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# MULTIVITAMINS AND OTHER DIETARY SUPPLEMENTS FOR BETTER HEALTH

A Position Paper  
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**Council for Responsible Nutrition**  
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### Summary

- **Nutrition surveys consistently reveal that substantial numbers of Americans fail to obtain recommended amounts of various nutrients from diet alone. If official nutrient recommendations are taken seriously, then it must follow that people would be better off getting the full recommended amount of each nutrient than falling short of that amount.**
- **Dietary supplements have been widely used and highly valued by American consumers ever since vitamins were discovered and commercialized, beginning in the early decades of the 1900s. Usage has grown steadily with every decade, as documented by NHANES surveys beginning in the 1970s. In the most recent NHANES survey, supplement use was reported by over half the adult population.**
- **Multivitamins are a convenient and affordable way of filling nutrient gaps. For some population groups, supplemental intakes are specifically recommended as a preferred means of obtaining certain nutrients, and a multivitamin will cover many of those needs. In addition, evidence suggests that people who use multivitamins and/or other specific nutrient dietary supplements have a lower risk of some chronic diseases.**
- **Generous intakes of antioxidant vitamins have been associated with reduced risk of some chronic diseases, in the same way that generous intakes of fruits and vegetables have been associated with similar health benefits.**
- **Taking a multivitamin containing folic acid will dramatically reduce a woman's risk of having a baby with a neural tube birth defect, and folic acid plus vitamins B-6 and B-12 may reduce cardiovascular disease in the general population.**
- **Dietary supplement use has been associated with decreased risk of chronic diseases in numerous observational studies involving tens of thousands of people, and in some studies the benefit has increased with long-term use. Supplement use is a rational choice made by consumers who are also likely to adopt other healthy habits, and the available evidence suggests that it is a positive choice.**
- **The best solution for most people is to eat the best diet possible, adopt other healthy habits, and use a rational assortment of nutritional dietary supplements, most notably a multivitamin, to ensure adequate intakes or to try to approach levels that may be considered optimal.**

## **Introduction**

Americans are passionate about their vitamins. This is not a new phenomenon, and it is not without a scientific basis. Nutritional dietary supplements, including multivitamins, have been marketed in the United States since the early decades of the 1900s, and consumer interest in these products is not only widespread but intense. In 1938, a consumer magazine published by the American Medical Association was already taking note of the determination of the American people to consume “quantities of vitamin pills and capsules to prevent colds, to ward off a long list of dread diseases, to give themselves pep, beauty and strength.” (1). Multivitamins represent a safe, cost-effective means of delivering adequate amounts of nearly all the essential vitamins and minerals. Their widespread use helps to ensure adequate nutrition for millions of Americans and contributes to reductions in the risk of several chronic diseases.

### **Who uses dietary supplements? More than half the population.**

The National Health and Nutrition Examination Surveys (NHANES) have been conducted periodically in the United States since the early 1970s, and they show a steadily increasing prevalence of supplement use. Each of the surveys shows that supplement use is higher among women than men in all age groups and higher among older consumers than among young and middle-aged adults. Among older age groups in the NHANES surveys, the prevalence of supplement use increased from 30% in the early 1970s to 40% by 1980, 55% by 1990, and 63% by 2000 (Table 1) (2-6). In the 1999-2000 NHANES survey, overall supplement use by adults was 52%, with a range of 43% to 63% for various age-sex groups (Figure 1) (6). By far the most commonly used supplement is the multivitamin, with or without minerals—used by 35% of American adults in 2000. The next most popular dietary supplements are vitamin C, vitamin E, and calcium—each used by only 10 to 13% of American consumers. The vast majority of supplement users take only one to three products on a regular basis, while 17% of supplement users take four or more.

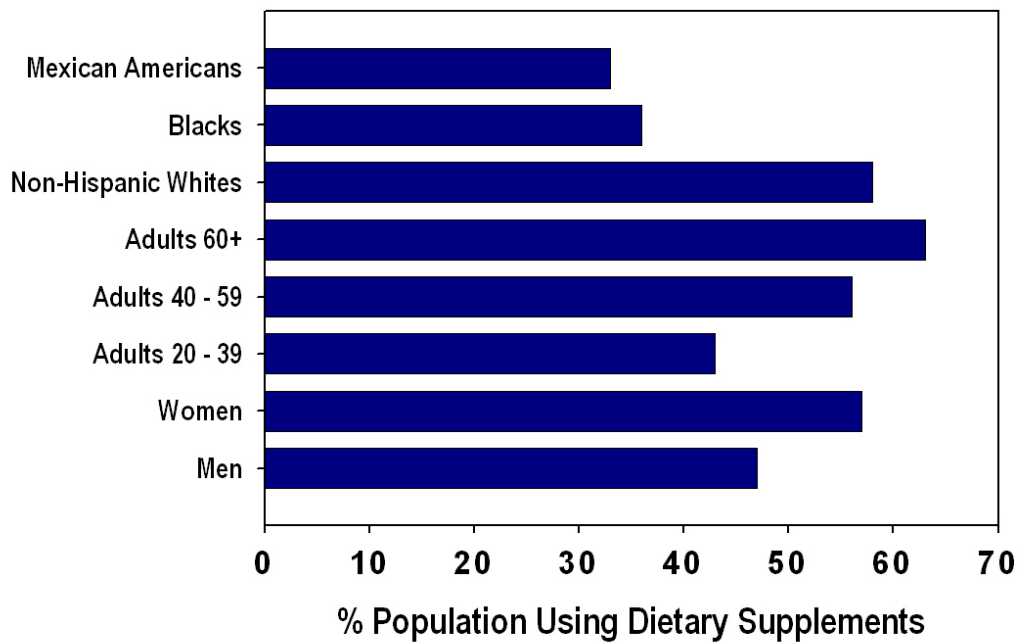
The NHANES data provide one estimate, with some other surveys showing higher use. For example, data from The National Family Opinion and Natural Marketing Institute (NMI) survey of grocery shoppers/heads of household partially funded by the National Institutes of Health

(NIH) found that over 50% of respondents use multivitamins on a daily basis (7). Gallup also estimates multivitamins are the most commonly used dietary supplement, with 79% of dietary supplement users taking multivitamins (8). The Council for Responsible Nutrition’s 2005 Consumer Confidence Survey also found that 62% of adults in the United States use supplements at least occasionally. Forty-six percent of the population said they used supplements regularly. Twenty-four percent of the population said they were regular users of multivitamins only, while another 22% of the population said they were regular users of a variety of different supplements, including multivitamins, single nutrients, herbal products, and specialty products. Fourteen percent of the population said they used supplements only occasionally, and two percent said they used supplements on a seasonal basis. Seventy-seven percent of the population indicated that they were very confident (27%) or somewhat confident (50%) in the safety, quality and effectiveness of dietary supplements (9).

**Table 1.** *Supplement use by various age groups according to NHANES survey*

Survey	Percent of adults using dietary supplements	
	Daily (% range)	Daily + Occasional (% range)
1972-74 (NHANES I)	20-30	
1976-1980 (NHANES II)	17-34	29-44
1988-1994 (NHANES III)		30-55
1999-2000 (NHANES)		43-63

The use of nutritional dietary supplements is related to other healthy habits, indicating that it is a lifestyle choice made by people who are seeking various ways to improve their overall health. The use of dietary supplements is positively related to education, and their use among health professionals is just as likely as among members of the general public (10-13).



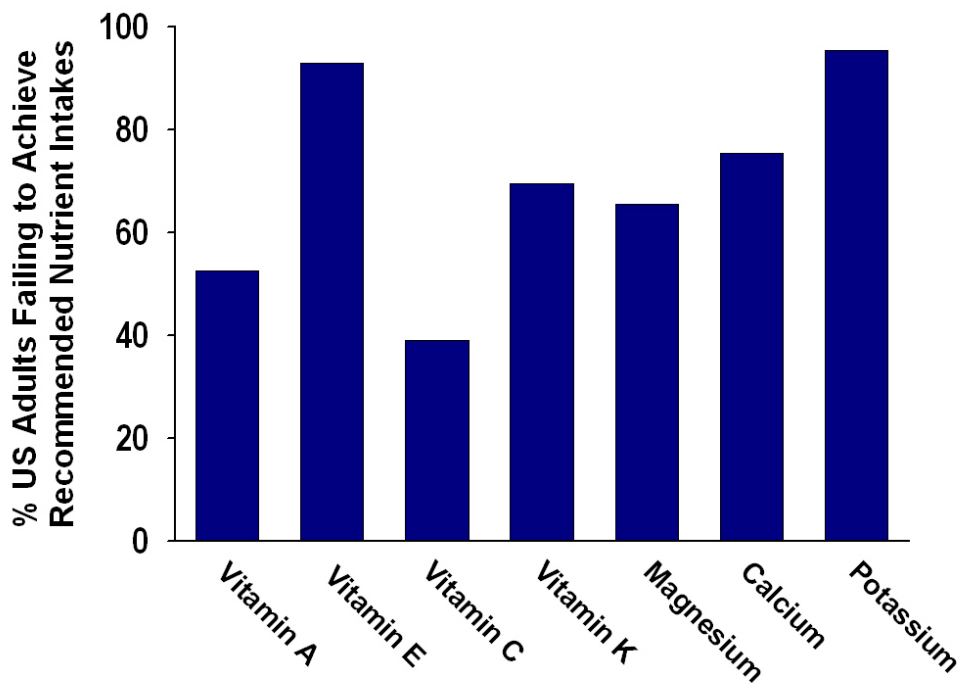
**Figure 1.** *Percent of US population using dietary supplements*  
 Data derived from Radimer et al., 2004 and NHANES 1999 – 2000.

**Who needs nutritional dietary supplements? Practically everybody.**

Scientists have put substantial effort into developing and revising Recommended Dietary Allowances (RDAs) over the years. Nutritional surveys consistently reveal that a large percent of the American population falls short of recommended intakes of numerous vitamins and minerals. According to the 2005 Dietary Guidelines for Americans, the vitamins and minerals that are especially low in American diets include vitamin A (from carotenoids), vitamin C, vitamin E, calcium, and magnesium (summarized in Figure 2 and Table 2) (14).

The 2001 – 2002 NHANES survey of dietary intakes shows that 93% of Americans fail to get even the Estimated Average Requirement (EAR) for vitamin E, let alone the RDA. A multivitamin would definitely fill that gap. More than half of adults fail to get even the average requirement for vitamin A, and that gap could be filled by a multivitamin containing beta-carotene or by eating more fruits and vegetables rich in beta-carotene (15). Vitamin C is relatively easy to obtain in large quantities from ordinary foods, but apparently many people

don't choose to consume the fruits and vegetables and juices that are rich in vitamin C as well as other antioxidants. About one-third of nonsmoking adults fall short of the average requirement for vitamin C. Because vitamin C needs are higher for smokers than for nonsmokers, more than 2/3 (76%) of smokers fall short of the target (15). A simple, convenient, inexpensive multivitamin would fill those gaps. Calcium needs are high, and getting an adequate amount from diet alone is a challenge. Ten percent of teenage boys and more than 25% of teenage girls don't even achieve half of the Adequate Intake (AI) for calcium, according to the NHANES survey. Among older men and women, 25 to 50% get less than half of the amount they need (15). Most calcium supplements provide about 500 mg per tablet, plus some vitamin D. One tablet in the morning and one in the evening would virtually ensure adequacy.



**Figure 2.** *Percent of US adults with nutrient intakes below recommended levels.*

Data derived from Radimer et al., 2004 and NHANES 1999 – 2000.

**Table 2. Major nutrient intake shortfalls in the U.S. population**

<b>Nutrient</b>	<b>Target population</b>	<b>Comments</b>
<i>Vitamin A</i>	Boys 14 – 18	55% get less than EAR of 630 RAE* Over 75% less than RDA of 900 RAE
	Women 19 – 30	58% get less than EAR of 500 RAE Over 75% less than RDA of 700 RAE
	Men 31 – 50	55% get less than EAR of 625 RAE Over 75% less than RDA of 900 RAE
	Women 51 – 70	43% get less than EAR of 500 RAE Over get 50% less than RDA of 700 RAE
<i>Vitamin C</i>	Men 20 – 50	35% of non-smokers get less than EAR of 75 mg 67% of smokers get less than EAR of 110 mg
	Women 20 – 50	34% of non-smokers get less than EAR of 60 mg 88% of smokers get less than EAR of 95 mg
<i>Calcium</i>	Boys 14 – 18	69% get less than AI of 1300 mg 10% get less than <b>half</b> of this amount
	Girls 14 – 18	91% get less than AI of 1300 mg Over 25% get less than <b>half</b> of this amount
	Men 19 – 30	47% get less than AI of 1000 mg
	Women 31 – 50	85% get less than AI of 1000 mg
	Men 51 – 70	84% get less than AI of 1200 mg 25% get less than <b>half</b> of this amount
	Women 71+	96% get less than AI of 1200 mg Almost 50% get less than <b>half</b> of this amount

Based on NHANES 2001 – 2002 (15); \*Retinol Activity Equivalents

A number of reviews written by notable experts have been published in recent years calling for an increase in vitamin D intakes among the world's population for both bone health and cancer prevention (16-23). These arguments are based on observational data showing that the vitamin D nutritional status of most of the world's population is less than half of what it should be and intakes in excess of 1000 IU per day are likely needed by most, especially dark-skinned individuals, the elderly and those living in the northern latitudes (due to reduced sun exposure). Although most current multivitamins contain only a fraction of this amount, they do contribute significantly to vitamin D nutriture, especially during the winter months. Further, because of the relatively low bulk density of vitamin D, much higher levels can easily be incorporated into standard tablets, making multivitamins a potentially excellent delivery mechanism for the extra vitamin D that nearly all experts agree is needed.

If the Dietary Reference Intakes (DRIs) established by The Institute of Medicine's (IOM) expert scientist panels are to be taken seriously—and they are certainly meant to be taken seriously—then it follows that it would be better for people to achieve recommended amounts of nutrients than to fall short. A multivitamin is a convenient and inexpensive means of ensuring adequate intake of a variety of nutrients, and a supplement containing calcium with vitamin D is an ideal way to boost intake of these critical nutrients without increasing caloric intake.

**Who recommends nutritional dietary supplements? Some major nutrition experts, independent organizations and the government.**

Drs. Walter Willett and Meir Stampfer, two prominent physician-researchers at Harvard University, wrote an article in 2001 in the *New England Journal of Medicine* stating that a daily multivitamin “makes sense for most adults,” and that an additional supplement of vitamin E might also be reasonable (24). Dr. Willett reiterated this advice in a 2005 book chapter on preventive nutrition (25), and his own book *Eat, Drink and Be Healthy* features a modified food guide pyramid with a side bar recommending “multivitamins for most.” (26).

Drs. Kathleen Fairfield and Robert Fletcher of Harvard reviewed the benefits of vitamins in a 2002 article in *JAMA* and also concluded that a multivitamin would be prudent for virtually all adults (27).

Dr. David Heber of the UCLA Center for Human Nutrition recommends “four vitamin supplements to complement the so-called basic four food groups.” Dr. Heber's *basic four* nutritional dietary supplements are: a multivitamin with minerals, plus 400 IU of extra vitamin E, 500 mg of extra vitamin C, and 1000 to 1500 mg of calcium (28).

Scientists at the USDA Human Nutrition Research Center on Aging at Tufts University have given careful thought to the nutritional needs of the elderly. Older people have lower energy needs, tend to eat less and may have difficulty digesting food, making it difficult to obtain recommended amounts of nutrients. Less than adequate intakes of calcium, vitamin D, and vitamin B-12 are of particular concern in the elderly. To assist in nutrition education, the scientists have developed a special Food Guide Pyramid for people over 70. They suggest that

“a flag should be placed on the top of the 70+ Food Pyramid indicating that supplements of calcium, vitamin D and vitamin B-12 are frequently appropriate to promote optimal health.” (29).

The DRIs established by the Food and Nutrition Board (FNB) of the IOM, as well as the Dietary Guidelines for Americans established by USDA and Department of Health and Human Services, recommend that women capable of pregnancy obtain 400 mcg of folic acid (a B vitamin) from supplemental sources and that people over the age of 50 obtain vitamin B-12 from supplemental sources (30). A multivitamin will effectively provide these nutrients, as well as others.

The 2005 edition of the USDA *Dietary Guidelines for Americans* (14) acknowledges the need for dietary supplements, including folic acid for women who could become pregnant, vitamin D for older adults and others with little exposure to sunlight, and B-12 for people over the age of 50, because their absorption of B-12 from food may not be efficient. All of these can be obtained from a multivitamin.

The American Dietetic Association (ADA) advocates meeting nutritional needs through wise selection of a wide variety of foods, but has adopted a policy statement recognizing that nutritional dietary supplements and food fortification may be desirable for some nutrients and for some individuals. The ADA’s recommendations are listed below (31).

- Folic acid for women capable of becoming pregnant
- Vitamin B-12 for people over 50 and for vegans
- Calcium for some people
- Vitamin D for the elderly
- Iron during pregnancy

### **Dietary Improvements and Disease Prevention: A Historical View**

Until 20 or 30 years ago, the goal of dietary improvement was to ensure or optimize normal nutrition (i.e. prevent nutrient inadequacies), and that remains a key purpose of dietary guidelines and nutrient recommendations. However, beginning in the late 1970s and continuing throughout

the 1980s, a series of major reports began to emphasize not only “health promotion” but also “disease prevention.”

A number of dietary improvements were identified that experts believed would dramatically reduce the risk of several chronic diseases, including cancer and heart disease. The improvements included eating less fat and more fruits, vegetables, and whole grains. It was emphasized that the benefits were most likely to be derived from whole foods, not from supplementation with individual nutrients present in those foods. At the same time the National Cancer Institute (NCI) and other research organizations launched a number of clinical trials specifically designed to examine potential benefits of supplementation with individual vitamins, especially antioxidant vitamins. By 1986, NCI had already launched more than 20 clinical trials in which dietary supplements of various nutrients, especially beta-carotene, would be tested in an effort to reduce cancer risk (32).

Meanwhile, evidence was developing in other areas of research involving nutritional dietary supplements. Several NIH Consensus Conferences confirmed the importance of generous intakes of calcium, in addition to other factors, in building bone mass and reducing age-related bone loss to protect against osteoporosis (33). In a dramatic demonstration of the power of supplementation, it was found that women of childbearing age could substantially reduce the risk of having a baby with a neural tube birth defect (NTD) such as spina bifida, if they took a multivitamin or folic acid (34). It also appeared that multivitamins containing folic acid, B-6, and B-12 had other benefits, including protecting cognitive function (35, 36). These B vitamins were found to reliably reduce homocysteine levels, which in turn appeared to reduce the risk of heart disease and stroke (37-40).

### **Multivitamins and Improved Health**

In the following sections, specific nutrients and disease conditions will be discussed. However, it is useful to note that many of the benefits attributed to antioxidants, folic acid or various combinations of B vitamins were specifically related to multivitamin use. Following are some examples of observational studies that have reported benefits from multivitamins.

- People who took multivitamin supplements daily for 10 years had one-half the risk of colon cancer, compared to those who did not take multivitamins (41).
- Men in Quebec who took vitamin supplements had a 70% lower risk of dying from ischemic heart disease and a 50% lower risk of myocardial infarction (MI) (42).
- In a Wisconsin study, risk of cataract was 60% lower in people who had used multivitamins or a vitamin C or vitamin E supplement for more than 10 years (43).
- The Longitudinal Study of Cataract found a decreased risk of cataract in people who were regular users of multivitamins or vitamin E supplements (44).
- In the Physicians' Health Study (PHS), doctors who used multivitamins had a lower risk of cataract (45).
- People in New Mexico who took vitamin supplements performed better on various tests of cognitive performance (46).
- In a New Jersey study, taking a daily multivitamin for one year strengthened the immune system of elderly persons (47).
- In England, giving a multivitamin with folic acid to women who had already had a pregnancy affected by a NTD reduced the risk of having another affected pregnancy by 80% (48, 49).
- In Hungary, women planning a pregnancy were given a multivitamin containing folic acid or a placebo, as part of a family planning program. There were no NTDs in the supplemented group, and there were fewer malformations of all types in the supplemented group (50).
- In half a dozen epidemiological studies in the U.S. and Canada, it was observed that women who took multivitamins during the periconceptional period (several weeks or months before and after conception) had a substantially reduced risk of having a baby with a NTD such as spina bifida, and the risk of other defects was also lowered (51-55).
- Among over 80,000 nurses, there was a 45% reduction in risk of heart disease in women with high intakes of both folic acid and vitamin B-6. Ninety-five percent of the women in the highest intake group were users of multivitamins (40).
- In the European Concerted Action Project, people with high homocysteine levels were twice as likely to have vascular disease. The increased risk related to homocysteine was comparable to the risk related to high cholesterol levels or smoking. People who used vitamin supplements had a 62% reduced risk (56).

Researchers at Harvard have compiled a list of “prudent” dietary patterns characteristic of people with reduced risk of various diseases. These prudent habits include the use of a multivitamin (57-59).

## Antioxidants and Cancer

Antioxidants are powerful protective agents that occur naturally in fruits and vegetables and other foods which also exert their protective effects when consumed in the form of nutritional dietary supplements. Here are a few examples of the kinds of evidence supporting this assertion.

- People with high beta-carotene intakes have about one-third the cancer risk as people with low beta-carotene intakes (60).
- People with diets high in vitamin C have about half the risk for many types of cancer, compared to people with low vitamin C intakes (61).
- People with low intakes of many vitamins have more DNA damage than people with generous intakes (62).
- People with the highest dietary intakes of vitamin C, beta-carotene and vitamin E had a 68% lower risk of lung cancer (63).
- Men who took vitamin E supplements for 10 years or more had a 30% lower risk of bladder cancer (64).
- People who took multivitamin supplements daily for 10 years had one-half the risk of colon cancer, compared to those who did not take multivitamins (41).

Despite strong epidemiological evidence for benefit in protecting against various cancers, the results from clinical trials testing some antioxidant nutrients have been disappointing, especially for beta-carotene. Two major trials not only found no benefit, but found some increased risk of lung cancer in lifelong smokers or asbestos workers who took beta-carotene and/or vitamin E (65-67). Perhaps testing this nutrient in these very high-risk groups was too extreme. The PHS also found no protection of beta-carotene against cancer or heart disease, but also found no harm from beta-carotene (68). Researchers continue to believe there is value in increasing antioxidant intakes for many reasons, including potentially for protection against some cancers. A recent review on nutrition and colon cancer concluded that there is evidence that selenium, vitamin E, vitamin C, calcium, folic acid, and vitamin D may play a preventive role for some cancers (69). NCI is also still committed to further exploration of the benefits of antioxidants, and is currently supporting a major clinical trial in more than 30,000 men to test whether selenium and vitamin E supplements can reduce the risk of prostate cancer (70).

## Antioxidants and Heart Disease

A large body of experimental evidence, an abundance of epidemiological observations, and some clinical research suggests that high intakes of vitamin E may help reduce the risk of heart disease. For example:

- Elderly people who took dietary supplements both of vitamin E and vitamin C had a decreased risk of mortality from heart disease as well as total mortality (71).
- Women in Iowa with high dietary intakes of vitamin E had a 68% lower risk of death from heart disease. There appeared to be no effect of vitamin E supplements, but few of these women actually used vitamin E and there was no information on duration of use (72).
- Men in Quebec who took vitamin supplements had a 70% lower risk of dying from ischemic heart disease and a 50% lower risk of MI (42).
- In the Nurses' Health Study involving more than 87,000 women, there was a 41% reduction in risk of heart disease for those who took vitamin E for more than two years. Average intake in the lowest-risk group was 200 IU (73).
- In the Nurses' Health Study, using a vitamin C supplement was also independently related to a lower risk for heart disease (74).
- In the Health Professionals Follow-up Study involving almost 40,000 men, there was a 37% reduction in risk of heart disease in men who took vitamin E for more than two years. Average intake in the lowest-risk group was 400 IU per day (75).

The results from clinical trials examining the effect of vitamin E supplementation on heart disease risk have been mixed. The two trials that used the highest levels of vitamin E were positive. One trial using 800 IU and 400 IU per day of vitamin E found a 75% reduction in heart attack risk among men who already had heart problems (76). Another used 800 IU per day of vitamin E in people who had end-stage kidney disease and who were on dialysis and found a protective effect against cardiovascular death and non-fatal MI (77). Three trials using 300 IU per day of vitamin E have failed to show a benefit on primary endpoints, although some found a benefit on some secondary endpoints. These included the Gruppo Italiano per lo Studio della Sopravvivenza nell'Infarto miocardico (GISSI) trial in Italy, the Antioxidant Supplementation in Atherosclerosis Prevention (ASAP) trial in Finland, and the Primary Prevention Project (PPP) trial in Italy (78-80). The HOPE trial and the HOPE-TOO follow up used 400 IU per day of natural vitamin E and saw no benefit for cardiovascular or cancer risk, and some increase in risk

of heart failure during the HOPE-TOO follow up (81, 82). The recently published follow up to the GISSI study also reported an increase in heart failure in patients with cardiovascular disease (83). The Women's Health Study, which was a trial using natural source vitamin E (600 IU every other day) in almost 40,000 apparently healthy women, over a period of 10 years, found a significant 24% reduction in cardiovascular death, but no significant protective effects on MI, stroke or cancer risk (84).

A meta-analysis from Johns Hopkins University was published in early 2005, suggesting an increase in total mortality was associated with intake of high-dose vitamin E (85). This was based on an analysis of 19 clinical trials with vitamin E supplementation ranging from less than 20 IU up to 2000 IU per day, and the statistical methods have been strongly criticized. (*The Annals of Internal Medicine*, the journal that published the meta-analysis, has since published an unprecedented sixteen published "Letters to the Editor".) The idea that "total mortality" is a meaningful measure has also been questioned, since this crude measure includes deaths from any cause, such as accidents with no possible association with the treatment. Further, the Office of Dietary Supplements (ODS) at NIH convened a group of vitamin E experts following this publication to determine whether there truly was a safety concern with vitamin E, and the group produced no such consensus (86), nor were any of the large ongoing government trials on vitamin E stopped.

At least two ongoing clinical trials are still investigating the relationship between supplementation with antioxidant vitamins and the risk of heart disease. These include the Women's Antioxidant Cardiovascular Disease Study (WACS) using vitamin C, vitamin E, and beta-carotene and the Physicians' Health Study using beta-carotene, multivitamins, and vitamin E. Dr. Daniel Steinberg of the University of California at San Diego, a leading researcher in the areas of antioxidants and heart disease, commented on the disappointing results of some vitamin E trials. He said these results "lead us to re-examine the question of what might be the appropriate nature of trials in humans, but they do not invalidate the large body of experimental evidence supporting the role for oxidative modification of LDL and atherogenesis." (87).

## Other Benefits of Antioxidants

There is substantial scientific evidence suggesting that generous intakes of a variety of antioxidant nutrients can help protect vision, lung function, and neurological function, especially in the aging population. For example:

- In the Nutrition and Vision Project, the development of cataracts was lower in women who had used a vitamin C supplement for 10 years or more (88).
- In a Wisconsin study, risk of cataract was 60% lower in people who had used multivitamins or a vitamin C or vitamin E supplement for more than 10 years (43).
- The Longitudinal Study of Cataract found a decreased risk of cataract in people who were regular users of multivitamins or vitamin E supplements (44).
- In the PHS, doctors who used multivitamins had a lower risk of cataract (45).
- The Age-Related Eye Disease Study (AREDS) at NIH found that daily supplementation with antioxidants, zinc, and copper delayed progression of age-related macular degeneration (AMD) (89).
- Research suggests that antioxidants may help support lung function and protect the lungs from oxidative damage, including damage from ozone (90-92).
- Men in Hawaii who used dietary supplements of vitamin C and vitamin E had improved cognitive function and lower risk of dementia (93).
- People in New Mexico who took vitamin supplements performed better on various tests of cognitive performance (46).
- In a study on Alzheimer's disease, 2000 IU per day of vitamin E delayed progression of the disease (94).

## Multivitamins for the Elderly

Infectious disease places a heavy burden on the immune system of the elderly, and improved nutrition may enhance their overall well-being and disease resistance. Nutrient intakes of the elderly are often low, even in healthy people living independently in the community—and are often especially low in nursing homes.

- Among healthy older adults in Arizona, more than 60% had deficient intakes of vitamin D, vitamin E, folate and calcium—intakes below the average requirement, let alone the recommended intakes (95).
- In rural Iowa, 80% of elderly people living in the community had inadequate intakes of four or more nutrients. The researchers concluded, “Multivitamin/mineral supplementation with additional calcium may be necessary for the old to achieve adequate nutrient intakes.” (96).

- In a recent review, experts on immune function commented that “older subjects should be encouraged to take a low-dose multivitamin/mineral supplement, especially those with poor diets.” (97).
- Older Americans are two to 10 times more likely than younger adults to die of infections. A recent review concluded that use of a daily multivitamin supplement with trace minerals should be recommended for the elderly (98).
- In a New Jersey study, taking a daily multivitamin for one year strengthened the immune system of elderly persons (47).
- In a nursing home in France, supplementation with zinc and selenium, with or without vitamins, reduced respiratory infections and urogenital infections over a two-year period (99).
- In a Boston Study, supplementation with 200 mg per day of vitamin E by elderly subjects improved some measures of immune function (100).
- In a study of people in Veterans Administration nursing homes, researchers observed a high prevalence of very low nutrient intakes, which according to the study authors “can lead to adverse effects on nearly all organ systems and can contribute to many of the physical and mental complications commonly seen in nursing home residents.” Nursing home administrators were urged to provide a multivitamin supplement with minerals to their residents (101).
- In some nursing home patients, RDA levels of nutrients do not normalize blood levels, and supplementation with several times the RDA of water soluble vitamins may be indicated (102).
- One researcher observed that, while many problems that afflict nursing home residents may be difficult to resolve, micronutrient deficiencies can be avoided through inexpensive, safe supplementation (103).

### **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 plays a critical role in protecting against NTDs such as spina bifida, when taken by women of childbearing age before and during pregnancy. Most of the evidence is based on the use of multivitamins containing folic acid, rather than the use of folic acid supplements *per se*. The use of multivitamins results in a decrease in other types of birth defects, as well as NTDs.

- In England, giving a multivitamin with folic acid to women who had already had a pregnancy affected by a NTD reduced the risk of having another affected pregnancy by 80% (48, 49).
- In a multi-center trial in 1195 women who had already experienced at least one NTD pregnancy, giving a high dose of folic acid had a protective effect of 72% against the recurrence of NTDs in the next pregnancy (104).

- In Hungary, women planning a pregnancy were given a multivitamin containing folic acid or a placebo, as part of a family planning program. There were no NTDs in the supplemented group, and there were fewer malformations of all types in the supplemented group (50).
- In half a dozen epidemiological studies in the U.S. and Canada, it was observed that women who took multivitamins during the periconceptional period (several weeks or months before and after conception) had a substantially reduced risk of having a baby with a neural tube birth defect such as spina bifida, and the risk of other defects was also lowered (51-55).
- In a public health program in China, almost 250,000 women were advised to take a folic acid supplement daily from the time of their premarital medical examination until the end of their first trimester of pregnancy. There was an 80% reduction in NTDs in northern China, where the rate had been relatively high, and a 40% reduction in southern China, where the rate had already been relatively low (105).
- An education and intervention program featuring supplementation with folic acid in South Carolina, where the level of NTDs was high, cut the incidence in half over a period of six years (106).
- In three separate studies in Ireland, Minneapolis, and Boston, researchers found that dietary improvement was ineffective and only supplementation was effective in raising folic acid status. One researcher commented that “advice to women to consume folate-rich foods as a means to optimize folate status is misleading.” (107-109).

In revising dietary recommendations for B vitamins in 1998, the Food and Nutrition Board (FNB) of the IOM concluded that women capable of becoming pregnant should consume 400 mcg of folic acid daily from supplemental sources, in addition to consuming food sources of folate from the diet. They noted that the evidence for a protective effect is much stronger for folic acid supplements than for food folate (30).

The Food and Drug Administration (FDA) has approved a health claim for folic acid and neural tube birth defects, which can appear on the labeling of foods and dietary supplements that are good sources of food folate or folic acid. Also, beginning in 1998, FDA regulations require that “enriched” grain products contain folic acid as well as the other nutrients that have traditionally been added to enriched products (110).

The March of Dimes and the Centers for Disease Control have undertaken a nationwide campaign to encourage women of childbearing age to take a multivitamin with folic acid daily as part of a healthy diet and other healthy lifestyle practices. They recommend “...that all women

of childbearing age take a multivitamin with 400 mcg of folic acid every day, as part of a healthy diet.” (111)

## **B Vitamins, Homocysteine, and Cardiovascular Disease**

Homocysteine is an amino acid produced in the body as a by-product of the one-carbon cycle, a set of metabolic reactions critical for the synthesis of DNA, new cells, and vital metabolic compounds. Normally homocysteine is recycled in a series of reactions involving folic acid, vitamin B-12, and vitamin B-6. When it builds up, additional amounts of these B vitamins can effectively facilitate its recycling or metabolism.

High plasma levels of homocysteine are considered to be a risk factor for cardiovascular disease. Numerous observational studies have shown that people with higher levels of these B vitamins and lower levels of homocysteine have a lower risk of heart attack and stroke.

- In NHANES III, people with higher levels of homocysteine were twice as likely to have a history of heart attack or stroke (39).
- In a study of over 80,000 nurses, there was a 45% reduction in risk of heart disease in women with high intakes of both folic acid and vitamin B-6. Ninety-five percent of the women in the highest intake group were users of multivitamins (40).
- 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 Americans obtained adequate amounts of folic acid (112).
- In the PHS, men with high homocysteine levels had a three-fold increased risk of heart attack (113).
- In the European Concerted Action Project, people with high homocysteine levels were twice as likely to have vascular disease. The increased risk related to homocysteine was comparable to the risk related to high cholesterol levels or smoking. People who used vitamin supplements had a 62% reduced risk (56).
- Many survivors of the original Framingham Heart Study were diagnosed with stenosis (narrowing of the carotid artery). This was twice as common in those who had high homocysteine levels, and those with stenosis tended to have lower plasma levels of folate and vitamin B-6 (114).
- In the Framingham Offspring cohort, taking B vitamin supplements lowered homocysteine levels. FDA’s folic acid fortification program raised B vitamin levels in that population, but not as much as using a supplement (37, 38).
- In the Nutrition Canada Survey, people with low serum folate levels were almost twice as likely to die from coronary heart disease (115).

- An Oregon study showed that multivitamin users had lower levels of homocysteine and higher plasma levels of folate, and vitamins B-6 and B-12. It was suggested that multivitamin users should be excluded from clinical trials on homocysteine and cardiovascular disease, to avoid potentially masking positive results (116).
- Among Norwegians over the age of 65, there was a strong association between high levels of homocysteine and mortality from cardiovascular disease or cancer (117).

To test the protective effect of B vitamins against cardiovascular disease and cancer, a number of clinical trials were undertaken in the mid-to-late 1990s—all of them in people who already had cardiovascular disease. Since they already had disease, the patients in these secondary prevention studies were taking numerous medications (e.g. beta-blockers, statins, diuretics, etc...), in accordance with current standards of medical care. Rather than testing the question of whether supplementation with B vitamins by healthy individuals might reduce the risk of cardiovascular disease or events in these people, these studies addressed the question of whether the B vitamins combined with a cocktail of medications would have an impact in patients who were already diseased.

- The Vitamin Intervention for Stroke Prevention (VISP) trial was conducted in patients who had already suffered an ischemic stroke. Everybody was given a multivitamin—even the placebo group. In addition, some were given a low dose or a high dose of B vitamins, or a placebo. Overall, there appeared to be no benefit, but a subsequent analysis showed a 21% reduction in risk of stroke, coronary disease, or death in those who got the highest level of vitamin B-12 (118, 119).
- The Norwegian Vitamin Trial (NORVIT) was conducted in more than 3700 patients who entered the trial within a week of suffering an acute MI. Most were being treated with aspirin, beta-blockers, and statins, and some were also being treated with ACE inhibitors and diuretics. Under these circumstances, supplementation with three B vitamins did not reduce the risk of a combined endpoint that included recurrent MI, stroke, and sudden death (120).
- In Heart Outcomes Prevention Evaluation (HOPE-2), three B vitamins were given to over 5500 patients with vascular disease or diabetes. Although no benefit was found for a composite outcome of cardiovascular death, MI, and stroke, there was a significant 25% reduction in stroke alone in the B vitamin supplemented group. Most of the patients were being treated with aspirin, ACE inhibitors, and lipid-lowering drugs, and some were also receiving other medications (121).
- While the results of these clinical trials have led some researchers to say the B vitamin hypothesis for cardiovascular disease is dead, one of the investigators has urged the scientific community to “call off the funeral” pending further research in this area (122).

Additional clinical trials on B vitamins and cardiovascular disease are still under way, including the Women's Antioxidant and Cardiovascular Disease Study (WACS) at Harvard and the Vitamins to Prevent Stroke Study (VITATOPS) in Australia. A collaborative group of B vitamin investigators has suggested that it would be desirable to conduct a meta-analysis of all the trials, to enhance the power of the combined studies to detect a potential benefit even in patients with pre-existing disease.

### **Calcium, Vitamin D, Osteoporosis and Cancer**

There is no question that a generous intake of calcium plus vitamin D contributes significantly to achieving peak bone mass during growth and will also slow the rate of bone loss that occurs with aging. Most people do not get enough calcium or vitamin D in their diets, and in many individuals osteoporosis is only recognized when a fracture occurs.

- Dr. Robert P. Heaney of Creighton University says there have been at least 139 published reports on calcium and bone in the past 25 years. Almost all the controlled trials in adults showed that increasing calcium intake reduced or stopped age-related bone loss, or reduced the rate of bone fractures, or both. Dr. Heaney also advises that calcium should be included in any treatment regimen for osteoporosis (123).
- Three NIH consensus conferences (1984, 1994, and 2000) have emphasized the role of calcium and vitamin D, plus other factors, in protecting against osteoporosis. They have recommended intakes of 1000 to 1500 mg/day of calcium in men as well as women. The most recent also recommended that calcium and vitamin D be given in conjunction with any drug therapy for osteoporosis (33, 124, 125).
- The National Osteoporosis Risk Assessment study showed that almost half of women over 50 have undiagnosed low bone mineral density (but not osteoporosis), and this low bone density doubled their risk of bone fracture within the first year of the study (126).
- Researchers at the USDA Human Nutrition Research Center on Aging at Tufts University gave a supplement of 500 mg of calcium and 700 IU of vitamin D to almost 400 men and women over age 65. The supplement resulted in a lower rate of bone loss and fewer nonvertebral fractures (127).
- In New Zealand, a supplement of 1000 mg of calcium per day reduced bone loss and reduced bone fractures (128).
- A study in France showed that calcium and vitamin D supplementation in 3000 women over the age of 69 not only reduced bone loss but slightly increased bone mass. There were 43% fewer hip fractures in the supplemented group (129).
- In a New York study, giving calcium supplements along with osteoporosis treatment (estrogen or calcitonin) increased the positive effect on bone mass. The amount of calcium needed to show a benefit was about 1200 mg per day (130).

- A meta-analysis of 33 studies concluded that a calcium supplement of about 1000 mg per day in postmenopausal women “can prevent the loss of more than 1% of bone per year” at most bone sites (131).
- The Women’s Health Initiative (WHI), a study involving over 36,000 women for seven years showed that women who were actually compliant with their supplemental regimen (400 IU vitamin D, 1000 mg calcium per day) experienced a significant 26% reduction in hip fracture risk (132).
- Another large calcium supplementation study published in the Archives of Internal Medicine also showed that subjects who were most compliant with their supplemental regimen derived the most benefit. Compared to placebo, those subjects experienced a 34% reduction in osteoporotic fracture risk vs. placebo (133).
- It has been estimated that over 130,000 hip fractures per year could be avoided in the U.S. if people over the age of 50 habitually consumed about 1200 mg per day of supplemental calcium (134).

FDA has approved a health claim for calcium and osteoporosis, which can be used on the labels of foods and dietary supplements that are good sources of calcium (135).

In recent years a large body of observational data has been published showing a strong inverse association between vitamin D nutritional status (as measured by the plasma levels of the marker compound, 25-hydroxyvitamin D3, 25(OH)D) and risk for cancers of the breast, colon and prostate (20, 21, 136-139). This area holds a high level of promise and the initiation long-term prospective, randomized, controlled trials is anticipated in the near future.

Observational studies also suggest that dietary calcium may be inversely related to colon cancer risk (136, 140, 141). While pilot clinical trials conducted in the 1990s showed some promise for benefit (142-144), these results were not reproduced in the one large-scale prospective randomized, controlled trial conducted in women (145).

**Will multivitamins or other nutritional dietary supplements serve as a substitute for a good diet and healthy behavior? Unlikely.**

Some experts appear to be concerned that if people use dietary supplements, they may neglect the overall quality of their diets. However, survey data show that in fact supplement users tend to have somewhat better diets than other people and also are more likely to adopt other health-

related habits, suggesting that they use dietary supplements as one element of an overall approach to a healthier lifestyle (Table 3) (6). People with a low Body Mass Index (BMI) are more likely to use dietary supplements than people who are obese, and people who engage in moderate or vigorous physical activity are more likely to be supplement users than people who avoid physical activity. Dietary supplement use is more common among people who say their health is excellent than among people who say their health is poor. Nonsmokers and former smokers are more likely to be supplement users than are current smokers. A 2003 survey of grocery shoppers/heads of households conducted by the National Family Opinion and the NMI, and co-funded by NIH revealed that the main driver for vitamin and mineral supplement use was overwhelmingly to maintain overall health and wellness (>60% of respondents vs. the next highest response, for performance/energy at 25%) (7). These findings are consistent with a number of other published surveys indicate that the primary motivation for using multivitamin supplements is to maintain good health (146, 147), ensure adequate nutrition (148, 149) and to provide energy (150). In other words, people do not become supplement users in a vacuum; they adopt supplement use in an effort to improve their health, and they are also likely to adopt other healthy habits.

- The NHANES II survey showed that people who took dietary supplements had a higher mean intake of nutrients from their diet than nonusers. The difference remained significant even after adjusting for the fact that supplement users have somewhat higher income and education levels than non-users (3, 4).
- In the 1992 National Health Interview Survey, diets of supplement users were lower in fat, higher in fiber, and higher in some vitamins and minerals, compared to diets of non-users. Differences were statistically significant, but the magnitude of the difference was small (151).
- American Institute for Cancer Research (AICR) showed that 39% 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% also used dietary supplements. Among the 61% who had *not* changed their diets, only 36% were supplement users. These data suggest that people who become sufficiently health conscious to use dietary supplements are likely also to improve their diets, and vice versa (152).
- In a study of elderly people in Georgia, supplement users were more likely than non-users to be physically active and to follow current dietary advice in terms of getting less salt, fat, cholesterol, sugar and caffeine and getting more fiber. Though supplement users had somewhat better diets than nonusers, both groups failed to get RDA amounts of some nutrients from diet alone (153).
- In a study of 4654 American men of Japanese ancestry living in Hawaii, 58% took vitamin supplements during the previous year. Among supplement users, 77% took

multivitamins, 53% took vitamin C, and 43% took vitamin E. The supplement users were more physically active and less obese than non-users. They also slept less, smoked less, and consumed less alcohol and caffeine (154).

The fact that supplement users have somewhat better diets than non-users does not mean their diets are perfect. In a survey of healthy elderly in Boston, it was observed that “dietary intake [of nutrients] is generally greater for users of supplements compared to non-users. Still dietary intake alone fails to protect many elderly from the threat of nutrient deficiencies.” (155).

**Table 3.** *Percent of population using dietary supplements*

<b>Education and various personal characteristics</b>	<b>%</b>
<i>Education</i>	
Less than high school education	35
High school diploma	48
More than high school	62
<i>BMI</i>	
BMI <25	57
BMI 25-30	52
BMI =30	46
<i>Physical activity</i>	
No physical activity	43
Moderate or vigorous activity	59
<i>Health status (self report)</i>	
Excellent health	55
Good health	50
Fair or poor health	47
<i>Smoking status</i>	
Never	52
Former	61
Current	43

Some prominent scientists have pondered whether public nutrition advice should focus on foods or on dietary supplements (156). The very question assumes that the two are mutually exclusive, which they are not. It should be obvious to all concerned that neglecting the quality of the overall diet is foolish in the extreme and that a bad diet plus dietary supplements will still be a bad diet. The Council for Responsible Nutrition believes the best solution for most people is surely to eat the best diet possible, adopt other healthy habits, and use a rational assortment of

nutritional dietary supplements, most notably a multivitamin, to ensure adequate intakes or to try to approach levels that may be considered optimal.

## **Safety**

Multivitamin/mineral supplements are an effective means of delivering adequate amounts of most essential nutrients to help Americans achieve recommended intakes. Further, the great majority of dietary supplements, including multivitamins, are safe for regular use. In addition to establishing recommended intakes for essential nutrients, the latest series of DRI books written by the U.S. FNB also included a safe or tolerable upper intake values for most of these nutrients (30, 157-159). Establishment of these values required a comprehensive review of the literature and took into account nutrient intake from multiple sources, including traditional and fortified foods and dietary supplements. Contrary to some assertions, the UL does not represent a threshold value, above which safety immediately becomes an issue. Rather, according to the standard risk assessment approach used by the FNB, the UL "...is the highest level of daily nutrient intake that is likely to pose no risk of adverse health effects to almost all individuals in the general population. As intake increases above the UL, the risk of adverse effects increases..." (160). Therefore, nutrient intakes that approach or even exceed the UL are not automatically deemed unsafe. Most multivitamins contain nutrient doses at only a fraction of the UL, even when combined with other sources (Table 4).

Some have argued that the ULs for certain nutrients set by the FNB are overly conservative and may be based on outdated information. In the case of vitamin D, experts have been calling for a revision of both the recommended intake and the UL, claiming that both are far lower than optimal for both public health and research (16, 18, 19, 23, 161-169). The outcry from experts, combined with recent publication of well-designed, rigorous randomized controlled trials examining vitamin D safety in recent years, has culminated in the recent proposal to raise the UL for vitamin D from the current level of 2000 IU (157) up to 10,000 IU (170).

There are several nutrients for which the FNB was unable to establish a UL value (i.e. vitamin K, thiamin, riboflavin, vitamin B12, biotin, pantothenic acid, chromium, potassium). This does not constitute an uncertainty by the group regarding the safety of these nutrients. On the contrary, it

is the absence of any toxicity associated with these nutrients that has precluded the expert panel from establishing a UL (identifying and selecting a critical adverse effect is a normal part of the risk assessment process; in its absence a UL cannot be set). As a means to contend with the absence of ULs for certain nutrients, The Council for Responsible Nutrition has used the Observed Safe Level (OSL) approach to establishing upper levels (171). In the case of nutrients without established toxicity or adverse effects, this approach involves choosing the highest dose tested in well-designed human clinical trials. Hence the rationale for using the terminology ‘observed safe level’. The Food and Agriculture Organization/World Health Organization has adopted a similar methodology for assessing the safety of nutrients with as yet undefined adverse effects, referring to this as the Highest Observed Intake (HOI) (172). The OSL or HOI method has also served as the basis for establishing Upper Limits for Supplements (ULS), which are defined and selected to represent amounts of vitamins and minerals known to be safe for supplemental intake by healthy adults who consume typical diets (Table 4) (171).

A series of well-publicized clinical trials conducted in diseased patients utilizing relatively high doses of single nutrients or combinations of nutrients (such as vitamin E and/or beta-carotene (65-67, 81, 82) and B vitamins (120)), have yielded disappointing results, and even suggested the presence of harm. However, these trials involved nutrient doses many times that found in most multivitamins and were conducted in patients with serious illnesses (i.e., cancer or cardiovascular disease) who were on multiple concomitant medications or who were smokers. Therefore, the results, conclusions and subsequent interpretation of these trials must be placed into the appropriate context and are not applicable to the general healthy population.

A key aspect for all of the approaches for establishing upper levels for nutrients is that they apply to the general healthy population. The levels described in Table 4 refer to the values established for healthy adults. Separate risk assessments are required to establish potential adverse effects and ULs for unique or specific sub-populations, such as children, elderly or those coping with chronic disease.

**Table 4.** Comparison of typical nutrient doses present in multivitamins to established safe upper limit (UL) values for healthy adults.

Typical multivitamin		FNB Safe Upper Limit (UL)	CRN Upper Limit for Supplements (ULS)
<i>Nutrient</i>	<i>Dose</i>	<i>Dose</i>	<i>Dose</i>
Vitamin A	2500 IU	10000 IU*	10000 IU* 25 mg (beta-carotene in non-smokers)
Vitamin C	60 mg	2000 mg	2000 mg
Vitamin D	400 IU	2000 IU	2400 IU
Vitamin E	30 IU	1500 IU	1600 IU
Vitamin K	25 mcg	N/E	10 mg
Thiamin (B1)	1.5 mg	N/E	100 mg
Riboflavin (B2)	1.7 mg	N/E	200 mg
Niacin	20 mg	35 mg (all forms)	500 mg (nicotinic acid) 1500 mg (nicotinamide)
Vitamin B6	2 mg	100 mg	100 mg
Folic acid	400 mcg	1000 mcg	1000 mcg
Vitamin B12	6 mcg	N/E	3000 mcg
Biotin	20 mcg	N/E	2500 mcg
Pantothenic acid	10 mg	N/E	1000 mg
Calcium	200 mg	2500 mg	1500 mg
Iron	15 mg	45 mg	60 mg
Phosphorus	100 mg	4000 mg	1500 mg
Iodine	150 mcg	1100 mcg	500 mcg
Magnesium	100 mg	350 mg	400 mg
Zinc	15 mg	40 mg	30 mg
Selenium	50 mcg	400 mcg	200 mcg
Copper	2 mg	10 mg	9 mg
Manganese	2 mg	11 mg	10 mg
Chromium	120 mcg	N/E	1000 mcg
Molybdenum	75 mcg	2000 mcg	350 mcg
Potassium	100 mg	N/E	1500 mg

\*as retinol and its esters; N/E = not established

According to NHANES, 35% of American adults use multivitamins on a regular basis (6). With the adult (18+ years of age) population estimated at 223 million people, that translates into roughly 78 million users of multivitamins. Despite this widespread usage, to our knowledge there have been no specific published reports of toxicity or adverse effects associated with the use of multivitamins.

## Summary

Nutrition surveys consistently show that substantial numbers of Americans fail to obtain recommended amounts of various nutrients from diet alone. If official nutrient recommendations are taken seriously, then it must follow that people would be better off getting the full recommended amount of each nutrient than falling short of that amount. Multivitamins are a safe, convenient and affordable means of filling nutrient gaps. In addition, evidence suggests that people who use multivitamins and/or other specific nutritional dietary supplements have a lower risk of some chronic diseases.

Some nutrition experts have urged multivitamin use by all adults, and for some adults supplemental intakes are specifically recommended as a preferred means of obtaining certain nutrients. Experts have also recommended supplementation with specific nutrients for particular needs, such as folic acid for women of childbearing age and vitamin B-12 for people over 50. A multivitamin will cover these special needs. The elderly are especially likely to have low calorie and nutrient intakes and to be susceptible to infectious disease, and a multivitamin can improve their overall nutrient intake and potentially help protect against disease and cognitive decline. Many people fall short in both calcium and vitamin D intake, with a substantial percent of all age groups getting less than half the amount considered to be adequate. A calcium supplement with vitamin D can be confidently recommended for the elderly and indeed for all adults, as well as for children and teens, except perhaps those who are avid consumers of dairy products.

Generous intakes of antioxidant vitamins have been associated with reduced risk of some chronic diseases, in the same way that generous intakes of fruits and vegetables have been associated with similar health benefits. Antioxidant vitamins and minerals can protect eyesight, help maintain cognitive function, combat oxidative damage from environmental exposures, and potentially reduce the risk of some chronic diseases including some cancers and heart disease. The epidemiological evidence is strong. While the results from some clinical trials conducted thus far are mixed, the results of many more are still awaited. It should also be considered, that the current trials may not be the best possible model.

Vitamins and minerals cannot be expected to perform like drugs, nor should they be counted on to reverse decades of poor lifestyle or serious illnesses. In some conditions, including the promotion of bone health and protection against neural tube birth defects, the benefits of supplements have been documented both by epidemiological studies and by clinical trials. In other areas, there is strong epidemiological evidence of benefit but either little clinical investigation or mixed results from clinical research. For example, the association between fruit and vegetable consumption and a reduced risk of heart disease and cancer is based almost entirely on observational data, which is accepted as a sound basis for public policy regarding these dietary recommendations. Other observational data supports an association between antioxidant supplements and disease prevention, but clinical trials have been mixed, perhaps because of limitations in the study designs. Disappointing clinical trials in these cases may point the way to improvements in design, but do not necessarily negate the sound and extensive epidemiological evidence of benefit related specifically to supplement use.

Nutritional dietary supplements have been widely used and highly valued by American consumers ever since vitamins were discovered and commercialized, beginning in the early decades of the 1900s. Usage has grown steadily with every decade, as documented by NHANES surveys beginning in the 1970s. In the most recent NHANES survey, supplement use was reported by over half the adult population. Multivitamin users tend to adopt other healthy habits. Just as eating right and exercising are smart lifestyle choices, so is the addition of a daily multivitamin, used consistently over the long-term.

In short, supplementation with multivitamins, some specific antioxidant nutrients, and calcium plus vitamin D, is a common practice which is very likely to be of substantial benefit. Such supplementation, along with other healthy lifestyle habits, should be actively encouraged by health professionals and public policy makers. Science is an evolving discipline, and therefore, research should also continue, in an effort to define optimum patterns of supplementation, as an adjunct to consumers' efforts to improve their overall diets. But what we know now about multivitamins warrants a continued strong recommendation for consistent use by virtually every American.

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