Human Dietetics and Asian Food Crops

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SUMMARY. Consumption of Asian herbs, spices, and vegetables in the U.S. has increased considerably within the past decade. This paper reviews some Asian culinary herbs and vegetables that are now increasingly used by American mainstream consumers, as well as ethnic Asians. It briefly summarizes traditional medicinal properties and the accumulating scientific evidence for functional properties of these plant species.

Epidemiological studies and comparisons of the incidences and mortality rates due to coronary heart disease and various cancers, including breast cancer and prostate cancer, reveal marked variations among Asian Americans compared to Caucasians and to similar Asian groups living in their countries of origin. High consumptions of fruit and vegetables have been reported to reduce risks of cancers at many sites (Block et al., 1992, Steinmetz and Potter, 1991). Although medicinal herbs have been used in clinical medicine for thousands of years, it is only recently that we have been able to use scientific methods to prove the efficacy of many of these herbs and achieve a better understanding of their mechanisms of action. Considerable attention has been focused on identifying naturally occurring chemopreventive substances capable of inhibiting, retarding, or reversing multistage carcinogenesis. A wide array of phenolic substances, particularly those present in dietary and medicinal plants that are mostly of Asian origin, have been reported to possess substantial anticarcinogenic and antimutagenic activities (Nair et al., 1998). Most of these naturally occurring phenolics retain antioxidative and antiinflammatory properties, which appear to contribute to their chemopreventive or chemoprotective activity. Diet can modify the pathophysiological processes of various metabolic disorders. Thus, dietary modification can be an effective preventive strategy for different disease processes, most of which often involve oxidative damage. Both nutrient and nonnutrient components of the human diet have been recognized for their antioxidant and other potential benefits. Several plant foods contain phytochemicals such as flavonoids and phenolic acids, which show biological activity and are recognized as nutraceuticals and functional foods (Kelloff et al., 2000).

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The U.S. population is heterogeneous, as it is composed of many racial, ethnic, and religious groups. Each of these groups has traditional foods and food habits that may vary significantly from the typical American diet. The purpose of this paper is to identify some of the newer Asian food crops, with specific attention to herbs, spices, and vegetables. Since it is beyond the scope of this paper to be an encyclopedia in coverage, only a few plant species are discussed, presenting traditional as well as modern uses in human dietetics for their nutritive value and health benefits. These plant species were chosen because of the greater attention they are currently receiving for their functional properties.

Asian diets

To Asians, food plays a vital role in preventing and treating diseases and other chronic health conditions. The basis for classical Asian food and medicine is the concept of yin and yang, or hot and cold, considered as the two opposing forces that interact with one another to maintain balance and harmony of the mind and body. Good health is achieved when there is a balance between the mind and the body. Food items or preparations are classified as either yin or yang, or hot and cold, depending on the type of energy they produce when metabolized.

Some strengths of Asian cuisine that have been associated with lower risk of chronic diseases are that they are abundant in complex carbohydrates and include a wide variety of meat, fruit, and vegetables. Rice is the staple of most Asians, but wheat is increasingly consumed as noodles, breads, dumplings, and steamed buns. Asians consume poultry, eggs, lamb, and fish meat more than beef, use soybeans as sprouts, tofu, (high in protein, calcium, and B vitamins, yet low in fat), and drink soymilk. Other desirable factors in Asian cuisine include 1) use of vegetable oils such as peanut and sesame for cooking; 2) a preference for green, red, and scented teas instead of carbonated and bottled drinks; 3) use of healthier cooking methods such as steaming and stir-frying; 4) traditional health beliefs and medical systems, such as Ayurveda, which limits the quantity of food eaten and advocates against obesity; and 5) religious beliefs of Hindus and Muslims that prohibit alcohol consumption.

On the other hand, some unhealthy factors of Asian cuisine include 1) the frequent use of lard instead of oil to glaze meat; 2) marinating with soy sauce, oyster sauce, and bean paste; 3) use of preserved foods that are high in sodium; 4) use of deep frying, braising, roasting, and smoking to increase the taste of food in the place of steaming or boiling; 5) limited use of dairy products because most Chinese and Japanese are lactose intolerant; and 6) use of pickled food. Some misconceptions in their cuisine include beliefs that 1) an animal organ would improve the functioning of a respective human organ, 2) sweet broth is soothing and can give smooth skin to pregnant women, 3) body weight is directly proportional to prosperity, and 4) that being overweight is a blessing. Furthermore, the use of coconut, a rich source of highly saturated fatty acids by the Asian from the Philippines, southwestern India, and parts of southern Asia often results in high blood cholesterol. Additionally, eating raw fish has the risk of causing food poisoning when the processing is not completely or correctly carried out.

Western diets

Surveys of American eating habits showed that the average American eats only about 1.5 servings of vegetables per day and less than 1 serving of fruit per day. It was also revealed by these surveys that only 1 in 11 Americans met the guidelines for eating at least 3 servings of vegetables per day and at least 2 servings of fruit per day (Patterson et al., 1990). A traditional western diet is characterized by high animal protein, calories from sugar, saturated fatty acids, and low fruit and vegetables. Evidence shows that people who eat high amounts of fruit and vegetables have only one-half the risk of cancer and less mortality from cancer (Steinmetz and Potter, 1991). Thus, the western diet is probably a significant factor in the high prevalence of chronic diseases such as cancer and heart disease in the United States.

It has been concluded in many studies that high consumption of meat, sugar, and saturated fats have adverse health consequences and, thus, vegetarian diets lower in sugar and fat content tend to impart health advantages. However, the mere inclusion of a certain number of servings of vegetables and fruit *per se* may not be

healthful, but should also include adequate amounts of fiber, polyunsaturated fatty acids, and phytochemicals and nutraceuticals that impart specific health benefits. Additional information is needed to define the characteristics of a healthful vegetarian diet that is specific to individual ethnic groups as well as develop required dosages or daily requirements of the phytochemicals and nutraceuticals.

Asian horticultural food crops

HERBS AND SPICES. Phytochemicals found in a variety of herbs have many functional properties: they stimulate vital detoxification processes in the body that eliminate carcinogenic factors; they stimulate and strengthen the body's immune system; many herbs have free radical scavenging properties; and they lower blood cholesterol and sugar levels. It is critical to consider the possibility that whatever properties and effects found in one plant may be found in others. Thousands of herbs are known to have therapeutic value in ancient cultures around the globe, but less than 1% has been researched and, thus, most of them remain to be discovered.

Turmeric (*Curcuma longa*) is a perennial herb with deep-orange oblong rhizomes; mature leaves are about 2 ft (0.6 m) long, lanceolate, with a petiole and tapering at each end, smooth, and of a uniform green; flowers are pale yellow, three or five together surrounded by bracteole. It is propagated from cuttings of the rhizome.

Turmeric has been used as a dye, medicine, and flavoring since 600 BC (Government of India, 1989). Turmeric has been used medicinally throughout Asia to treat stomach and liver ailments. It was also used externally to heal sores and as a cosmetic. Turmeric has a distinct fragrance but a slightly bitter taste. It is commercially available as fresh or dried rhizome, powder sold in Asian grocery stores, and encapsulated powder in health food stores and pharmacies. Turmeric is an essential ingredient of curry powder and is used extensively in Indian dishes and in almost all Southeast Asian cooking. Turmeric is also added to pickles and relishes and occasionally used in place of saffron to provide color and flavor. Sometimes turmeric is also called Indian saffron because of its brilliant yellow color.

Turmeric is used extensively in the Asian medical systems (traditional Indian, Chinese, and Japanese medicines) and is officially entered in the *Ayurvedic Pharmacopoeia of India* (Government of India, 1989), *Pharmacopoeia of the People's Republic of China* (Tu et al., 1992), and in the Japanese Standards for Herbal Medicines (Japanese Ministry of Health and Welfare, 1993).

Turmeric contains curcumin and essential oils (turmerone, zingiberins). Curcumin is one of the diet-derived promising chemopreventive agents studied for its anticarcinogenic properties (Kelloff et al., 2000). Curcumin has antiinflammatory and cytotoxic effects (Sung et al., 1997); possess antifungal and antibacterial properties (Roth et al., 1998); lowered cholesterol levels and ulcers and demonstrated antioxidant, antimutagen, and anticarcinogen properties (Dorai et al., 2000, Graf, 2000, Polasa et al., 1992, Selvam et al., 1995, Van Dau et al., 1998). Turmeric is reported to be effective in the treatment of scabies (Charles and Charles, 1992) and number of conditions including arthritis, aids digestion and offers liver protection (Palaniswamy, 2000).

Fenugreek (*Trigonella foenum-graecum*) is an annual herb with alternate leaves that consist of three ovate leaflets, white flowers, and long slender green pods. Mature brown pods contain about 20 small yellow seeds. The plant thrives in full sun on rich, well-drained soils. It is widely cultivated in India, China, northern and eastern Africa, Ukraine, and Greece. The leaves are used alone or combined with lentils in curried dishes, while the seeds are frequently used as condiment. People in India use the leaves as a vegetable and the seed as a spice in curry.

Fenugreek leaves are a rich source of calcium, iron, beta-carotene, and other vitamins (Sharma, 1986). Fenugreek seeds are described in Greek and Latin pharmacopoeias as having antidiabetic activity (Loeper and Lemaire, 1931, Moissides, 1939, Shani et al., 1974). Its antidiabetic properties have been demonstrated in animal and human subjects in noninsulin-dependent and insulin-dependent diabetic patients (Madar et al., 1988, Puri 1999, Ribes et al., 1984, Shani et al., 1974, Sharma et al., 1990). All evidence suggests that the use of fenugreek

as a dietary item can provide additive effect to current dietary and/or drug courses of therapy prescribed for diabetics. Supplementation of fenugreek seeds in the diet also lowered lipid peroxidation and had a hypocholesterolemic effect (Ravikumar and Anuradha, 1999, Billaud and Adrian, 2001).

Coriander (*Coriandrum sativum*) is derived from the Greek word *kopis*, which means bug, based on its peculiar odor, somewhat obnoxious to some. Coriander is an herbaceous plant growing to a height of up to 2 ft with bright green leaves and small white flowers formed in umbellike clusters. Coriander looks like parsley but the bunches of green coriander can be distinguished in the market for their aroma. Tender leaves before bolting are harvested for use in oriental dishes. The leaves are not suitable to be dried for culinary use. Coriander is widely used in whole or ground forms for flavoring purposes. In India, powdered coriander seeds are used in curry powders (25% to 40% world production) and it is used to flavor liqueurs in Russia and Scandinavia and is an important flavoring agent in gin production. The seeds are also used (both whole and ground) in baking, sausages, pickles, candies, sauces, and soups.

In Asian cultures, coriander is considered to have cooling, stimulant, carminative, and digestive properties (Lad, 1996). Coriander has been documented as a traditional treatment for diabetes in Ayurvedic medicine. Coriander incorporated into the diet and drinking water demonstrated the presence of antihyperglycemic, insulin-releasing, and insulinlike activity (Gray and Platt, 1999). Fresh coriander leaves are commonly added to spicy foods to provide additional flavor.

Fennel (*Foeniculum vulgare*) plants grow to about 4 ft tall. Fennel has dark green very feathery and pinnate leaves. The tiny yellow flowers are umbels. The fruit are large and have a spicy licorice taste. Fennel seeds are used as a condiment, while the green leaves are consumed as a vegetable. All parts of fennel, including the roots and stems, are used for culinary purposes. Chopped leaves are used to add flavor to stews, potato salad, dressing, dips, or cream sauce. Use of fennel imparts a distinct sweet flavor to the dishes. Dried seeds are often chewed as a breath sweetener or to aid in diges-

tion, and it is believed to promote lactation in mothers (Lad, 1996). In Ayurvedic medicine, a tea made with a few fresh sprigs of fennel or a level teaspoon of seeds is prescribed to relieve indigestion (Lad, 1996). Fennel is an effective treatment for respiratory congestion and is a common ingredient in cough remedies. Anethole, the chief constituent of fennel, has been shown to block inflammation and carcinogenesis (Chainy et al., 2000). The main active constituents, including the terpenoid anethole, are found in the volatile oil. Anethole and other terpenoids may have mild estrogenlike activity (Albert-Puleo, 1980) and they inhibit spasms in smooth muscles (Forster et al., 1980), such as those in the intestinal tract. Recent studies have found fennel to possess diuretic, choleric (increase in production of bile), pain-reducing, fever-reducing, and antimicrobial actions (Tanira et al., 1996). Fennel was formerly an official drug in the United States and was listed as being used for indigestion and possibly for stimulating milk flow in women (Hare et al., 1916).

Curry leaf (*Murraya koenigii*) is a small deciduous plant. The foliage of this plant is known as the curry leaf because of the popular use of its aromatic leaves to flavor curried dishes. Fresh curry leaves are available in U.S. in most Asian grocery stores. They retain their flavor even in the dried state and, hence, are often stored as dried leaves for year-round use. Curry leaf is a rich source of beta-carotene (Bhavani and Kamini, 1998) and possess hypoglycemic, hypolipidemic, anticarcinogenic, and antioxidant properties (Khan et al., 1995, 1996a, 1996b, 1997). The roots, bark, and leaves of the curry leaf tree are used medicinally internally and externally in India and other parts of Asia.

VEGETABLES. Asian vegetables discussed include bitter melon, taro, and drumstick.

Bitter melon (*Momordica charantia*) or bitter gourd, warty in appearance, is a cucurbit vine widely cultivated throughout the world for the immature fruit and sometimes for the tender leaves or ripe fruit. Other bitter melons of the *Momordica* species used for their immature fruit in a similar way are *M. cochinchinensis* and *M. dioica*. The fruit vary in size from 2.4 to 11.8 inches (6 to 30 cm) long. The bitter principle, for which the fruit

Fig. 1. The Asian food pyramid based on the Nutrition Education for New Americans Project of the Department of Anthropology and Geography, Georgia State University, Atlanta.

is named, is due to the alkaloid momordicine. Immature fruit are less bitter than the mature but unripe ones. The fruit are sometimes parboiled or soaked in salted water to reduce bitterness.

The immature fruit are stuffed, pickled, and sliced into various dishes. Tender fruit are boiled or fried often after rinsing with salt water to reduce the bitter taste. Fruit are used in curries and pickles. Inclusion of bitter melon in the diet of diabetics is a common treatment in Ayurvedic medicine (Lad, 1996). Recent studies provide evidence that including this vegetable in the daily diet can lower cholesterol and blood sugar. Fresh bitter melon fruit and/or dried seed powder are reported to show antitumor activity, hypolipidemic, and hypoglycemic activity (Cunnick et al., 1990; Jayasooriya et al., 2000).

Taro (*Colocasia esculenta*) is an herbaceous perennial plant with large leaves and bears edible starchy underground stems (corms). Taro, a long-time popular vegetable in Hawaii, has been gaining greater acceptance in the

mainland United States. Fermented taro is the famous *poi*. Both leaves and the underground corm are excellent sources of fiber and are used in food by Asians and the Pacific Islanders. Use of taro in the diet is associated with a decrease in blood cholesterol (Mani et al., 1989) and, perhaps, lower incidence of colorectal cancer (Ferguson et al., 1992).

Drumstick (*Moringa oleifera*), also known as ben oil tree, is a perennial tree that grows up to 20 ft (6.1 m). The root of the drumstick tree is sometimes used as a substitute for horseradish and, hence, it is also called the horseradish tree. The drumstick leaves, fruit, and flowers are edible and a common vegetable in India. The fruit are pods that grow up to about 2 ft long and enclose crunchy edible seeds. The drumstick leaves and pods are used as an aphrodisiac, food, and medicine in Asia (Ramachandran et al., 1980). Industrial uses of the drumstick tree include the use of its wood in paper and textile industries, its bark in the tanning industry, and its seeds in water purification (Bhattacharya et al.,

1982; Mayer and Stelz, 1993; Palada, 1996). Drumstick leaves are good source of protein (Freiberger et al., 1998). Aqueous leaf extracts are reported to regulate thyroid hormones and can be used to treat hyperthyroidism (Tahiliani and Kar, 2000). Drumstick leaves and pods also have a positive effect in reducing blood cholesterol (Ghasi et al., 2000) and antitumor promoting activity (Guevara et al., 1999). Furthermore, it is an important source of the glucosinolate precursors of the isothiocyanate group of chemopreventives (Daxenbichler et al., 1991) that can inhibit carcinogenesis.

CRUCIFEROUS VEGETABLES. A number of Asian vegetables of the family Brassicaceae (Cruciferae) that are becoming popular include white radish or daikon (*Raphanus sativus*), chinese cabbage (*Brassica rapa* var. *pekinensis*), chinese broccoli (*Brassica oleracea* var. *alboglabra*), chinese flowering cabbage (*Brassica rapa* var. *parachinensis*), shanghai chinese chard (*Brassica rapa* var. *chinensis*), and pakchoi (*Brassica campestris*). The cruciferous vegetables are being studied widely by horticulturists and the biomedical communities because they have been identified as good sources of the isothiocyanate group of chemopreventives that have been associated with anticarcinogenic properties (Zhang and Talalay, 1994, 1998).

Challenges to dieticians

Demographic shifts and changes in the food choices of minority as well as mainstream populations are constant concerns of dietitians. The USDA has sponsored several programs to educate the newly growing ethnic populations; for example, the Nutrition Education for New Americans project in the Department of Anthropology and Geography at Georgia State University, Atlanta, was funded to help low-income immigrants learn about healthy eating practices. Using the USDA food pyramid as the focus, materials and programs are designed to include traditional as well as American foods (Fig. 1). In traditional Asian diets, plant food contributes a large percentage and the animal food contribution is minimal. Plant-based foods commonly consumed in Asia include rice and other grains, noodles, flatbreads, potatoes, fruit and vegetables, nuts, seeds, beans, various soy foods, vegetable

and nut oils, herbs and spices, and plant-based beverages including tea, coffee, wine, and beer. A diet composed of these foods can provide all of the known essential micronutrients, vitamins and minerals, fiber, and other plant food substances believed to promote health. Because these substances are numerous and complex, occur in differing proportions in food, and interact in ways that are incompletely understood, virtually all contemporary dietary guidelines around the world emphasize a large and varied intake of these foods. The huge number of plant species consumed by the Asian populations would be expected to maximize contents of dietary fiber, antioxidants, other micronutrients, and nonnutritive substances found in foods from plants. Knowledge about the varied diets of the Asian populations forms an integral part of the curriculum of allied health professionals to enhance their cultural competence to offer appropriate counseling to their clients.

Challenges to horticulturists

Agriculture has always been responsive to changing consumer needs. With accumulating health benefits associated with phytochemicals, a greater understanding of the environmental and management factors on crop quality is needed, and strategies to produce nutritionally consistent products should be developed. Asian immigrants in the United States have introduced a number of food plants that can contribute to the diversity of diet in this nation. Research and development efforts are needed to explore the full potential of these new exotic food plants in the United States. The expanding market for Asian food crops pose a number of challenges to farmers and horticulturists. To grow these crops successfully, factors such as the status associated with foods, changing tastes, pest control, and the production and marketing costs must be considered. There is a growing need to develop production techniques, identify target markets, educate consumers, design marketing programs, and develop promotional materials for extension programs and suitable publications for producers and consumers.

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