Nutrition, Supplements, AND Aging

Sandra J.W. Smeeding, APRN, CNS, cFNP

Nutrition clearly is a factor in determining the quality and perhaps the quantity of life. Improved nutrition in this century has contributed to an increased life expectancy, and public awareness of the significant role diet plays in health has increased accordingly. The American Cancer Society estimates that as many as 35% of all cancers may be diet related.¹,² Therefore, nutrition is important in disease prevention and health maintenance.

Although the important role nutrition plays in health and well-being generally is acknowledged, few physicians and nurse practitioners are educated in prescribing specific changes in diet or offering patients nutritional supplements to improve their health status. The purpose of this article is to discuss information and current research on nutrition, nutritional supplements, and herbal products to promote health and treat disease.

IMPORTANCE OF ANTIOXIDANTS

Antioxidants that act as free radical scavengers are able to protect and perhaps assist the repair of cellular damage caused by free radicals. However, not all free radicals are scavenged by antioxidants; some escape and cause DNA, protein, and cellular membrane damage. In addition, the elderly generally have decreased blood levels of vitamins A and C, which may contribute to increased cellular damage. Proponents of the free radical theory believe selecting food with high antioxidant properties and low potential for stimulating free radical activity plays an important role in healthy aging.³

NUTRITION AND CANCER PREVENTION

Declining immune function and reduced immunosurveillance, coupled with a higher prevalence of malignancy, is a grave concern in the elderly. Research has shown a strong relationship between nutrition and cancer risk. In 1996, Steinmetz⁴ reviewed 206 human epidemiological studies and 22 animal studies and determined higher fruit and vegetable consumption offers greater protection against the risk of cancer. Diets rich in fruits and vegetables are good sources of antioxidants, including vitamins E and C and carotenoids like beta-carotene and lycopene. Lycopene, which gives tomatoes their red color, has been found to be one of the most potent and effective dietary antioxidants. Lycopene may have a role in preventing prostate cancer, the second most common form of cancer for men, especially elderly men. Table 1 outlines several nutritional supplements and their advantages and concerns.

In a recent study,⁵ 30 patients with localized prostate cancer scheduled for prostatectomy were randomly selected to receive either 15 mg of lycopene as a pure tomato extract two times per day or no intervention. After surgical removal of the prostate, the tumors in the treated group were smaller than those who received no intervention. Serum levels of prostate-specific antigen, which rise with prostate cancer, were decreased in the patients who consumed lycopene. In addition, tumors in these patients showed regression and decreased malignancy.

Research conducted by Dr. A. Venket Rao, a professor in the department of nutritional sciences at the University of Toronto, revealed that lycopene is more bioavailable after cooking or when tomatoes have been processed into juice, sauce, soup, and other tomato-based products.⁶ People who consume tomato juice or sauce every day for 1 week in addition to their regular diet are able to increase their blood lycopene and reduce the amount of oxidized lipids, protein, and DNA. Lycopene is available as a supplement, and the typical dose is 5-10 mg/day, although natural sources seem to be...
<table>
<thead>
<tr>
<th>Product</th>
<th>Efficacy</th>
<th>Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lycopene</td>
<td>Reduces cancer risk (prostate, lung, stomach)</td>
<td>5-10 mg, one serving of tomato juice or tomato products/d to 10 servings per week</td>
</tr>
<tr>
<td>Coenzyme Q10</td>
<td>Treats congestive heart failure, hypertension</td>
<td>CHF: 50-100 mg bid. HTN: 225 mg/d</td>
</tr>
<tr>
<td>Lutein</td>
<td>Prevents macular degeneration and senile cataracts</td>
<td>6 mg/d supplement or 44 mg of lutein/ C cooked kale, 26 mg/C cooked spinach, 3 mg/C broccoli</td>
</tr>
<tr>
<td>Vitamins B6 and B12, folate</td>
<td>May be useful for secondary prevention</td>
<td>Folate: 0.4-1 mg/day, vitamin B6: 2 mg/d, vitamin B12: 6 µ/d in vitamin-fortified foods or supplements. To reduce hyperhomocysteinemia, start folate at 1 mg/d, B6 at 10 mg/d B12 at 250 µ/d</td>
</tr>
<tr>
<td>Vitamin E</td>
<td>May have cardiovascular benefit</td>
<td>100 to 800 IU per day. Natural form of alpha-tocopherol or d-alpha tocopherol is superior in absorption and retention in the body.</td>
</tr>
<tr>
<td>Vitamin C</td>
<td>May have cardiovascular benefit</td>
<td>75-90 mg per day with upper limit of 2 g per day</td>
</tr>
<tr>
<td>Cholestin (red rice yeast)</td>
<td>Treats hypercholesterolemia. Reduces total cholesterol, LDL cholesterol, and triglyceride levels</td>
<td>1200 mg BID. A total daily dose of 2400 mg contains approximately 9.6 mg total statins, of which 7.2 mg are lovastatin.</td>
</tr>
<tr>
<td>Gugulipid (guggul)</td>
<td>Reduces total cholesterol, LDL, and triglycerides. Guggulsterone has thyroid-stimulating activity.</td>
<td>75 mg per day; 100-500 mg have been used</td>
</tr>
<tr>
<td>Soy</td>
<td>Reduces total cholesterol 5%-9%, LDL 13%</td>
<td>25 g of soy protein daily: 1 C soy milk = 3-10 g. 4 oz tofu = 5-13 g. 1/2 C textured soy protein = 6-11 g. C soy flour = 20 g. 3 tbsls. soy protein isolate = 22 g</td>
</tr>
<tr>
<td>Side effects</td>
<td>Drug interactions</td>
<td>Comments</td>
</tr>
<tr>
<td>------------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>None known</td>
<td>None known</td>
<td>Antioxidant found in tomatoes and tomato products, 10 servings per week suggests a risk reduction of 21%-35% in prostate cancer.</td>
</tr>
<tr>
<td>Rare. Various forms of epigastric distress reported. Gastritis/ nausea and diarrhea when taken in doses &gt; 300 mg/d. Taking with food can prevent side effects.</td>
<td>HMG-CoA reductase inhibitors (statins might reduce the effects of supplemental CoQ10, oral hypoglycemic agents [glyburide, acethohexamide, tolazamide]) can reduce serum CoQ10 levels and may reduce supplementation effects. CoQ10 can reduce warfarin’s anti-coagulation effects.</td>
<td>Found in mitochondria of all cells. Highest concentrations in heart, liver, kidney, pancreas. Functions in ATP production as part cellular respiratory chain. Also has been shown to exhibit activity as a free radical scavenger and antioxidant.</td>
</tr>
<tr>
<td>None reported</td>
<td>None known. Olestra lowers lutein in healthy people.</td>
<td>Dietary carotenoid with antioxidant activity</td>
</tr>
<tr>
<td>Rare—diarrhea, itching, vascular thrombosis</td>
<td>Vitamin B12 can mask folate deficiency. Assess folate status before using B12. Large amounts of vitamin C can destroy vitamin B12 and should not be taken within an hour of oral vitamin B12. Chloramphenicol can impair response to B12.</td>
<td>Deficiencies of one or more of these vitamins can lead to hyperhomocysteinemia. Observational evidence supports folate supplements, but no clinical trial has been completed. If family history of early MI, may screen for homocysteine levels, but most insurance does not reimburse.</td>
</tr>
<tr>
<td>Rare—GI upset, headache, fatigue, rash</td>
<td>Warfarin: concomitant use of &gt; 400 u/d might prolong INR and bile. Sequen-trants decrease absorption of supplemental vitamin E.</td>
<td>Safe and inexpensive, but results from clinical trials are inconsistent. Evidence is insufficient to recommend routine use for prevention of CAD and stroke. Cholestyramine, colestipol, gemfibrozil, and mineral oil can reduce dietary vitamin E absorption and serum levels.</td>
</tr>
<tr>
<td>Rare—dose-related in higher doses, GI upset, fatigue, deep vein thrombosis, kidney stones</td>
<td>Concomitant use with aspirin, aluminum-containing antacids, nicotine can increase urinary excretion of ascorbic acid. May impair response to warfarin, increase absorption of dietary iron.</td>
<td>Safe and inexpensive, but research shows insufficient evidence for routine use for CAD prevention. As little as 500 mg per day may promote oxalate kidney stones. Rebound scurvy is possible after abrupt cessation of large doses.</td>
</tr>
<tr>
<td>Abdominal discomfort, possible liver enzyme elevation and myositis, but none recorded</td>
<td>Avoid concomitant use with HMG-CoA reductase inhibitors (statins). Contraindicated with liver dysfunction or abnormal liver function test. May interfere with thyroid therapy, levothyroxine. Grapefruit juice can increase serum lovastatin levels.</td>
<td>Action is similar to commercially available statin drugs.</td>
</tr>
<tr>
<td>Can cause GI upset, headache, hiccups</td>
<td>Concomitant oral administration can reduce bioavailability of propranolol, diltiazem, and may interfere with thyroid drugs.</td>
<td>Widely used in India</td>
</tr>
<tr>
<td>Soy allergies may cause stomach pain, diarrhea</td>
<td>None known</td>
<td>FDA has proposed food labeling that soy protein may play a role in reducing risk of coronary heart disease for products containing at least 6.25 g of soy protein per serving—25% of the effective amount of 25 g/d.</td>
</tr>
</tbody>
</table>
better absorbed by the body. Although current studies suggest lycopene is associated with a lower risk of prostate cancer, more large-scale studies must be conducted before any definitive conclusions can be made.

NUTRITION AND EYE HEALTH

Age-related macular degeneration (AMD) is the leading cause of irreversible blindness among Americans 65 and older. It also is the cause of partial vision loss for one of every 20 U.S. residents. Several studies have linked phytonutrients, such as lutein and zeaxanthin, in the prevention of AMD. Lutein and zeaxanthin are in the carotenoids class of antioxidants found in fruits and vegetables. Lutein is concentrated in the macula of the eye and converted to zeaxanthin in the serum. They are thought to reduce photo-oxidation. Lutein filters out blue light that is known to cause free radical damage to the eyes. Lutein is found in kale, collards, spinach, and broccoli. One study found an intake of 6 mg per day of lutein led to a 43% lower prevalence of AMD. Antioxidant supplements also may help prevent the progression of AMD, indicating it is a nutrient-responsive disease.

Senile cataracts are caused primarily by oxidative stress induced by free radicals or exposure to excessive ultraviolet light (photo-oxidation). Lens proteins do not undergo rapid turnover but remain in the lens for decades and are subject to insult from oxidation and environmental conditions. Antioxidant enzymes are diminished in the aging lens. Foods high in lutein and zeaxanthin, found in eye lenses, may reduce the risk of cataract formation. The benefits of lutein-zeaxanthin have been associated with as much as a 50% reduction in need for cataract surgery. The future of nutritional factors to reduce the incidence of cataracts and AMD appears hopeful.

NUTRITION AND CARDIOVASCULAR HEALTH

Coenzyme Q10 (CoQ10) or ubiquinone is a coenzyme with antioxidant properties. CoQ10 has a key role in oxidative respiration functioning in the production of adenosine triphosphate. Although found in all tissues of the body, CoQ10’s highest concentrations are in the heart, liver, kidney, and pancreas. Research indicates CoQ10 may play an important role in the maintenance of normal heart function by regulating myocardial energy metabolism, its antioxidant effect, and cellular membrane stabilization. CoQ10 levels peak around age 20 and decline with age. Individuals taking cholesterol-lowering HMG-CoA reductase inhibitors (statins) and some oral hypoglycemic agents (eg, glyburide, acetohexamide, and tolazamide) have reduced blood levels of CoQ10.

Double-blind, placebo-controlled trials have confirmed CoQ10 as adjunctive treatment in heart failure with beneficial effects on patients’ clinical outcomes, physical activity, and quality of life. Patients demonstrated improvement in dyspnea at rest, exertional dyspnea, palpitations, cyanosis, hepatomegaly, pulmonary edema, heart rate, and systolic and diastolic blood pressure. Myocardial tissue CoQ10 levels can be improved by oral supplementation (100 mg daily). CoQ10 may be used as an adjunct to standard therapy for CHF. Studies have found no adverse side effects at dosages of 100 mg daily for 6 years or 200 mg daily for 1 year (see Table 1).

CoQ10 also may be beneficial as an adjunctive treatment in hypertension. A study was conducted in a cardiology clinic involving 109 patients with the diagnosis of essential hypertension. An average daily dose of 225 mg of CoQ10 was added to their existing antihypertensive drug regimen. Functional status gradually improved, and the need for antihypertensive drug therapy decreased. Fifty-one percent of the patients discontinued between one and three antihypertensive drugs in an average of 4.4 months after starting CoQ10, and 9.4% of patients had a highly significant improvement in left ventricular wall thickness and diastolic function.

Antioxidants and folic acid are being investigated for ways to prevent coronary artery disease (CAD). Oxidized low-density lipoprotein (LDL) cholesterol promotes atherosclerosis by interacting with macrophages and platelets in the vascular lining. It also interferes with vasorelaxation and can cause endothelial necrosis. Vitamins E and C inhibit LDL oxidation in vitro. Researchers have theorized that these vitamins may play a role in preventing CAD by reducing LDL oxidation and thus atherogenesis. Observational studies suggest a cardiovascular benefit of vitamin E. Although promising, the results of controlled clinical trials on vitamins E and C so far are inconsistent regarding a preventive effect on myocardial infarction (MI).

The Cambridge Heart Antioxidant Study showed that 400-800 international units (IU) per day of vitamin E reduced the risk of nonfatal MI by 73%. Yet the Health Outcomes Prevention Evaluation assessed the effect of 400 IU per day of vitamin E on patients with known cardiovascular disease and found no effect on incidence of MI, stroke, or cardiovascular death. The GISSI prevention trial with 300 mg per day of vitamin E had no effect on MI, stroke, or cardiovascular death rates.

At this time, the role of vitamins E and C in CAD prevention is unclear. Daily doses of more than 800 IU vitamin E may adversely affect platelet function; more than 1200 IU/d may interfere with vitamin K function and granulocytic response. The cardiovascular data on vitamin C are weak but suggest a therapeutic threshold of 50-100 mg per day with an upper limit of 2 gm per day. However, vitamin C doses of as little as 500 mg/d may promote oxalate kidney stones. Long-range clinical trials may prove vitamin E and C beneficial to some individuals in preventing MI.

HOMOCYSTEINE

Homocysteine, an amino acid product of protein metabolism, is under investigation as a causative role in cardiovascular disease. A high homocysteine concentration at
5 to 10 times the normal level directly damages endothelium and promotes atherogenesis.\textsuperscript{19} Normal levels of fasting plasma homocysteine are between 5 and 15 \textmu mol/L. Folate and vitamins B12 and B6 are involved in homocysteine metabolism.

Most individuals have normal homocysteine levels and are able to obtain and absorb adequate amounts of folate and vitamins B6 and B12 from their dietary intake. However, some individuals have high homocysteine levels and may be at higher risk for cardiovascular disease from this mechanism. High-risk individuals are those with a strong family history of premature atherosclerosis, especially without other risk factors. Hyperhomocysteinemia in CAD seems to be an autosomal dominant mechanism.\textsuperscript{19} Other high-risk conditions include advanced age, hyperthyroidism, impaired kidney function, systemic lupus erythematosus, and use of nicotinic acid, theophylline, methotrexate, bile acid-binding resins, and L-dopa.\textsuperscript{20}

Clinical studies have demonstrated that supplemental folic acid and B12 can lower serum homocysteine levels, but vitamin B6 studies have yielded mixed results.\textsuperscript{20} An estimated 25% reduction in homocysteine concentration can be achieved with 0.5-5.7 mg of folic acid per day, and an additional 7% lowering has been observed after the addition of vitamin B12 (0.02-1 mg/d; mean, 0.5 mg).\textsuperscript{20} Although considerable epidemiologic evidence exists for a relationship between plasma homocysteine and cardiovascular disease, not all prospective studies have supported such a relationship.\textsuperscript{20} The potential for reducing homocysteine levels with increased intake of folic acid is evident, but it is not known whether homocysteine reduction by diet or vitamin therapy will reduce the risk of cardiovascular disease, or if high homocysteine levels are a marker for the disease.

Until results of controlled clinical trials become available, population-wide screening is not recommended, and emphasis needs to be placed on meeting dietary recommendations for folate and B vitamins through vegetables, fruits, legumes, meats, fish, and fortified grains and cereals.\textsuperscript{20} However, homocysteine screening may prove beneficial in selected high-risk individuals with a personal or family history of premature cardiovascular disease; those with malabsorption syndromes, including elders with malabsorption of food-bound B12; and those on medications associated with elevated homocysteine levels.

A fasting homocysteine level greater than 10.0 \textmu mol/L is considered high. Screening for folate and vitamin B6 and B12 levels at the same time as homocysteine is recommended. Adding daily supplemental vitamins of 0.4 mg of folic acid, 2 mg of vitamin B6, and 6 μg of B12 may be prudent for at-risk populations. Laboratory values should be rechecked periodically. However, doses over 1 mg/d of folate may mask B12 deficiency and possibly interfere with zinc absorption.

### Table 2.

Nutritional Supplement Websites

- www.supplement.com
- www.consumerlab.com
- www.prescribersletter.com
- www.herbalgram.org

### HYPERCHOLESTEROLEMIA AND CARDIOVASCULAR DISEASE

**Soy.** A recent meta-analysis\textsuperscript{21} demonstrated a beneficial effect of soy protein on total cholesterol and LDL cholesterol. The meta-analysis showed an average decrease of 9% in total cholesterol, 13% in LDL levels, and 10% in triglyceride levels in subjects who ingested soy. In October 1999, the U.S. Food and Drug Administration approved the labeling of soy products with the health claim, “A diet low in saturated fat and cholesterol that includes 25 g of soy protein may reduce the risk of heart disease.” To carry the health claim, a soy product must contain at least 6.25 g of soy per serving and be low in saturated fat and cholesterol.

**Cholestin.** Cholestin, a rice product on which “red rice yeast” is grown, has been used for centuries in China. Cholestin contains at least eight statin compounds, primarily lovastatin, which functions as human menopausal gonadotropin coenzyme A (HMG CoA) reductase inhibitors. Chinese and U.S. studies have verified a drop in total cholesterol levels of 11% to 32%. A recent U.S. trial\textsuperscript{21} reported a double-blind, placebo-controlled study in which patients with hypercholesterolemia were able to lower their total cholesterol levels by approximately 15% and LDL levels by about 22% with cholestin. These results are very similar to the pharmaceutical statin drugs.

Cholestin may be a cost-saving option with no reported adverse effects. However, because the mechanism of action between statin drugs and cholestin may be similar, monitoring liver function and creatin kinase levels is advisable.

**Gugulipid (guggul gum).** Used in India to treat hypercholesterolemia, gugulipid is a relatively new product in the Western world that shows promising results in research trials. Guggul is the gum resin of the Indian bdellium tree; its extracts are guggulsterone and gugulipid. Several placebo-controlled studies and one multicenter trial have demonstrated gugulipid’s ability to reduce total cholesterol levels from 11% to 22%, LDL levels by 12%, and triglyceride levels 12% to 25%.\textsuperscript{21} Gugulipid appears to have a low side-effect profile; in the clinical trials, the side effects were no different than placebo. In addition, gugulipid is markedly cheaper than statin drugs. The sug-
The recommended dose is 75 mg of guggulsterone/day.\textsuperscript{21} An important note is that coadministration of gugulipid reduces the bioavailability of single doses of propranolol and diltiazem in healthy people.\textsuperscript{7}

**NURSING IMPLICATIONS**

This is a very exciting time in adjunctive medical research. More and more studies are being conducted in the areas of nutrition, nutritional supplements, and other holistic therapies to promote and maintain health. Health care professionals need to become educated in the advances in nutritional health and supplements. A holistic nursing educational curriculum that includes information on nutritional supplements and alternative health practice research would be a beneficial addition for students. Immediate information on nutritional supplements can be found on the Internet; Table 2 features several helpful websites. Health care professionals need to become informed and help patients with herb/drug supplement actions, interactions, doses, adverse effects, and benefits.

A nutritional and supplement assessment of older adults through an accurate history is imperative. Asking patients specifically about nutritional supplements and diet in an open, nonjudgmental manner can reap valuable information into health concerns and values. Health care providers need to keep an open mind, realizing some people benefit from taking nutritional supplements, should they choose that option. Health care providers should be able to answer questions or provide resources for patients already using nutritional supplements or those seeking information.

**REFERENCES**


SANDRA J. W. SMEEDING, APRN, CNS, cFNP, is codirector of the Integrative Health Program and a nurse practitioner in general and plastic surgery for the Veterans Affairs Health Care System in Salt Lake City, Utah.

Copyright © 2001 by Mosby, Inc.
0197-4572/2001/$35.00 + 0 34/1/117919