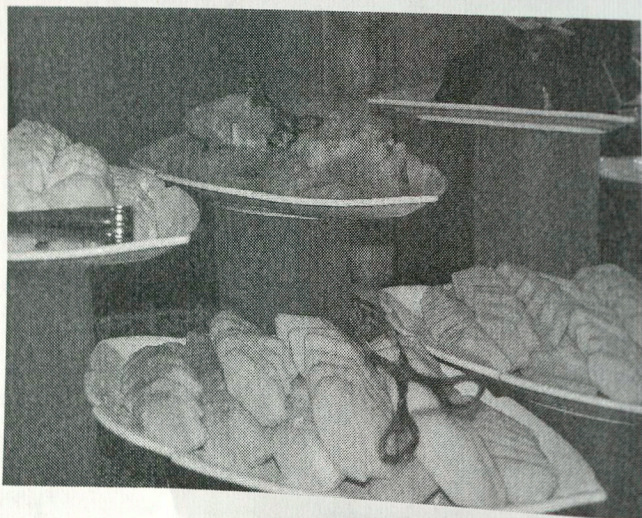
is to block air from the surface. This can be done by dipping the cut fruit into an acidic fruit juice or by sprinkling some granulated sugar on the surface and stirring to spread the sugar uniformly. The sugar draws some water from the cut cells to make a sugar solution on the surface, thus effectively blocking air from the fruit itself. A solution of ascorbic acid is yet another means of preventing browning, in this case by providing ascorbic acid to interact with oxygen and protect the pigments. Browning problems can be reduced by chilling fruit in the refrigerator from the time that it is cut until it is served.

Simmered Fruits

Fruits can be heated gently in water to tenderize them. When fruits are heated in water just below boiling, the

Figure 6.17

Melons prepared by peeling and slicing into attractive pieces are a nourishing dessert with particular appeal to people watching calories. Courtesy of Plycon Press.



process is called poaching, simmering, or stewing. **Poaching** softens the cellulose and other fibrous tissue, modifies the flavor, and halts enzymatic browning. Usually, a limited amount of water is heated to just below boiling in a covered pan containing the fruit. By controlling the heat at simmering, agitation from active boiling is avoided, and the shape of the fruit is retained rather well. Retention of the delicate flavors of fruits is aided by keeping the cover on throughout the simmering period, thus reducing loss of volatile flavoring components.

Apples, pears, and peaches are well suited to simmering without losing their shape. Cranberries and rhubarb also are simmered to make sauces, but their structures are broken, and their shapes become quite blurred during cooking.

Dried fruits frequently are simmered to tenderize and rehydrate them before being served or used in other recipes. Dried plums (also called prunes) and other dried fruits are ready when they can be cut with ease. The actual simmering time required depends on the amount of soaking done prior to simmering, the size of the pieces of fruit, and the amount of cut surface exposed. By soaking dried fruit in warm water for an hour before simmering is begun, the simmering time is shortened. Dried fruits with cut surfaces rehydrate more quickly than do whole fruits because the cut cells provide easy entry into the fruit.

poaching Simmering in water or other liquid just below boiling until food is tender.

SCIENCE NOTE OSMOTIC PRESSURE

Fruits have cells with walls that are semipermeable membranes; that is, water can pass in and out of the cells, but the wall blocks other substances. Equilibrium exists when the concentration of solute is the same on both sides of the cell membrane. However, a change in the concentration of the solute in the solvent outside the cells can cause water to move in or out of the cell, depending on the external concentration. The pressure that builds up to attempt to equalize the concentrations is termed **osmotic pressure**.

Fruits naturally contain sugars dissolved in the water inside the cells. If apples or other fruits are placed in water and simmered, water will begin to move into the cells in an attempt to dilute the sugar present in the cells. The osmotic pressure created in this circumstance can cause so much water to go into the cells that some of the walls will rupture, creating a mushy texture. This is desirable in making a puréed product. This is the reason that sugar is added to taste only after the desired mushy texture has been achieved when making applesauce. The rehydration of dried fruits is also promoted by simmering them in water without adding sugar.

The reverse may also occur with **coddling** fruits, or simmering of fruits in a sugar syrup. The aim is to have just enough sugar in the cooking syrup to approximate the level in the cells. Then water will pass into and out of the cells in equilibrium; it will not build up in excess in the cells. A very slightly lower level of sugar in the cooking syrup will cause a small amount of water to be drawn into the cells of the coddled fruit, giving just a suggestion of plumpness. With prolonged use of the sugar syrup, the loss of water will begin to raise the relative concentration of sugar, and water may start to move from the fruit into the syrup to attempt to equalize the two solutions. When this happens, the fruit being coddled will start to look wizened due to loss of water from the cells. By simply adding a bit of water to the sugar syrup, water can once again be moved back into the fruit cells.

The coating of berries or other fruit with some dry sugar has a dehydrating effect on the fruit. Again, osmotic pressure develops because the high external concentration of sugar draws water out of cells. Evidence of this is seen when strawberries are allowed to sit for a while after sugar has been added. Juice from the berries will begin to collect in the bottom of the bowl, and the berries will begin to droop. Thus, berries should be sweetened just before they are served.

osmotic pressure Pressure exerted to move water in or out of cells to equalize the concentration of solute in the cell and in the surrounding medium.

coddling Simmering fruit in a sugar syrup.

Other Preparation Procedures

A few fruits, notably apples and pears, are well suited to baking, their skins serving as an adequate protection against drying. A considerable amount of pressure can build up in these fruits because of the conversion of some of the juice to steam during baking. To avoid a possible explosion of the fruit, a narrow strip of skin should be peeled around the equator of the fruit. Microwaving rather than baking these fruits saves considerable time. Since browning is not necessary, the lack of browning typical of microwave oven cookery does not present a problem. However, the rapid heating of the fruit is very effective in retaining a good skin color and excellent fresh fruit flavor.

Broiling is a quick way of adding interest to fruits. Grapefruit halves can be broiled, sometimes with a light sprinkling of brown sugar for color and flavor, to make a special breakfast treat or a light dessert after a heavy meal. Canned or fresh peach halves also broil quickly to provide eye-catching garnishes for a meat platter.

Frying is yet another means of preparing fruits. Apple rings can be fried in shallow fat to provide a tasty complement to pork chops. Fruit slices can be dipped in a medium batter and then fried in deep fat at 375°F (190°C) until golden brown and served hot with powdered sugar or syrup.

Fruits are featured in many different recipes for baked products. Some quick breads gain their distinctive flavors from fruits incorporated in their batters. Cranberry, blueberry, orange, date, prune, apple, fig, and lemon muffins are some of the variations possible with a basic muffin recipe. Special breads may be made using various mashed, stewed, canned, frozen, fresh, grated, or candied fruits. Pies may have a sweetened filling made from fresh, canned, or frozen fruits thickened with starch. Grated citrus rinds are excellent flavoring substances for meringue and chiffon pies when care is taken to grate only the flavorful and colorful flavedo of the rind. Cream pies often are made with a layer of various fruits such as bananas, peaches, or strawberries.

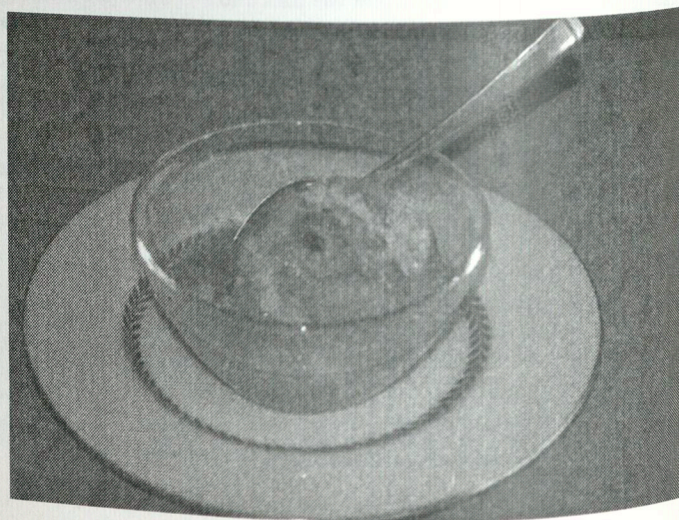
Fruits combine well with other foods to make special desserts. For instance, sliced fruits may be served with a cream pudding, in combination with yogurt, with ice cream in sundaes or parfaits, or even in a cheesecake or a cobbler (Figure 6.18). Cherries jubilee, peach melba, fruit tortes, fruit-filled angel food cakes, and fruit soufflés are other examples of the excitement that fruits can bring to a dessert. Of course, fruit-flavored ice creams and sherbets also have become very popular uses of fruits.

Preparation Using Canned and Frozen Fruits

Canned fruits are used frequently in food preparation because of their convenience and availability throughout the year. Many recipes are based on the use of canned fruits, particularly for the preparation of pies and other desserts. For success in preparing these recipes, it is important to drain the fruit well, using only the amount of juice specified in the recipe to avoid too thin a product. Extra juice can be reserved for some other use or discarded.

Figure 6.18

Peach cobbler is particularly delicious made with fresh peaches, but canned ones can be used when the season is over. Courtesy of Plycon Press.



JUDGING POINTS FRESH FRUITS

- Good color typical of the fruit
- Attractively cut and/or arranged
- Soft, but not mushy if cooked or limp if sugar is added
- Pleasing, bright flavor



Figure 6.19

Fresh pineapple cannot be used in gelatin recipes because bromelain, a protein-digesting enzyme, will prevent setting of the gel structure. Courtesy of Plycon Press.

When pineapple is an ingredient in gelatin products, it is important to use only canned pineapple, never the fresh or frozen fruit (Figure 6.19). The heat treatment in the canning of pineapple is sufficient to destroy its proteolytic enzyme (bromelain). However, the enzyme is active in fresh or frozen pineapple; the result is a gelatin mixture that simply will not set.

Frozen fruits retain the bright color and bright flavors of their fresh counterparts, but their texture is altered significantly by freezing because the ice crystals break cell walls. If frozen fruits can be served while they still have a few ice crystals, the texture will be more appealing than when the fruit has thawed to the point where the pieces are flabby. If only the pieces of fruit are to be used in a recipe, the thawed juice needs to be drained thoroughly and removed. Otherwise, there will be too much liquid in the recipe.

SUMMARY

The various classifications of fruits include berries, citrus, drupes, grapes, melons, pomes, and tropical and subtropical. Characteristically, fruits are very high in water and contain a moderate amount of carbohydrate, usually in the form of sugars and fiber. In addition to fiber, fruits are rich sources of vitamins A and C and modest amounts of other vitamins and minerals, particularly calcium and iron.

The cell walls in fruits are abundant sources of cellulose, hemicelluloses, and pectic substances, which often occur in the intercellular spaces. Fruits have a dermal layer surrounding their vascular cells and parenchyma cells. The parenchyma

cells have chloroplasts, and leucoplasts containing pigments and starch in the cytoplasm. Their large vacuole is the site of the flavonoid pigments, sugars, acids, and many other flavoring substances, as well as water.

Careful control of temperature and atmosphere is necessary during the marketing of fruit because fruits are very susceptible to spoilage. When selecting fresh fruits, avoid those with blemishes and spoiled areas. Each type of fruit has certain desirable qualities to guide consumers in selection, and knowledge of these qualities is important since grade designations are not ordinarily available to consumers. The best variety for

the type of preparation being planned should be selected when making choices among apples and other fruits with more than one variety on the market at the same time. Select canned and frozen products by reading labels carefully and also remembering previous experience with particular brands.

In the home, temperature control is required to maintain the fruit at its optimum until it is served. Usually, refrigerator storage is recommended, although a few fruits, such as bananas, should be stored in a cool room.

Preparation of raw fruit requires attention to washing and then cutting and arranging close to serving time to avoid loss of vitamin C and the possible problem of enzymatic browning. Always simmer fruits; boiling should be avoided because of its

destructive effect on shape. The level of sugar in the cooking liquid should be appropriate to the type of preparation so that osmotic pressure will help to achieve the desired texture. Baking, broiling, and frying are other cookery techniques appropriate to the preparation of some fruits. Many fruits also can be used in a wide array of baked products, as well as in elegant dessert combinations. Canned and frozen fruits can be used in some recipes satisfactorily if they are drained thoroughly to avoid extra juice. The texture in frozen fruits usually is quite soft and mushy unless they are served while some ice crystals are still present. Canned pineapple can be used satisfactorily in gelatin products, but fresh and frozen pineapple should be avoided because gelatin will not set when these forms are used.

STUDY QUESTIONS

1. Visit a grocery store to see what fresh fruits are available. How does the cost of the fresh fruits compare with their canned and frozen counterparts?
2. How does the cost of reconstituted frozen orange juice concentrate compare with fresh orange juice and with a powdered imitation orange drink?
3. How are the following fruits classified: oranges, avocados, strawberries, kumquats, apricots, plums, apples, nectarines, tangerines, Thompson seedless grapes, cranberries, pears, cantaloupe, quince, pomegranates, currants, Tokay grapes, bananas, and pineapple? When is each of these usually available?
4. How can osmotic pressure be controlled to aid in making applesauce and coddled apples?
5. Why is ascorbic acid added to some fruits?

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