
The Benefits of Nutritional Supplements: Executive Summary and Call to Action

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Executive Summary

Nutrition plays a major role in determining our state of health and our susceptibility to many diseases. (McGinnis and Ernst 2001) It has been estimated that *every year* there are:

- 14 million cases of preventable heart disease,
- 1.2 million preventable cases of cancer,
- more than half a million preventable strokes,
- and 2500 babies born with neural tube defects that could have been prevented by a simple vitamin.

Disease prevention can reduce health care costs as well as lessen the personal burden of disease. For example, improving nutritional practices could potentially delay the onset of cardiovascular disease, stroke, and osteoporosis by five years, thus saving \$89 billion in health care costs **annually**. (Blumberg 1997)

While the overall improvement of dietary habits is the focus of much research on health promotion and disease prevention, scientists and health care professionals increasingly recognize that nutritional supplements also play an important role. This report presents an overview of the research findings that continue to illuminate the value of nutritional supplements.

Supplements Should Be an Integral Part of a Healthy Diet

The 2000 edition of the *Dietary Guidelines for Americans*, published by the U.S. Department of Agriculture and the Department of Health and Human Services, recognizes that “**some people need a vitamin-mineral supplement to meet specific nutrient needs.**” The American Dietetic Association has a policy statement on dietary supplements that closely parallels the advice contained in the *Dietary Guidelines*. (Dietary Guidelines 2000, ADA 2001)

Drs. Walter Willett and Meir Stampfer of Harvard Medical School and the Harvard School of Public Health recently advised, based on their research and expertise, that a

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daily multivitamin “makes sense for most adults” for a variety of reasons. They note that the cost of a multivitamin “is so low—similar to that of about a quarter of a serving of fruit or vegetables—that it is unlikely to displace healthful foods in most persons’ budgets.” (Willett and Stampfer 2001) Two other Harvard physicians, Drs. Kathleen Fairfield and Robert Fletcher, also recently concluded that it would be prudent for most adults to use a multivitamin to reduce the risk of chronic disease and emphasized the reasonable cost of this simple insurance against suboptimal nutrient intakes. (Fairfield 2002, Fletcher 2002) Dr. David Heber of the UCLA Center for Human Nutrition recently suggested that consumers think of the “basic four” supplements—a multivitamin, extra vitamin C, extra vitamin E, and calcium—as an integral part of their diets along with the four food groups. (Heber 2001)

All of these recommendations recognize the simplicity and importance of daily supplementation.

Calcium, Vitamin D, and Bone Health

“Calcium is the nutrient most important for attaining peak bone mass and for preventing and treating osteoporosis.” Yet many, perhaps most, Americans fail to consume recommended amounts of calcium. “Randomized clinical trials have demonstrated that adequate calcium intake from diet or supplements” increases bone mineral density, and other trials have demonstrated that combined treatment with vitamin D and calcium reduces the incidence of hip fractures and other fractures. (NIH Consensus Development Panel on Osteoporosis, 2001)

In 1997, the Food and Nutrition Board of the Institute of Medicine issued new, higher intake recommendations for calcium and vitamin D, especially in adults over the age of 50. Dietary surveys show that less than 10 percent of teenage girls get the amount of calcium they need to build optimal bone mass, and less than 10 percent of adults over 50 consume the amount of calcium they need to slow bone loss during aging. (Food and Nutrition Board 1997)

The National Osteoporosis Foundation reports that many women and young girls consume less than half the amount of calcium they need for bone health and points out that a calcium supplement can help make up the shortfall. (NOF website)

A recent national study found that almost half of women over 50 have undiagnosed low bone mineral density. In other words, half of American women are *currently at risk of bone fractures*, without knowing it. For these women, “the risk of fracture is not a decade or more in the future” but is a risk facing them today or within the coming year. (Siris 2001)

Dr. Robert P. Heaney, one of the nation’s leading experts on calcium and bone health, recently observed that 139 studies have been published in the past 25 years on calcium intake and bone status. Almost all the studies in adults showed that increasing calcium intake reduced or stopped age-related bone loss, or reduced the rate of bone fractures, or

both. All of the trials in children and adolescents showed that consuming supplemental calcium (from supplements or from dairy products) increased bone growth. This means that current levels of calcium intake in children are not sufficient to build optimal bone mass. Also, current intakes in adults are not sufficient to protect the “bone capital” they have amassed during their lifetime. (Heaney 2000)

Because of the strength of these findings, the Food and Drug Administration has approved a health claim about calcium and osteoporosis that can appear on labels of foods and supplements that are good sources of calcium. The claim can say that diets high in calcium may reduce the risk of osteoporosis. (FDA 1993)

It has been estimated that, if people over the age of 50 habitually consumed about 1200 mg per day of supplemental calcium, more than 130,000 hip fractures per year could be avoided. This would prevent suffering and a loss of independence for many individuals and could also result in an annual savings of \$2.6 billion in direct medical costs. (Bendich 1999)

The cost of adding 1000 mg of calcium to the diet is less than a quarter a day for most calcium supplements, less than a dollar a day if the calcium comes from lowfat milk or a calcium-fortified breakfast cereal, and about \$1.38 per day if the calcium comes from calcium-fortified orange juice. Adding a supplement appears to be the easiest and least costly option, but any of these alternatives would be an economical and sound investment in longterm health for any consumer.

Folic Acid and Neural Tube Birth Defects

One of the most exciting scientific developments in the past several decades is the finding that folic acid (one of the B vitamins) plays a critical role in protecting against some serious birth defects, when taken by women of childbearing age before and during pregnancy.

A number of clinical trials, supported by epidemiological evidence, show that women who took a multivitamin supplement containing folic acid at the level of 360 to 800 µg per day, *in addition to the folate in their usual diet*, had a reduced risk of having a baby with a neural tube defect such as spina bifida. These defects occur in the United States and Canada in about one of every thousand births.

The studies show that it is critical for the supplement to be used *at least a month before conception* and during at least the first month following conception, because the neural tube of the fetus closes (or tragically fails to close) in the first month of pregnancy, at a time when many women are not yet aware they are pregnant.

The Food and Nutrition Board of the Institute of Medicine recognized these findings when it issued new dietary recommendations for the B vitamins in 1998, recommending “that women capable of becoming pregnant **consume 400 µg of folate daily from supplements, fortified foods, or both** in addition to consuming food folate from a varied

diet.” The Food and Nutrition Board added, **“At this time the evidence for a protective effect from folate supplements is much stronger than that for food folate.”** (Food and Nutrition Board 1998, emphasis added)

The Centers for Disease Control and Prevention (CDC) provided leadership in this field by issuing a public health recommendation in 1992 urging all women of childbearing age to get 400 µg (0.4 mg) of folic acid daily, in order to help prevent neural tube defects. (CDC 1992)

The March of Dimes initiated a national campaign on folic acid in 1995, emphasizing that regular use of a multivitamin containing folic acid could reduce the incidence of neural tube defects by up to 70 percent. Unfortunately, supplement use is low among young women of childbearing age. **“The March of Dimes recommends that women of childbearing age take a multivitamin daily as part of a healthy diet rich in fortified and natural food sources.** Folate is found in leafy green vegetables, whole grain foods, and citrus fruits. While a healthy and diverse diet is important, it may not be sufficient to reduce neural tube defects by 70 percent. Supplementation is essential to achieve this reduction.” (March of Dimes 2001, emphasis added)

The Gallup Organization recently surveyed women of childbearing age and found that, while 80 percent of the women were aware of folic acid, only about 30 percent of them were taking a supplement containing folic acid. Dr. Jennifer L. Howse, president of the March of Dimes, called on “physicians, nurses, midwives, pharmacists, and other health professionals to use every contact they have with women of childbearing age to urge them to take a multivitamin with folic acid daily.” (March of Dimes 2002)

The Food and Drug Administration (FDA) has approved a health claim for folic acid, which can appear on the labels of foods and supplements that contain this B vitamin. The claim may state that “healthful diets with adequate folic acid may reduce a woman’s risk of having a child with a brain or spinal cord birth defect.” (FDA 1996)

FDA has also added folic acid to the list of nutrients that must be added to processed grain products in order for the product to be called “enriched.” (FDA 1996) This requirement took effect in January 1998 and has increased blood levels of folic acid in the population. However, experts still advise women of childbearing age to take a supplement with folic acid “to obtain the maximum protection against the development of NTDs.” (Mills 2001, Werler 1999)

Women can easily add 400 µg of folic acid per day to their dietary intake by using a multivitamin containing folic acid or by consuming a breakfast cereal fortified with 400 µg of folic acid per serving. The cost of the supplement would be less than a dime a day, and the cost of the cereal would be only about 38 cents per serving. Either is an excellent value, providing critically important protection for overall women’s health as well as protecting babies yet unborn from devastating neural tube birth defects.

B Vitamins, Heart Disease, and Stroke

A substantial body of scientific evidence suggests that generous intakes of three B vitamins may reduce the incidence of two of the primary causes of death and disability in the United States—heart disease and stroke. The particular B vitamins involved are folic acid, vitamin B-6 and vitamin B-12. Scientists believe they may reduce cardiovascular disease by lowering blood levels of homocysteine, the amino acid byproduct of one-carbon metabolism.

Studies in the Framingham Offspring cohort have shown that homocysteine levels were lower among people who used B vitamin supplements than in those who did not. FDA's folic acid fortification program for "enriched" grain products was found to have increased plasma folate levels and decreased homocysteine levels in this population, but not to the degree observed in those who used supplements. (Jacques 1999, Jacques 2001)

Drs. Meir Stampfer and Eric Rimm of the Harvard School of Public Health and Harvard Medical School have underscored the urgent need for a large clinical trial on folic acid and cardiovascular disease. They emphasized that, if proven effective, intervention with folic acid to lower homocysteine levels "could prevent tens of thousands of cases of cardiovascular disease each year at very low cost and with few (if any) adverse effects." (Stampfer and Rimm 1996)

While more studies are under way, many researchers believe there is sufficient evidence today to recommend that people supplement their diets with folic acid and possibly also with vitamin B-6 and vitamin B-12. A meta-analysis of 28 studies on folic acid, homocysteine and vascular disease predicted that more than 56,000 deaths could be avoided annually if all Americans obtained adequate amounts of folic acid. The authors of the analysis concluded that a strong case can be made for the likelihood that an increased folic acid intake will reduce the risk of heart disease and stroke. They indicated that, even while additional trials are pursued, "policies for increasing folic acid intake could have a considerable effect on the prevention of arteriosclerotic vascular disease." (Boushey 1995)

Other B vitamins, especially B-6 and B-12, also play a role in reducing homocysteine. Users of multivitamin supplements have lower homocysteine levels and a lower risk of heart disease. Taking a multivitamin is an easy and economical way to take advantage of these important benefits.

Improving Immune Function in the Elderly

Infectious disease places a heavy burden on the elderly, but evidence suggests that improved nutrition could enhance disease resistance in this vulnerable population. If immune function could be improved in the elderly, the impact on individual quality of life and on the nation's health care costs could be substantial.

An extensive survey of the dietary habits of 1740 healthy adults living in Arizona and over the age of 50 showed that more than 60 percent had deficient dietary intakes of vitamin D, vitamin E, folate and calcium. Their intakes were not only below the *recommended* levels, but below the *average requirement*. (Foote 2000)

Researchers in rural Iowa surveyed nutrient intakes of more than 400 elderly residents who were 79 years of age or older (average age 85) and living in the community, not in an institution. More than half lived alone. “Eighty percent of subjects reported inadequate intakes of four or more nutrients.” Folate, vitamin D, and calcium intakes were inadequate in most of this elderly population. “Multivitamin/mineral supplementation with additional calcium may be necessary for the old to achieve adequate nutrient intakes.” (Marshall 2001)

Dr. Ranjit Chandra, an internationally recognized expert in nutrition and immunity, has pointed out that even in the Western world nutritional deficiencies exist in at least one-third of the elderly, and these deficiencies can lead to impaired immune function. “It is expensive and impractical to estimate dietary intake or blood levels of various nutrients in individuals. Since there is no evidence to suggest that physiological amounts of vitamins and trace elements given for prolonged periods have any toxic or adverse consequences and given the high prevalence of deficiencies of several micronutrients in old age, it would be prudent to opt for a suitable micronutrient supplement in modest amounts for all elderly individuals in order to achieve the maximum physiologic and health benefit with the least risk of toxicity. Further research is needed to confirm the type and amount of micronutrient(s) to be included in the supplement.” (Chandra 1997) In other words, a broad multivitamin with minerals can provide excellent nutritional insurance for the elderly, although individuals may have different nutritional gaps. There is no harm in providing extra vitamins in modest amounts, but there *is* harm in allowing deficiencies to persist.

In clinical trials in people over the age of 65 and in people in the age range of 50 to 65, Dr. Chandra showed that a modest multivitamin with minerals improved biochemical measures of immune function and also decreased the number of days of infectious illness by half. (Chandra 1992, Chandra 2002)

A study of immune function in elderly persons in New Jersey showed that taking a daily multivitamin for one year resulted in a stronger immune system and higher blood levels of several vitamins. The researchers suggested that current recommendations for some micronutrients may be too low to support optimal immune function in healthy, independently living older adults. (Bogden 1994)

In a Boston study of 88 healthy people 65 years of age or older, vitamin E supplementation was found to improve some measures of immune function. Researchers at the USDA Human Nutrition Research Center on Aging indicated that the best responses were observed in people given 200 mg of vitamin E per day. No improvement in immune function was observed when a supplement containing only 60 mg of vitamin

E was given, and a supplement of 800 mg did not produce better results than 200 mg. (Meydani 1997)

“In comparison with the general population, older Americans are twice as likely to visit the doctor and 3 times more likely to be hospitalized; their average hospital stays are twice as long, and they consume twice the number of prescription drugs.” Infection is one of the most common causes of sickness in the elderly, and older people are two to ten times more likely to die of infections than younger adults. A review of clinical trials on nutritional interventions supports “use of a daily multivitamin or trace-mineral supplement that includes zinc (elemental zinc, >20 mg/day) and selenium (100 µg/day), with additional vitamin E to achieve a daily dosage of 200 mg/day.” Health care providers should be aware of common drug/nutrient interactions, since the elderly are heavy users of medications. (High 2001)

Elderly persons residing in nursing homes may be particularly at risk of unrecognized inadequacies of vitamins and minerals because their health may already be compromised by multiple disorders and because there may be difficulties in feeding. While other nutritional problems observed in nursing homes may be difficult to remedy, micronutrient deficiencies can be avoided through inexpensive, safe supplementation. Dr. Connie Bales of the Duke University Medical Center emphasizes that “the benefits could be remarkable, with the potential for improvements in a number of vital functions, including but not limited to cognitive ability and immunocompetence.” (Bales 1995)

It would make good sense to recommend routine use of a multivitamin with minerals for all adults, but especially for the elderly, to compensate for recognized nutritional shortfalls and to avoid the consequences of inadequate intakes of essential nutrients. In the elderly, such a supplement has been shown to help support a healthy immune system.

Vitamin E May Protect Against Heart Disease

Antioxidants help protect every cell and membrane in the body against the ravages of everyday living, and thus help prevent diseases that result from accumulated damage due to oxidation. Leading scientists such as Dr. Bruce Ames of the University of California at Berkeley are convinced that increasing the intake of a variety of nutrients, including antioxidant vitamins, could result in “a major improvement in health and an increase in longevity.” (Ames 1998, Ames 2001, Ames 2002)

Scientists believe that the process of atherogenesis that leads to heart disease is initiated when LDL cholesterol is oxidized. Vitamin E (alpha tocopherol) helps protect against LDL oxidation and thus may help protect against heart disease. There is considerable evidence to support this hypothesis, but large clinical trials have produced mixed results. The most strikingly positive trial was the Cambridge Heart Anti-Oxidant Study (CHAOS), which found that vitamin E supplementation was dramatically effective in reducing the risk of heart attacks in patients known to be at high risk. The primary author of this study said that he would be “recommending that patients with angina and those

who are at risk of heart disease should be given supplementary vitamin E at a high dose.” (Stephens 1996)

Positive results of vitamin E were also found in the SPACE trial (Secondary Prevention with Antioxidants of Cardiovascular Disease in Endstage Renal Disease), where the vitamin E treatment was associated with a significant protective effect against cardiovascular death and non-fatal myocardial infarction (heart attack). (Boaz 2000) However, three other major trials have failed to find a protective effect of vitamin E against heart disease. The earliest of these was the Alpha-Tocopherol Beta-Carotene Study, which was designed to test whether vitamin E and/or beta-carotene supplementation would reduce the risk of lung cancer in almost 30,000 smokers in Finland. Effects on coronary artery disease were also evaluated, and neither supplement was found to be protective against lung cancer or heart disease. (ATBC 1994)

In the GISSI trial in Italy, researchers gave 300 mg of vitamin E and/or one gram of omega-3 fatty acids or no supplement to over 11,000 patients who had survived a recent myocardial infarction (heart attack). (GISSI stands for the Gruppo Italiano per lo Studio della Sopravvivenza nell'Infarto miocardico.) The omega-3 fatty acid treatment reduced the risk of death, nonfatal heart attack, and stroke, but the vitamin E did not have a significant protective effect. The authors conclude that “the dose of vitamin E that is most effective and safe, as well as the minimum duration of treatment that is required to produce the postulated protective effects of vitamin E are still unknown.” (GISSI 1999)

In the Heart Outcomes Prevention Evaluation study (the HOPE trial), there were no significant effects of vitamin E on the risk of heart attacks, stroke, or death. This dose of the vitamin was “well tolerated, with no significant adverse events as compared with placebo.” The HOPE study is being continued “to evaluate the effects of vitamin E on the incidence of cancer.” (HOPE 2000)

Numerous researchers on antioxidants and heart disease still believe vitamin E will be proven to have a protective benefit in the general population. Drs. Ishwarlal Jialal and Sridevi Devaraj of the University of Texas Southwestern Medical Center and Dr. Maret Traber of the Linus Pauling Institute at Oregon State University recently reviewed the results of five major clinical trials on vitamin E and concluded that “the totality of evidence based on the epidemiologic data, in-vitro studies and animal models, and the clinical trials appears to support a benefit for alpha tocopherol supplementation in patients with pre-existing cardiovascular disease.” (Jialal 2001)

In a review article, Dr. William Pryor of Louisiana State University recently concluded that there is sufficient evidence on vitamin E and heart disease “to recommend modest vitamin E supplementation (100 to 400 IU per day) as part of a general program of heart-healthy behavior that includes a fruit- and vegetable-rich diet and regular exercise.” (Pryor 2000)

In a review of the evidence on antioxidants and heart disease, Drs. Eric Rimm and Meir Stampfer of the Harvard School of Public Health and Harvard Medical School concluded

that “results from observational and experimental studies consistently support an effect of vitamin E supplementation on reducing risk of coronary heart disease.” They indicated that “the net benefit of vitamin E supplementation among populations with existing coronary disease may be substantial,” although more evidence is needed. (Rimm and Stampfer 2000)

The Food and Nutrition Board of the Institute of Medicine published a report on antioxidants in 2000, recommending small increases in vitamin E intake but not recommending higher levels of vitamin E intake for purposes related to heart health, although additional research was encouraged. The report said: “Some physicians caring for patients with coronary artery disease are already prescribing vitamin E at doses used in the CHAOS study, 400 or 800 IU...Precisely how vitamin E works at these high doses is not known but could include both antioxidant and nonantioxidant mechanisms. This is an active research area at both the molecular and the clinical levels, and further research is needed.” If the results of ongoing trials are positive, “it may become necessary to review the recommendations for vitamin E intakes in some subgroups of the adult population, especially those in the groups over 50 years of age because increasing age is an important risk factor for heart disease.” (Food and Nutrition Board, 2000)

Given the current evidence and the continued scientific support for the antioxidant hypothesis, it would make sense for most adults to add a vitamin E supplement to their daily dietary regimen, for the longterm protection of heart health.

Antioxidants May Help Protect Against Some Cancers

Epidemiological evidence shows that people who consume large amounts of fruits and vegetables have reduced risk of many types of cancer. Many scientists believe that antioxidant nutrients may be responsible for some of the protective effects of fruits and vegetables. Researchers recently reviewed the evidence on nutritional supplements and cancer risk, including seven clinical trials, 16 cohort studies, and 36 case-control studies. They concluded that “there is modest evidence for protective effects of nutrients from supplements against several cancers.” (Patterson 1997)

Dr. Bruce Ames of the University of California at Berkeley has suggested that DNA damage resulting from micronutrient deficiencies is a major cause of cancer. “Micronutrient deficiency can mimic radiation (or chemicals) in damaging DNA by causing single- and double-strand breaks, or oxidative lesions, or both.” The key nutrients include folic acid, vitamins B-12 and B-6, vitamins C and E, iron, and zinc. “Optimizing micronutrient intake (through better diets, fortification of foods, or multivitamin-mineral pills) can have a major impact on public health at low cost.” (Ames 2001)

There is evidence that oxidative damage may play a role in prostate cancer, and selenium and vitamin E have both been shown in separate trials to help protect against prostate cancer. The National Institutes of Health are currently funding a study on selenium, vitamin E and prostate cancer involving more than 30,000 men. (Fleshner 2001)

In a review of the evidence on vitamin or mineral supplements and cancer, some researchers recently concluded that there is sufficient evidence to suggest that vitamin C supplements may reduce the risk of cancers of the gastrointestinal tract and bladder, that vitamin E may help protect against prostate cancer or colon cancer (in addition to being protective against heart disease), and that calcium supplements may reduce the risk of colon cancer. (Patterson 2001)

Antioxidants May Help Protect Against Cataracts

Cataracts are a major cause of blindness throughout the world, and antioxidants are believed to play a role in protecting against cataracts. Opacity of the lens of the eye is one of the first signals that cataracts are developing. In the National Eye Institute's Longitudinal Study of Cataract, researchers found that study participants who were regular users of multivitamin supplements or vitamin E supplements were less likely to have a worsening of lens opacity during the study period. (Leske 1998)

In the Nutrition and Vision Project (NVP), the development of cataracts (lens opacity) in almost 500 women over the age of 50 was studied over a period of 13 to 15 years. Prevalence of lens opacities was lower in women with high intakes of vitamin C and in women who had used a vitamin C supplement for ten years or more. (Jacques 2001)

Among residents of Beaver Dam, Wisconsin, the risk of developing a cataract over a period of five years was 60 percent lower in people who had used multivitamins or a supplement containing vitamin C or vitamin E for more than 10 years, compared to people who did not use such supplements. (Mares-Perlman 2000)

For the protection of eye health, eating large quantities of fruits and vegetables and adding supplemental antioxidant vitamins makes good sense.

Antioxidants May Help Protect Against Macular Degeneration

The macula is the part of the retina that is responsible for central vision and visual acuity. In primates, including humans, the central area of the macula is yellow, due to the presence of "macular pigment" containing a high concentration of the carotenoids lutein and zeaxanthin. Age-related macular degeneration (AMD) occurs in about 20 percent of the population above the age of 65. It is irreversible and is the leading cause of visual impairment in the United States. Supplementation with lutein has been found to increase macular pigmentation. (Snodderly 1995, Landrum 1997, Pratt 1999)

The Age-Related Eye Disease Study (AREDS) is an 11-year multicenter trial involving more than 3600 people who had evidence of age-related macular degeneration when they entered the trial. Participants were assigned to one of four groups, with each group receiving antioxidant supplements, zinc supplements, both or a placebo. The antioxidant supplement included 500 mg vitamin C, 400 IU vitamin E and 15 mg beta-carotene. The zinc supplement included 80 mg zinc and 2 mg copper. The people that received both the

antioxidant and the zinc supplements were significantly protected from development of advanced AMD. The researchers suggested that people at risk of AMD “should consider taking a supplement of antioxidants plus zinc such as that used in this study...” They note, however, that smokers should not use supplements of beta-carotene, because of earlier studies that suggested an increased cancer risk in smokers supplemented with beta-carotene. (AREDS 2001)

Antioxidants and Brain Function

Growing evidence also links antioxidants to improved mental function in elderly individuals. In a longterm study of more than 3000 elderly Japanese-American men living in Hawaii, researchers found that the use of vitamin C and vitamin E supplements improved cognitive function and reduced the risk of developing dementia. (Masaki 2000) A longitudinal study of aging conducted by researchers from the University of New Mexico School of Medicine demonstrated that use of vitamin supplements and higher dietary intakes of vitamin C, thiamin, riboflavin, niacin and folate were correlated with better performance on various tests of cognitive performance. (La Rue 1997)

It is well established that deficiencies of the B vitamins involved in the single-carbon cycle have severe effects on brain function that can result in depression, dementia, and other disorders. “Although severe vitamin deficiencies and congenital defects are rare, milder subclinical vitamin deficiencies are not uncommon in the elderly. Interest is increasing in learning the extent to which these mild, reversible deficiencies contribute to some decline in cognitive function in the later years of life.” Results of some studies “support the possibility that poor vitamin status is partially responsible for the cognitive decline seen in some elderly persons.” (Selhub 2000)

In a study in Newfoundland, supplementation of apparently healthy men and women over the age of 65 for a period of one year improved cognitive function as measured by tests of short-term memory, abstract thinking, problem-solving ability, and attention. The supplement given was a modest multivitamin with minerals. The author of the study, Dr. Ranjit Chandra of the Memorial University of Newfoundland, concluded, “Given the high frequency of nutrient deficiencies in old age, it would be prudent to opt for a suitable micronutrient supplement for all elderly subjects to achieve the maximum physiologic and health benefits with the least risk of toxicity.” He added that such a supplement “might significantly delay or prevent the onset of overt Alzheimer’s disease.” (Chandra 2001)

According to the authors of a study on Alzheimer’s disease, “there is evidence that medications or vitamins that increase the levels of brain catecholamines and protect against oxidative damage may reduce the neuronal damage and slow the progression of Alzheimer’s disease.” In a two-year clinical trial, vitamin E (2000 IU per day) or the monoamine oxidase inhibitor selegiline delayed progression of the disease. (Sano 1997) Another study has been initiated to determine whether vitamin E can prevent or delay development of Alzheimer’s disease in patients with mild cognitive impairment. (Grundman 2000)

Parkinson's disease affects about 3 percent of the population over 65 years of age. While the causes are not known, it is recognized that the neurons "are constantly exposed to external and internal toxins in the brain," and many of these neurotoxins produce free radicals that can cause oxidative damage. While clinical trials continue, Dr. Kedar Prasad of the Colorado Health Science Center suggests that supplementation with a number of antioxidants might be advisable for people at high risk of Parkinson's disease. (Prasad 1999)

Long Chain Omega-3 Fatty Acids May Protect Against Heart Disease

An abundance of evidence strongly suggests that increased intakes of long chain omega-3 fatty acids (also called n-3 fatty acids) can markedly reduce the risk of heart disease. The omega-3 fatty acids believed to be largely responsible for these effects include EPA and DHA (eicosapentaenoic acid and docosapentaenoic acid), which are naturally found in fish. Most Americans eat very little fish and thus have very low intakes of these omega-3 fatty acids.

According to Dr. William E. Connor of Oregon Health Sciences University, an internationally recognized expert on omega-3 fatty acids and health, hundreds of experimental and clinical studies have provided strong evidence that omega-3 fatty acids may help prevent heart disease through a number of different mechanisms. Connor concludes that omega-3 fatty acids "are natural food substances that prevent coronary artery disease and sudden death." He emphasizes that these fatty acids "have immense public health significance for the control of the current coronary epidemic." (Connor 2001)

In the Physicians' Health Study, researchers found that doctors who consumed fish more frequently or had higher blood levels of omega-3 fatty acids had a significantly lower risk of sudden cardiac death. The researchers conclude that "the long-chain n-3 fatty acids found in fish may reduce the risk of sudden death from cardiac causes, even among men without a history of cardiovascular disease." They suggest that "increasing the intake of n-3 fatty acids by eating more fish or by taking supplements is an intervention that could be applied to this segment of the population at low cost and little risk." (Albert 2002, Albert 1998)

In the Nurses' Health Study, more frequent consumption of fish was found to be protective against heart disease, stroke, and all-cause mortality. A similar protective effect was found with the estimated intake of omega-3 fatty acids. "This finding is consistent with the hypothesis that omega-3 fatty acids are the active agent primarily responsible for the apparent protective effect of fish." (Hu 2002, Iso 2001)

In the Chicago Western Electric Study, researchers evaluated the association between fish consumption and mortality from heart disease over a 30-year period. The risk of death from heart disease was 40 percent lower in men who ate at least 35 grams of fish daily.

This amounts to a little more than an ounce a day, equivalent to 4.4 ounces twice a week or 8.8 ounces once a week. (Daviglus 1997)

In the MRFIT trial (Multiple Risk Factor Intervention Trial), involving men at high risk of heart disease, the consumption of polyunsaturated fatty acids from fish had a protective effect against mortality from cardiovascular disease over a period of 10.5 years. (Dolecek 1992) Another study in this same group of men examined serum fatty acid levels and also found that men with higher levels of omega-3 polyunsaturated fatty acids had a lower risk of heart disease. (Simon 1995)

In a case-control study of 334 people with primary cardiac arrest and 493 controls, researchers in the Cardiovascular Health Research Unit at the University of Washington found seafood consumption to be protective. People who ate even one fatty fish or seafood meal per week had a 50 percent reduced risk of cardiac arrest, compared to people who ate none. The researchers concluded that modest amounts of omega-3 fatty acids from seafood “may reduce vulnerability to ventricular fibrillation and, thereby, reduce the risk of coronary heart disease mortality.” (Siscovick 1995)

A large intervention trial in Italy specifically studied the impact of omega-3 fatty acid supplements on more than 11,000 men who had survived a heart attack (MI, or myocardial infarction). It sought the degree of supplement protection against later events, including nonfatal MI, stroke, or death. The omega-3 group was given one gram of combined EPA and DHA per day, and this supplement “significantly decreased, over 3.5 years, the rate of death, non-fatal myocardial infarction, and stroke.” The decrease in risk was 10 to 15 percent. (GISSI 1999)

There are numerous mechanisms by which long chain omega-3 fatty acids can have an impact on the risk of atherosclerosis. They not only lower triglycerides, but also decrease platelet aggregation, favor dilation of the blood vessels, and decrease the tendency to thrombosis. In a review article, Dr. Artemis Simopoulos of the Center for Genetics, Nutrition and Health lists no less than 17 separate mechanisms by which omega-3 fatty acids may have these physiological effects. In clinical trials, beneficial effects have been attributed primarily to reducing arrhythmias and reducing thrombosis in the vessels. (Simopoulos 1999) These key nutrients are readily available as inexpensive supplements.

Characteristics of Supplement Users

National surveys indicate that about half of Americans use dietary supplements. Industry sources suggest that as many as 70 percent of Americans may use supplements at least occasionally, but estimate that only about 40 percent of the population uses supplements with any regularity. (NHANES III 1999, Kaufman 2002, NBJ 2001, Council for Responsible Nutrition 2001)

In general, supplement users are healthy people who view supplements as just one of several approaches to improving health. There is no evidence that supplement users rely on supplements as a substitute for improving dietary habits. In fact, surveys show that

supplement users tend to have somewhat better diets than nonusers. (Koplan 1986, Looker 1988, Hartz 1988, Slesinski 1996) This suggests that consumers who use supplements are also paying more attention to their overall nutritional habits. Even so, these consumers have nutrient shortfalls in their diets, and supplements can help fill those gaps.

The American Institute for Cancer Research commissioned a study on whether consumers had made dietary changes to reduce cancer risk. Overall, 39 percent of those surveyed said they had made changes to their diets to reduce cancer risk. Among those who said they had changed their diets, 68 percent also used dietary supplements. Among the 61 percent who had *not* changed their diets, only 36 percent were supplement users. CRN believes these data suggest that people who become sufficiently health conscious to use supplements are likely also to improve their diets, and vice versa. (AICR 2000)

Health professionals including physicians generally, cardiologists specifically, dietitians, nurses, and pharmacists are at least as likely as the general population to be users of nutritional supplements. This further supports the observation that supplement use is associated with health consciousness and awareness of the scientific evidence relating to nutrition and health. (Frank 2000, Mehta 1997, Worthington-Roberts 1984, Ranelli 1993)

Call to Action

As demonstrated in this document, strong and accumulating scientific evidence supports the beneficial effects of daily, longterm use of multivitamins and some additional supplements. Though some studies identify benefits only in people who have used a supplement for ten years or more, other studies show specific benefits after only a short period of use. **It is never too late** to start incorporating multivitamins—and a few additional supplements—into an overall healthy lifestyle. The maximum benefits will accrue to those who are persistent in their use of these key supplements.

The evidence shows that multivitamins, B vitamins including folic acid, antioxidants including vitamin C and vitamin E, calcium and vitamin D, and long chain omega-3 fatty acids have the potential for:

- Reducing the current incidence of neural tube birth defects by 50 percent or more,
- Decreasing the number of sick days due to infectious illnesses in the elderly by as much as 50 percent,
- Delaying or avoiding 20 percent or more of the hip fractures caused by osteoporosis,
- Giving the gift of sight to millions by delaying the onset of cataracts and age related macular degeneration,
- Reducing the incidence of heart disease and stroke, and
- Protecting against some types of cancer.

These potential gains can be realized only if consumers, health professionals, and government agencies actively support the universal use of appropriate nutritional supplements, especially multivitamins. Today more than half of Americans use some type of nutritional supplement. More could benefit, if fuller information and encouragement for nutritional improvement were provided by authoritative sources.

Consumers Should Choose to Incorporate at Least a Multivitamin Every Day

Every day, more than 280 million Americans get up and go about their business. That business requires nourishing their bodies. What most people eat is influenced more by habit and convenience than by considerations of nutritional needs. Yet what people eat is an important determinant of how they feel, how effectively they function, how well they ward off infection, how clearly they think, how well they can see, how they protect themselves against chronic and killer diseases, and ultimately how long they live. In combination with improved overall dietary habits and regular exercise, a daily multivitamin would benefit virtually all consumers.

A basic multivitamin should provide 100 percent of the Daily Value for all or most of the 13 vitamins. (The percent Daily Value is shown on the nutrition label of the product, in the Supplement Facts box.)

A multivitamin with minerals can be expected to provide 100 percent of the Daily Value for all or most vitamins and a number of minerals, but most will *not* be able to provide the full amount of calcium, because calcium is needed in such a large amount.

A multivitamin with minerals can fill nutrient gaps, optimize function, protect health, and help prevent disease—all for about a dime a day. There is no better use for a dime a day, and there is no other dietary choice or lifestyle habit that is as easy to incorporate and that has such a high potential payoff. For fuller coverage, consumers should consider adding other key supplements, including vitamin E, vitamin C, and calcium. In addition, evidence reviewed in this document relating to carotenoids such as lutein, antioxidant minerals such as selenium, and long chain omega-3 fatty acids such as EPA and DHA suggests additional benefits to be gained by incorporating these supplements. Consumers who choose to delve deeper into the dietary supplement category may also add botanical or herbal supplements for specific applications, or other types of specialty supplements.

Are there other choices people make every day that are just as important as taking their vitamins? Certainly. Every effort should be made to get regular exercise, avoid tobacco

products, maintain a healthy body weight, eat lots of fruits and vegetables, choose whole grain breads and cereals, select lowfat animal foods (dairy, meat, poultry), and include fish at least once or twice in every week's menus. These choices may be harder to incorporate, but they are very important. However, success in implementing these lifestyle changes does not diminish the value of supplements.

Every Health Care Professional Should Recommend a Multivitamin as an Integral Part of a Healthy Diet

Every day, hundreds of thousands of health professionals talk to millions of consumers. Unfortunately, many health professionals receive minimal nutrition education during their training and may not be comfortable offering their patients nutritional advice. One message they can and should confidently deliver is that everyone could benefit from the longterm regular use of a multivitamin, preferably with minerals. The regular use of a multivitamin is an important positive action that almost all patients or clients should be encouraged to incorporate as an integral part of their daily pattern of activities.

An obstetrician seeing a woman planning to become pregnant should strongly advise her to take a multivitamin containing the B vitamin folic acid. She should be taking the multivitamin *before* she gets pregnant, and should continue it (or switch to a prenatal multivitamin) during the pregnancy. Failure to offer this advice is failure to apply existing scientific knowledge about the importance of folic acid in preventing a large fraction of neural tube birth defects such as spina bifida.

Family physicians and nurses seeing women of childbearing age who have no plans whatsoever to become pregnant should nevertheless advise them to take a multivitamin containing the B vitamin folic acid. Because most pregnancies are unplanned, the Food and Nutrition Board of the Institute of Medicine has recommended that all women capable of pregnancy should be getting 400 µg (0.4 mg) of folic acid daily from a multivitamin or from a fully-fortified breakfast cereal—in addition to the folate they get from their daily diets—in order to protect against having a baby with a neural tube birth defect such as spina bifida. The critical period for formation of the neural tube is during the first month of pregnancy, at a time when many women are not yet aware they are pregnant. Therefore, effective prevention requires that women of childbearing age be using multivitamins containing folic acid on a regular basis. Usual prenatal care may come too late to provide this protection.

Physicians, nurses, and case workers who have contact with senior citizens should not miss the opportunity to advise people to make regular use of a multivitamin supplement, preferably with minerals, to provide nutritional insurance generally and specifically to support a healthy immune system. This applies especially to health professionals who work with patients in nursing homes, since these patients are particularly fragile and prone to illness. Every nursing home should have appropriate multivitamin supplements in its formulary and should encourage their regular use, in order to avoid adding nutrient deficiencies to the multitude of health problems that already beset residents of nursing homes.

Many cardiologists take a vitamin E supplement themselves and recommend one to patients who are at risk of heart disease. While the evidence on vitamin E is still developing, many researchers are convinced it will help protect against heart disease by preventing oxidation of LDL cholesterol, a step that leads to the initiation of plaque formation and the development of atherosclerosis. Multivitamins with folic acid, vitamin B-12 and vitamin B-6 are also believed to play a role in protecting against heart disease and stroke by reducing blood levels of homocysteine. It would be reasonable for cardiologists to suggest that their patients incorporate both a multivitamin and additional vitamin E into their daily regimen. The cost would be minimal, and the potential benefits could be great.

Pharmacists are the health care professionals perhaps most readily available to consumers, and they are often asked about nutritional supplements. They should take the opportunity to provide scientifically sound advice in support of longterm regular use of multivitamins, calcium, and extra C and E.

Dietitians obviously are the health professionals who should be most nutritionally aware and most informed about the benefits of a rational supplementation program. Unfortunately, the dogma of many dietetic programs is to focus solely on food patterns and to denigrate the importance of supplementation, apparently in the erroneous belief that people who use supplements will tend to pay less attention to their diets. Survey results show the opposite is true: people who use supplements tend also to be more interested in overall nutritional improvement and healthy lifestyles. Many individual dietitians use supplements themselves and recommend supplements to their clients. The complementary use of foods and supplements should become an accepted feature of dietetic practice.

Government Agencies and Health Advocacy Groups Should Incorporate Multivitamins Into Public Recommendations

The 2000 edition of *Dietary Guidelines for Americans*, published by the U.S. Department of Agriculture and the Department of Health and Human Services, recognizes that many people may need nutritional supplements to meet dietary recommendations for some nutrients. This represents an important step forward in government policy. However, advice coming from other respected sources sometimes falls short of the ideal.

Private health advocacy organizations such as the American Heart Association, the American Cancer Society and the American Institute for Cancer Research regularly provide nutritional recommendations to the public but generally do not recommend nutritional supplements. They recognize that the evidence in favor of some nutritional supplements is building, but tend to believe no public recommendation should be made until the evidence is “complete.” By the time the evidence is complete, several generations of people may already have died of conditions that could have been delayed or avoided. When the potentially beneficial interventions involve something as simple and safe as a vitamin or a multivitamin, the Council for Responsible Nutrition argues that

the appropriate action would be to make the recommendation for general use, with whatever caveats the organizations believe necessary, in order to permit current generations to make protective choices within their lifetimes.

The Food and Nutrition Board of the Institute of Medicine recommends folic acid supplementation for women capable of pregnancy, in order to protect against having a baby with a neural tube birth defect such as spina bifida, and also recommends that people over the age of 50 should get most of their vitamin B-12 requirement from synthetic sources (such as a multivitamin), because absorption of the food forms of B-12 decreases substantially with aging. This vital recognition of the value of vitamin supplements for general population use should be more widely embraced.

Some consumer groups including the Center for Science in the Public Interest (CSPI) have recognized the benefits of some nutritional supplements for health promotion and disease prevention. They continue to argue, as they should, for more research, high quality products, and truthful claims, but they do so in the context of granting the fundamental logic of nutritional supplementation as a means of filling nutrient gaps and adding protective nutrients to the diet. Other consumer groups would serve the public well by carefully considering and recommending appropriate nutritional supplements, even if they (like CSPI) have continuing concerns regarding other dietary supplement issues.

The Food and Drug Administration (FDA) is responsible for regulating the safety and quality of all foods including dietary supplements and has authority to ensure that all labeling is truthful and not misleading. The Federal Trade Commission (FTC) exercises authority over product advertising. While most dietary supplement manufacturers and marketers work hard to guarantee that products are safe, beneficial, and properly labeled, both FDA and FTC should increase enforcement activities against any company that fails to fulfill its responsibility to consumers. Consumer confidence in nutritional supplements is essential and can only be earned through a combination of industry responsibility and effective government oversight and enforcement of regulatory requirements.

Bottom Line

The regular use of multivitamins and a few other nutritional supplements can measurably improve the nutritional status and lifelong health of the American public. Adoption of the concept of supplementation as a part of personal lifestyles, health care practices, and public policy would benefit individuals, would improve the health profile of the nation as a whole, and could significantly reduce health care costs. The simple choice on the part of each individual to make a small investment in nutritional supplementation could save billions in medical expenses, in addition to protecting the health of all Americans—newborns and the very old, growing children and pregnant women, the wealthy as well as low-income populations, healthy men and women as well as people burdened with chronic disease. Virtually everyone would be helped by a rational program of supplementation, and it is never too late to begin.

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The Benefits of Nutritional Supplements: Introductory Information

Compiled by Annette Dickinson, Ph.D.
Council for Responsible Nutrition
June 2002

Abbreviations Used in This Document

AI	Adequate Intake
AMD, ARMD	Age-related macular degeneration
CDC	Centers for Disease Control and Prevention
CHD	Coronary heart disease
CRN	Council for Responsible Nutrition
DRI	Dietary Reference Intakes
EAR	Estimated Average Requirement
FDA	U.S. Food and Drug Administration
HDL	High-density lipoprotein cholesterol
HHS	Department of Health and Human Services
LDL	Low-density lipoprotein cholesterol
MI	Myocardial infarction
NHANES	National Health and Nutrition Examination Survey
NIH	National Institutes of Health
NLEA	Nutrition Labeling and Education Act of 1990
NTDs	Neural tube birth defects
RDA	Recommended Dietary Allowances
UL	Upper Tolerable Intake Level
USDA	U.S. Department of Agriculture

Units of Measure

g	Gram (1 g = 1000 mg)
IU	International Units (used for vitamins A, D, and E)
µg	Microgram (1000 µg = 1 mg), scientific abbreviation
mcg	Microgram, abbreviation used in dietary supplement labeling
mg	Milligram (1000 mg = 1 g)
µmol/L	Micromoles per liter (blood levels of a substance)
nmol/L	Nanomoles per liter (blood levels of a substance)

About the Council for Responsible Nutrition

The Council for Responsible Nutrition (CRN) is a trade association representing manufacturers of dietary supplements. CRN's diverse membership, whose products represent the majority of nutritional supplement sales in the United States, share the commitment to provide beneficial, safe, quality supplements to consumers. Member companies include manufacturers of brand name and private label finished products, manufacturers of bulk ingredients used to formulate dietary supplements, suppliers of packaging and labeling, affiliate members who manufacture related products or ingredients, associate members who provide services ranging from public relations to laboratory analysis, and international correspondents.

CRN's membership has ratified a Code of Ethics which affirms that CRN member companies:

- are dedicated to enhancing the health of the American public through improved nutrition, including the appropriate use of nutritional supplements;
- are committed to reducing health care costs through improved nutrition, health promotion, and disease prevention; and
- recognize their duty to provide the public with safe and beneficial nutritional supplements, manufactured to high quality standards, and to ensure that consumers are provided with the accurate information they need to make informed choices.

CRN is governed by its President and Chief Executive Officer, John Cordaro, and by a Board of Directors made up of representatives of member companies.

Additional information about CRN and its staff is available on the website at www.crnusa.org

About the Author

Annette Dickinson, Ph.D., is Vice President, Scientific and Regulatory Affairs, for the Council for Responsible Nutrition. A recognized expert and author, Dr. Dickinson has 30 years of experience with the dietary supplement industry. She was recently appointed to serve a 3-year term on the U.S. Food and Drug Administration's Food Advisory Committee. She was appointed by President Clinton to the Commission on Dietary Supplement Labels and is a frequent witness before the U.S. Congress and a speaker at numerous other public forums.

Her expertise includes the legal and technical aspects of marketing dietary supplements, including provisions relating to labeling, advertising, and good manufacturing practices. She is responsible for analyzing and responding to new regulatory or legislative proposals as well as evaluating new scientific research relating to the safety and benefits of dietary supplements. Dr. Dickinson is a recognized leader in the development of industry and government policies based upon current science.

A frequent contributor to national and international meetings and technical symposia, Dr. Dickinson is often called upon by the print and electronic media to represent the industry view on issues affecting dietary supplements. She earned her Ph.D. in nutritional sciences and her M.S. in food sciences at the University of Maryland.

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