Nutritional and health benefits of citrus fruits[1]

C. Economos and W.D. Clay
Christine Economos is Assistant Professor, Tufts University School of Nutrition Science and Policy, Medford, Massachusetts, United States. William D. Clay is Chief, Nutrition Programmes Service, Food and Nutrition Division, FAO, Rome.

Citrus fruits have long been valued as part of a nutritious and tasty diet. The flavours provided by citrus are among the most preferred in the world, and it is increasingly evident that citrus not only tastes good, but is also good for people. It is well established that citrus and citrus products are a rich source of vitamins, minerals and dietary fibre (non-starch polysaccharides) that are essential for normal growth and development and overall nutritional well-being. However, it is now beginning to be appreciated that these and other biologically active, non-nutrient compounds found in citrus and other plants (phytochemicals) can also help to reduce the risk of many chronic diseases. Where appropriate, dietary guidelines and recommendations that encourage the consumption of citrus fruit and their products can lead to widespread nutritional benefits across the population.

MORE THAN VITAMIN C: THE NUTRIENT CONTENT AND FUNCTIONS OF CITRUS

Citrus is most commonly thought of as a good source of vitamin C. However, like most other whole foods, citrus fruits also contain an impressive list of other essential nutrients, including both glycaemic and non-glycaemic carbohydrate (sugars and fibre), potassium, folate, calcium, thiamin, niacin, vitamin B_6, phosphorus, magnesium, copper, riboflavin, pantothenic acid and a variety of phytochemicals. In addition, citrus contains no fat or sodium and, being a plant food, no cholesterol. The average energy value of fresh citrus is also low (see Table), which can be very important for consumers concerned about putting on excess body weight. For example a medium orange contains 60 to 80 kcal, a grapefruit 90 kcal and a tablespoon (15 ml) of lemon juice only 4 kcal (Whitney and Rolfes, 1999).

Nutritional facts about citrus fruit

	Orange	Grapefruit	Tangerine
Weight *(g)*	131	236	84
Energy *(kcal)*	62	78	37
Fibre content *(g)*	3.1	2.5	1.7
Ascorbic acid *(mg)*	70	79	26
Folate *(mcg)*	40	24	17
Potassium *(mg)*	237	350	132

Source: Gutherie and Picciano, 1995.

[1] This article has been drawn from a paper presented at the Twelfth Session of the Intergovernmental Group on Citrus Fruit, 22 to 25 September 1998, Valencia, Spain.

WHOLE FOODS VERSUS SINGLE NUTRIENTS

Scurvy, a serious deficiency of vitamin C that has caused tremendous human suffering throughout history, was first described by ancient Egyptians, and then by the Greeks and Romans (Carpenter, 1986). For hundreds of years, scurvy was a scourge of long-distance sailors, soldiers, explorers and the poor in many countries where there was a lack of access to fresh fruits and vegetables. However, it was not recognized that scurvy could be prevented and cured by consuming citrus fruit until the eighteenth century. And it would be another 200 years before vitamin C was isolated and its deficiency identified as the cause of the disease.

The lesson from this is still important today; people do not need to understand everything about individual nutrients in order to consume nutritionally adequate and well-balanced diets. Even though the current understanding of nutrition, health and disease has advanced well beyond nutrient deficiencies, there is still much that is not known, and probably never will be known, about the relationships between diet and health. Fortunately, however, with a bit of common sense, people can still be well nourished even though the understanding of nutritional science may be incomplete.

For example, research efforts exploring the possible protective effects of phytochemicals against various forms of chronic diseases have often shown an association with the consumption of various foods rich in these compounds, but not with specific phytochemicals themselves. There are several possible explanations for this, including: the specific phytochemicals being investigated may not be the ones that have an effect; the effects of individual phytochemicals may be additive; and it may be the interaction of two or more phytochemicals and nutrients that produces an effect. Since the understanding of nutrition science and the complex functions and interactions of the many vitamins, minerals, macronutrients and phytochemicals contained in food is still so incomplete, it is important that a rational and time-tested approach be taken to the promotion of good nutrition. It is also important to continue emphasizing the benefits of nutrient-dense foods, such as citrus fruits, and to recognize that the consumption of whole foods and natural juices is preferred over the consumption of individual nutrients that have been isolated from food and then consumed as dietary supplements. Focusing on single nutrients, instead of foods and the total diet, does not constitute a healthful approach to good nutrition.

Carbohydrate

The main energy-yielding nutrient in citrus is carbohydrate; citrus contains the simple carbohydrates (sugars) fructose, glucose and sucrose, as well as citric acid which can also provide a small amount of energy. Citrus fruits also contain non-starch polysaccharides (NSP), commonly known as dietary fibre, which is a complex carbohydrate with important health benefits. The predominant type of fibre in citrus is pectin, making up 65 to 70 percent of the total fibre. The remaining fibre is in the form of cellulose, hemicellulose and trace amounts of gums. Citrus also contains lignin, a fibre-like component. In the body, NSP holds water-soluble nutrients in a gel matrix which delays gastric emptying and slows digestion and absorption. This tends to promote satiety, and may reduce the rate of glucose uptake following consumption of glycaemic (available) carbohydrate, thus helping to prevent a surge in blood glucose levels. Improper regulation of blood glucose results in either hyperglycaemia (high blood glucose) or hypoglycaemia (low blood glucose). NSP can also interfere with the reabsorption of bile acids which may help in lowering plasma cholesterol levels.

A reasonable goal for dietary NSP/fibre intake is 25 to 30 g/day, but in many developed countries the actual average intake is closer to 15 g (USDA, 1996; United States National Academy of Sciences, Food and Nutrition Board, 1989; Cleveland, Goldman and Borrud, 1996). With one medium orange containing approximately 3.0 g of NSP, citrus fruit can make a valuable contribution to meeting the daily fibre goal (Whitney and Rolfes, 1999).

Vitamin C

Vitamin C (ascorbic acid), an essential water-soluble vitamin, plays a key role in the formation of collagen, a primary component of much of the connective tissue in the body. Adequate collagen synthesis is essential for strong ligaments, tendons, dentin, skin, blood vessels and bones, and for wound healing and tissue repair. The weakening of these tissues is a symptom of vitamin C deficiency. Vitamin C is an important aid in the absorption of inorganic iron; it has also been shown to aid in the treatment of anaemia and stress. Contrary to popular belief, vitamin C does not seem to prevent the onset of the common cold, but in some studies it has been reported to reduce the length and severity of the symptoms.

Contemporary interest in vitamin C centres on its ability to perform antioxidant functions. As an antioxidant, it can help prevent the cell damage done by "free radical" molecules as they oxidize protein, fatty acids and deoxyribonucleic acid (DNA) in the body. Free radical damage has been implicated in the progression of several diverse and important disease states including cancer, cardiovascular disease and cataract formation (Gershoff, 1993; Harats *et al.*, 1998; Jacques *et al.*, 1997). Being a good source of antioxidants, if regularly consumed, citrus can be an important part of a diet aimed at reducing the risk of such chronic disease.

Only 10 mg of vitamin C per day are required to prevent vitamin C deficiency and the devastating disease scurvy (United States National Academy of Sciences, Food and Nutrition Board, 1990). However, for good health and sufficient body storage of vitamin C, 30 to 100 mg/day is generally recommended, although some recent studies have provided evidence that more than 200 mg/day may be optimal for the prevention of chronic disease. Too much vitamin C (above 500 mg), generally seen with very high levels of supplementation, may be dangerous, especially for those at risk of iron overload (Fleming *et al.*, 1998). Consuming five servings of fruits and vegetables each day can result in an intake of about 200 mg of vitamin C. Citrus fruits are a particularly good source of vitamin C, with one medium orange or grapefruit providing approximately 70 mg and 56 mg, respectively. A 225 ml glass of orange juice contains approximately 125 mg of vitamin C (Whitney and Rolfes, 1999).

Folate

Folate is a water-soluble vitamin essential for new cell production and growth. It helps in the production of DNA and ribonucleic acid (RNA) and mature red blood cells, which ultimately prevent anaemia. In the United States, the recommended daily intake of folate is 180 mcg for females and 200 mcg for males. Over the past decade, however, it has become clear that higher levels of folic, 400 mcg, are associated with the prevention of neural tube defects, a severe birth defect (Centers for Disease Control and Prevention, 1992). A 225 ml glass of orange juice provides 75 mcg of folic acid (Whitney and Rolfes, 1999).

Potassium

Potassium is an essential mineral that works to maintain the body's water and acid balance. As an important electrolyte, it plays a role in transmitting nerve impulses to muscles, in muscle contraction and in the maintenance of normal blood pressure. The daily requirement of potassium is approximately 2 000 mg and, while frank deficiency of potassium is rare, there is some concern that a high sodium-to-potassium intake ratio may be a risk factor for chronic disease. Increased consumption of citrus fruits and juices is a good means of increasing potassium intake. One medium orange and one 225 ml glass of orange juice provide approximately 235 mg and 500 mg of potassium, respectively (Whitney and Rolfes, 1999).

Phytochemicals

These naturally occurring compounds found in plants have a wide range of physiological effects and may help to protect

against various chronic diseases, including cancer and heart disease. The wide variety and number of known phytochemicals continue to grow, as does understanding of their role and importance in the diet (Steinmetz and Potter, 1991). Several classes of phytochemicals, including monoterpenes, limonoids (triterpenes), flavanoids, carotenoids and hydroxycinnamic acid, have been isolated from citrus (see Figure 1).

The possible anticarcinogenic mechanisms of phytochemicals include their antioxidant capabilities, their effects on cell differentiation, an increased activity of the enzymes that detoxify carcinogens, an altered colonic milieu, and the blocking of nitrosamines. The regular intake of a varied mix of phytochemicals is only possible through the consumption of plant-based foods, such as citrus, as part of the normal diet.

PREVENTION POTENTIAL OF CITRUS

There is considerable evidence that citrus foods may help reduce the risk, or retard the progression, of several serious diseases and disorders (see Figure 2).

Cardiovascular disease

It is well accepted that a diet low in saturated fat and cholesterol and rich in fruits and vegetables reduces the risk of heart disease. Epidemiological studies have also shown a significant association between vitamin C intake and protection against cardiovascular mortality, but the precise mechanism of protection is still unclear. One major culprit in the development of heart disease appears to be a high level of oxidized low-density lipoprotein (LDL), the so-called bad cholesterol. Significantly, a recent study has shown that high intakes of vitamin C (500 mg/day) obtained from the juice of freshly squeezed oranges, prevented a rise in the levels of oxidized LDL, even in the presence of a high-saturated fat diet (Harats *et al.*, 1998).

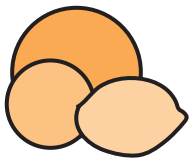
A low dietary intake of folate contributes to the decrease of plasma folate and the raising of plasma homocysteine levels (Bloom, 1998; Tucker *et al.*, 1996). Homocysteine is a toxic agent for the vascular wall and, when plasma levels rise above normal, there is an increased risk of cardiovascular disease. An inverse dose-response relationship has been identified for fruit and vegetable intake and plasma homocysteine levels. Frequent consumption of folate-rich foods, such as oranges and orange juice, tends to increase plasma folate levels and, thus, lower homocysteine levels.

1
Phytochemicals in citrus fruits

Plants are sources of phytochemicals, which provide significant health benefits and are generally available only from the diet.

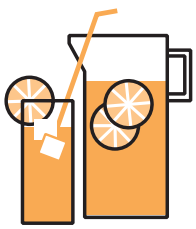
Citrus fruits provide these phytochemicals:

- monoterpenes
- limonoids (triterpenes)
- flavanoids
- carotenoids
- hydroxycinnamic acid



2
The prevention potential of citrus

- Cardiovascular disease
- Heart disease
- Hypertension
- Stroke
- Cancer
- Neural tube defects:
  spina bifida and anencephaly
- Anaemia



Cancer

After numerous studies of fruit and vegetable intake and cancer development, there is a consensus that consuming these foods has a protective effect (Block, Patterson and Subat, 1992). However, it is unlikely that one anticarcinogenic substance in particular is responsible for the benefit. There is reasonable scientific support for vitamin C's protective role in cancer. Many of the animal, cell culture and human studies have suggested it has a positive effect. However, epidemiological studies provide good evidence that protective effects are more closely associated with the consumption of fruits and vegetables rather than with the enormous levels of vitamin C often used in cell culture and animal studies.

Neural tube defects

During the first stage of pregnancy, adequate folate intake is critical for reducing the risk of severe birth defects, namely spina bifida and anencephaly. Public health recommendations in the United States include the consumption of 400 mcg of folate per day for women of child-bearing age (Centers for Disease Control and Prevention, 1992). Regular consumption of citrus foods can help supply adequate folate and thus reduce the risk of these birth defects.

Anaemia

Vitamin C can increase the absorption of non-haem iron (the inorganic iron form found in plant foods) two- to fourfold (Fleming *et al.*, 1998). The bioavailability of non-haem iron is much lower than that of haem iron, which is found in foods of animal origin (Whitney and Rolfes, 1999). Vegetarians and

individuals who consume little meat and animal products are at an increased risk of iron-deficiency, which can progress to anaemia over time. Worldwide, anaemia is one of the most serious nutrient-related public health problems, resulting in poor growth, impaired psychomotor development, reduced physical performance and decreased cognitive function. Consuming citrus fruits rich in vitamin C can help prevent anaemia and its devastating consequences.

Cataracts

Oxidation of the eye's lens plays a central role in the formation of age-related cataracts. The role of dietary antioxidants, such as vitamin C, in the aetiology of cataracts has been a recent focus of research (Jacques *et al.*, 1997). Lower cataract risk has been shown in individuals with high blood concentrations or intakes of vitamin C and carotenoids. There is now evidence to show that a high level of vitamin C intake over the long term decreases the risk of cataract development. Although epidemiological studies that measure past nutrient intake and status suggest a protective effect from citrus, further studies are needed to examine the long-term benefits of citrus fruit consumption and cataract protection.

RESEARCH

Bone metabolism and osteoporosis

The influence of nutrient intake on bone density is an area of current research with many unanswered questions. Long-term intake of various foods may be important to bone health, possibly because of their beneficial effect on the acid base balance (New *et al.*, 1997). Vitamin C intake has been associated with bone mineral density, but more work in this area is necessary to understand the mechanism of interaction.

Kidney stone disease

A kidney stone is a crystal structure formed by excessive salts in the urine. The most common type of stone is the calcium stone. A stone will increase in size until it is not passable and becomes lodged in the ureter. Stone symptoms include severe back pain, blood in the urine and fever. Stones strike men three to four times more often than women. Some people prone to stones have been found with insufficient levels of citrate in their urine and it has been suggested that eating citrus fruits and drinking orange juice may help prevent kidney stones by increasing urinary citrate. More research is needed in this area, but increasing fruit consumption is a nutritionally sound recommendation that may prove to be very beneficial for individuals at risk of certain kinds of kidney stones.

Cognitive function

Elevated homocysteine levels are associated with cognitive dysfunction in the elderly. Older subjects with greater intakes of fruits and vegetables, and the corresponding nutrients vitamin C and folate, have been shown to perform better on cognitive tests (Ortega *et al.*, 1997). The consumption of a satisfactory diet, containing nutrient-dense foods, appears to be associated with better cognitive function in the elderly. More research is needed to determine the effect of long-term citrus consumption on cognition.

Asthma

Some studies suggest that a diet low in vitamin C is a risk factor for asthma (Hatch, 1995). Vitamin C is the major antioxidant substance present in the airway surface liquid of the lungs, where it could be important in protecting against oxidants. More research is needed to understand whether vitamin C and citrus consumption is protective in the causation and progression of asthma.

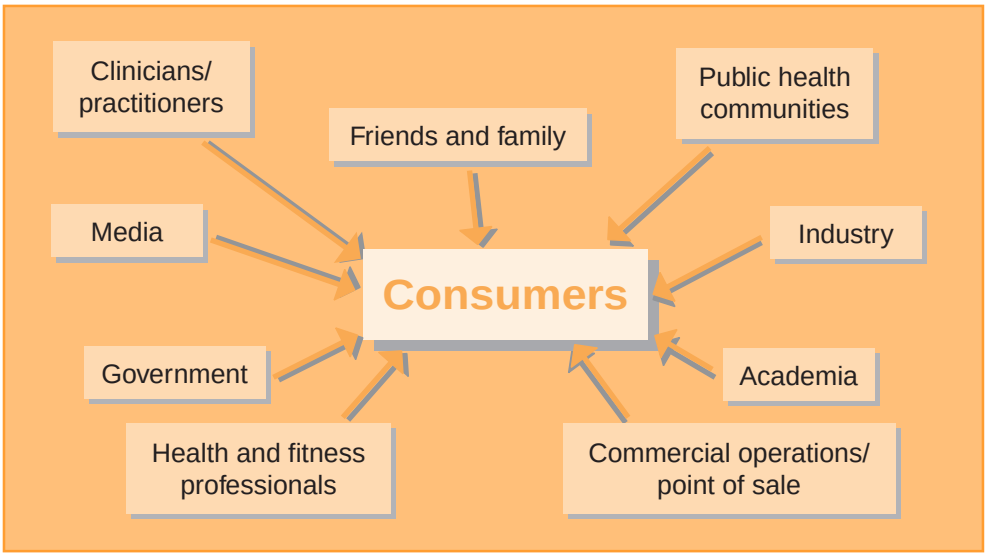
FACTORS AFFECTING CITRUS CONSUMPTION

In many populations, even among people who know that citrus is nutritious, the consumption of citrus is often very low. The reasons for this are varied, but it indicates that knowledge of a nutritional benefit is just one of the many factors that influence food choices (Nestle *et al.*, 1998). Among the other factors that greatly influence what foods people consume are: an individual's food preferences and previous experience with a given food; cultural values, perceptions, attitudes and societal influences including the media and advertising; and, most directly, the availability, taste and price of food items (see Figure 3). For these reasons, it is difficult to bring about widespread behavioural change. Clearly, strategies are more likely to modify behaviour and improve health if they are directed towards the relevant influences and barriers (Bandura, 1986; Contento, 1995). Some of the barriers to purchasing and consuming citrus are high cost, fear of harmful pesticides and quick spoilage (FMI, 1998).

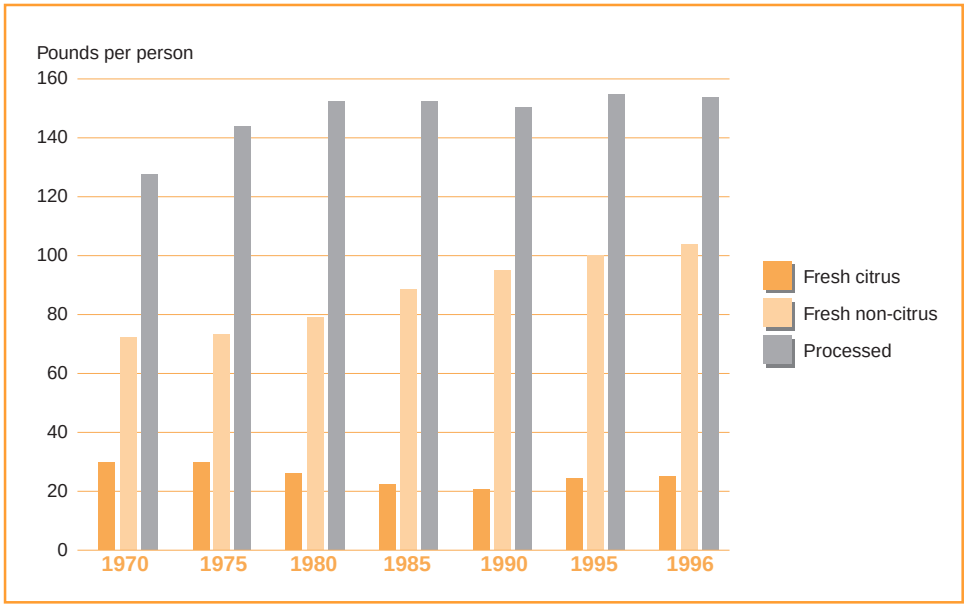
Over the past two decades, rising incomes and the shift in consumer preferences towards healthier, more convenient products have contributed to a growth in demand for citrus. Income levels also influence the variety and form of citrus consumed; in developed countries more processed citrus is consumed than in developing countries where people consume more fresh citrus (see Figure 4) (USDA, 1997; Putnam and Allshouse, 1997). Further increases in citrus consumption are possible, but will require an integrated approach to improving consumer awareness and bringing about behavioural change.

CONCLUSIONS

The health benefits associated with citrus consumption are clear (see Figure 5). Citrus fruits are nutrient-dense foods that



3
Consumers' information sources



4
Fruit consumption in the United States, 1970-1996

5
Vulnerable groups most likely to benefit from high citrus consumption

- Smokers
- Alcoholics
- Patients with severe burns, fracture, fever, tuberculosis and post-surgery
- Critically ill patients
- Immuno-compromised individuals
- Children
- The elderly

can be good sources of carbohydrates, including dietary fibre, and many vitamins and minerals. Citrus fruits are equally valuable among populations who need to overcome and prevent micronutrient deficiencies as well as those concerned with problems of overnutrition, obesity and diet-related chronic diseases. For example, citrus is an ideal component of low-fat, sodium-restricted diets.

As nutritionists and public health specialists learn more about the relationship between diet and health, the importance of balanced and varied dietary intakes becomes ever more evident. Accordingly, there is an increasing emphasis on promoting high levels of fruit and vegetable intakes among most population groups. Citrus consumption has a considerable potential to expand as part of this overall recommended increase in fruit and vegetable consumption.

While the supply of citrus is a problem in some areas, a greater obstacle is often the lack of effective demand for citrus. Addressing both supply and demand problems, as appropriate, will require that a range of issues, such as agriculture and trade policies, food and nutrition policies, dietary guidance and nutrition education, and marketing, are addressed effectively and in a comprehensive manner. In many countries, a multifaceted approach that brings together, as appropriate, representatives of producers, processors,

importers, retailers and consumers with nutritionists and public health specialists can have a significant impact on citrus consumption. Given that increasing the consumption of citrus benefits both producers and consumers, building effective partnerships to that end should not be difficult and would be an invaluable investment in the nutritional well-being and health of the population. ◆

REFERENCES

Bandura, A. 1986. *Social foundation of thought and action: a social cognitive theory*. Englewood Cliffs, NJ, USA, Prentice-Hall.

Block, G., Patterson, B. & Subat, A. 1992. Fruit, vegetable, and cancer prevention: a review of the epidemiological evidence. *Nutrition and cancer,* 18(1): 1-29.

Bloom, H. 1998. Determinants of plasma homocysteine. *American Journal of Clinical Nutrition*, 67: 188-189.

Carpenter, K. 1986. *The history of scurvy and vitamin C*. Cambridge, UK, Cambridge University Press.

Centers for Disease Control and Prevention. 1992. Recommendations for the use of folic acid to reduce the number of cases of spina bifida and other neural tube defects. *Morbidity and Mortality Weekly Report (MMWR)*, 41(RR-14): 1-7 (Review).

Cleveland, L., Goldman, J. & Borrud, L. 1996. *Results from USDA's 1994 Continuing Survey of Food Intakes by Individuals and 1994 Diet and Health Knowledge Survey*, p. 1-68. Riverdale, Md., USA, USDA.

Contento, I. 1995. The effectiveness of nutrition education and implications for nutrition education, policy, programs, and research: a review of research. *J. Nutr. Educ.*, 27: 277-418.

Fleming, D., Jacques, P., Dallal, G., Tucker, K., Wilson, P. & Wood, R. 1998. Dietary determinants of iron stores in a free living elderly population: The Framingham Heart Study. *American Journal of Clinical Nutrition*, 67: 722-733.

FMI. 1998. *Trends in the United States*. Washington, DC, Food Marketing Institute.

Gershoff, S. 1993. Vitamin C (ascorbic acid): new roles, new requirements? *Nutrition Reviews*, 51(11): 313-326.

Gutherie, H. & Picciano, M. 1995. *Human nutrition*. St Louis, MO, USA, Mosby.

Harats, D., Chevion, S., Nahir, M., Norman, Y., Sagee, O. & Berry, B. 1998. Citrus fruit supplementation reduces lipoprotein oxidation in young men ingesting a diet high in saturated fat: presumptive evidence for an interaction between vitamins C and E *in vivo*. *American Journal of Clinical Nutrition*, 67: 240-245.

Hatch, G. 1995. Asthma, inhaled oxidants, and dietary antioxidants. *American Journal of Clinical Nutrition*, 61(suppl): 625S-630S.

Jacques, P., Taylor, A., Hankinson, S., Willet, W., Mahnken, B., Lee, Y., Vaid, K. & Lahav, M. 1997. Long-term vitamin C supplement use and prevalence of early age-related lens opacities. *American Journal of Clinical Nutrition*, 66: 911-916.

Nestle, M. *et al.*, 1998. Behavioral and social influences on food choice. *Nutrition Reviews*, 56(5, Part II): S50-S74.

New, S., Bolton-Smith, C., Grubb, D. & Reid, D. 1997. Nutritional influences on bone mineral density; a cross-sectional study in premenopausal women. *American Journal of Clinical Nutrition*, 65: 1831-1839.

Ortega, R., Requejo, A., Andres, P., Lopez-Sobaler, A., Quintas, M., Redondo, R., Navia, B. & Rivas, T. 1997. Dietary intake and cognitive function in a group of elderly people. *American Journal of Clinical Nutrition*, 66: 803-809.

Putnam, J. & Allshouse, J. 1997. *Food consumption, prices, and expenditures*. Washington, DC, Economic Research Service, USDA.

Steinmetz, K. & Potter, J. 1991. Vegetables, fruit, and cancer, II. Mechanisms. *Cancer Causes and Control*, 2: 427-442.

Tucker, K., Selhub, J., Wilson, P. & Rosenberg, I. 1996. Dietary pattern relates to plasma folate and homocysteine concentrations in the Framingham Heart Study. *Journal of Nutrition*, 126: 3025-3031.

United States National Academy of Sciences, Food and Nutrition Board. 1989. *Diet and health: implications for reducing chronic disease risk*. Washington, DC, National Academy Press.

United States National Academy of Sciences, Food and Nutrition Board. 1990. *Recommended dietary allowances*. Washington, DC, National Academy Press. Tenth ed.

USDA. 1996. *Dietary Guidelines for Americans*. Washington, DC, Government Printing Office.

USDA. 1997. *World Horticultura; trade and US export*. Washington, DC.

Whitney, E. & Rolfes, S. 1999. *Understanding nutrition*. Belmont, Ca., USA, West/Wadsworth. Eighth ed. (ed. W. Rolfes). ◆

Summary/Résumé/Resumen

The nutritional and health benefits of citrus fruits

Public health workers and nutritionists generally encourage the consumption of citrus fruits and juices. The nutrient and non-nutrient factors in citrus promote health and may provide protection against a number of illnesses. Citrus fruits contain carbohydrate, fibre, vitamin C, potassium, folate, calcium, thiamin, niacin, vitamin B_6, phosphorus, magnesium, copper, riboflavin, pantothenic acid and a variety of phytochemicals. In this article, the history of knowledge about citrus fruit is reviewed and current research is described. There is scientific evidence that citrus consumption may help to reduce the risk of cancer, cardiovascular disease, anaemia, birth defects and cataracts. Citrus fruits are equally valuable among populations who need to overcome and prevent micronutrient deficiencies as well as those concerned with problems of overnutrition, obesity and diet-related chronic diseases. Surveys in many countries show that citrus intakes are often low. Food preferences, learning history, cultural values, perceptions, attitudes and societal factors, such as the media and advertising, as well as availability and variety, all play a role in determining food choice. Among the barriers to consumption of citrus are high cost, fear of harmful pesticides and quick spoilage. The elderly, the poor and the critically ill may have inadequate access to fresh food and often consume very little citrus fruit and juices. In the past 20 years, greater health-consciousness, the desire for convenience foods, and rising incomes have increased the demand for citrus. The potential for citrus consumption to increase as part of the overall recommended increase in fruit and vegetable consumption is considerable.

Les bienfaits des agrumes pour notre nutrition et notre santé

Les agents de santé publique ainsi que les nutritionnistes encouragent, de manière générale, la consommation des agrumes et de leurs jus. En effet, les éléments nutritifs et non nutritifs contenus dans les agrumes entretiennent la santé, et on leur attribue des vertus protectrices contre un certain nombre de maladies. Les agrumes contiennent des glucides, des fibres, de la vitamine C, du potassium, de l'acide folique, du calcium, de la thiamine, de la niacine, de la vitamine B_6, du phosphore, du magnésium, du cuivre, de la riboflavine, de l'acide pantothénique ainsi qu'une vaste gamme de composantes phytochimiques. Le présent article retrace l'acquisition des connaissances à propos des agrumes et fait le point des recherches actuelles. Selon les observations scientifiques, la consommation d'agrumes pourrait contribuer à réduire le risque de cancer, de maladies cardiovasculaires, d'anémies, d'anomalies congénitales et de cataractes. En outre, les agrumes offrent un apport précieux aux populations qui doivent surmonter ou prévenir des carences en micronutriments, ainsi qu'aux groupes vulnérables aux problèmes de surnutrition, d'obésité et de maladies chroniques liées au régime alimentaire. Or, des enquêtes conduites dans de nombreux pays montrent que la consommation d'agrumes est souvent faible. Les préférences alimentaires, les précédents, les valeurs, les perceptions et les attitudes culturelles ainsi que les facteurs influant sur le corps social tels que les médias, la publicité ainsi que la disponibilité et la variété, sont tous des éléments qui concourent à déterminer les choix alimentaires. À noter, parmi les obstacles à la consommation d'agrumes: leur coût élevé et leur détérioration rapide et la crainte des pesticides toxiques. Les personnes âgées, les économiquement faibles et les personnes très malades sont souvent mal placés pour se procurer de la nourriture fraîche, et leur consommation d'agrumes et de jus d'agrumes est donc souvent très faible. Au cours des 20 dernières années, une meilleure sensibilisation à l'égard de la santé, conjuguée au désir de consommer des aliments à préparation rapide et à l'augmentation des revenus ont contribué à l'accroissement de la demande d'agrumes. Il y a donc, en matière d'augmentation de la consommation des agrumes, un potentiel considérable qui s'inscrit dans le droit fil de la recommandation d'augmentation générale de la consommation de fruits et de légumes.

Efectos beneficiosos de los frutos cítricos en la nutrición y la salud

Los agentes de salud pública y los nutricionistas por lo general estimulan el consumo de frutos cítricos y de los zumos que se extraen de ellos. Los elementos nutrientes y no nutrientes de los cítricos favorecen el buen estado de salud y los protegen contra diversas enfermedades. Los frutos cítricos contienen carbohidratos, fibra, vitamina C, potasio, folato, calcio, tiamina, niacina, vitamina B_6, fósforo, magnesio, cobre, riboflavina, ácido pantoténico y diversos productos secundarios de plantas. En el artículo se examina

la historia de los conocimientos relativos a los frutos cítricos y se describen las investigaciones actualmente en curso. Existen pruebas científicas de que el consumo de cítricos puede contribuir a reducir el riesgo de contraer cáncer, enfermedades cardiovasculares, anemia, malformaciones congénitas y cataratas. Los frutos cítricos son igualmente valiosos para las poblaciones que necesitan compensar y prevenir las carencias de micronutrientes, así como las que tienen problemas ocasionados por la sobrealimentación, la obesidad y las enfermedades crónicas relacionadas con la dieta. Los estudios realizados en diversos países revelan que el consumo de cítricos a menudo es bajo. Las preferencias en materia de alimentos, el conocimiento de la historia, los valores culturales, la sensibilidad, las actitudes y los factores sociales tales como los medios de comunicación, la publicidad, la disponibilidad y la variedad influyen en la elección de los alimentos. Entre las barreras que obstaculizan el consumo de cítricos figuran los altos costos, el temor a los plaguicidas nocivos y la rapidez del deterioro. Es posible que los pobres, las personas mayores, y las que están gravemente enfermas tengan acceso limitado a los alimentos frescos y que a menudo consuman pocos cítricos y zumos. Durante los últimos 20 años, un mayor interés por la salud, el deseo de adquirir alimentos de fácil preparación y el aumento de los ingresos han incrementado la demanda de cítricos. Existen muchas posibilidades de que el consumo de cítricos aumente como parte del incremento global recomendado en el consumo de frutas y hortalizas. ♦