

\Scurvy Alive and Well?

AN INVESTIGATIVE REPORT



November 1, 2001
Updated: July 15, 2002
Updated: November 4, 2002

Roman Bystrianyk
<http://www.HealthSentinel.com>
feedback@HealthSentinel.com

A large number of men in our army were attacked by a certain pestilence, against which the doctors could not find any remedy in their art. A sudden pain seized their feet and legs; immediately afterwards the gums and teeth were attacked by a sort of gangrene, and the patient could not eat any more. Then the bones of the legs became horribly black, and so, after having continued pain, during which they showed the greatest patience, a large number of Christians went to rest on the bosom of our Lord.

-- Jacques de Vitry, the First Crusade

Vitamin C deficiency is no longer considered a national priority. Especially low intakes of vitamin C can result in [scurvy](#), which is generally considered a disease of the past or possibly found only in specific risk groups such as alcoholics, institutionalized elderly, and others. As a result, health care professionals are not trained to recognize scurvy in a clinical setting. But is scurvy and subclinical scurvy as rare in western society as we believe?

“Overt scurvy is not a common diagnosis in the United States or other industrialized countries. Nevertheless a review of the clinical literature reveals that scurvy may be resurgent, notably among children. Brought on by low intakes of vitamin C, scurvy’s primary symptom is weakened collagenous tissue, which results in [petechiae](#), bruising, and hemorrhaging. Because of the rapid development, children with scurvy also exhibit pathological changes in their bones, including osteoporosis, cortical thinning and epiphysiolysis. ... Patients who present with scurvy generally are misdiagnosed with [vasculitis](#), but they also may be diagnosed inappropriately with blood dyscrasias, ulcerative gingivitis, or rheumatic disorders.”¹

HISTORY

Scurvy is probably the nutritional disease that has caused the most suffering in human history. It is often associated with longer ocean voyages that began in the 15th century. One account by George Anson's 1740-1744 circumnavigation around the world returned from its voyages with only 145 of its original members. Only 4 men had died of enemy action and 1300 had died of disease, primarily of scurvy. But, in fact, most cases of scurvy during the centuries have occurred on land. Scurvy was widespread in northern Europe during the Middle Ages and later in history most cases occurred when food became scarce, such as during the Great Potato Famine of 1845-1848, the American Civil War, the Crimean War, and World War I. An estimated 10,000 people died of scurvy during the California Gold Rush where adequate fruits and vegetables were not in abundance.

In 1746, as full surgeon on the HMS Salisbury, James Lind watched an outbreak of scurvy and then again the following year. During the second outbreak he performed his now famous experiment. He supplied the one group of sailors with oranges and lemons and those receiving the fruit quickly improved. Lind concluded that the oranges and lemons were the most effective method of preventing scurvy.

“In point of fact little note seems to have been taken of Lind's ‘critical trial’. This was possibly because such a concept was hardly understood at the time, but also because there was already a large body of existing experience to the effect that fresh fruit and vegetables were a protective against the scurvy, at the time well known to affect particularly sailors on long voyages and troops on campaigns. One wonders, in fact, in how many naval engagements the outcome was principally determined by relative degrees of incapacitation of crews by scurvy and other diseases, as opposed to fighting skills.”²

The determination that vitamin C deficiency is actually the cause of scurvy was later discovered through a series of accidental findings. In 1907, Alex Holst discovered that guinea pigs on a restricted diet developed symptoms similar to scurvy. This provided the first animal model with which vitamin C deficiency could be tested. In 1928, a substance was isolated by a Hungarian biochemist by the name of Albert Szent-Györgyi, and that substance would later be termed ascorbic acid or vitamin C. The function of the substance remained a mystery until in 1932 when simultaneously in Hungary and in the United States experiments were conducted that showed that this substance, ascorbic acid or vitamin C, would cure the guinea pigs of scurvy.

MODERN DAY VITAMIN C DEFICIENCY

It seems difficult to imagine that a disease of basic vitamin C deficiency could still exist in this day and age. However, the medical literature shows us that a substantial percentage of the population consumes an inadequate amount of vitamin C.

The Recommended Daily Allowance (RDA) is currently at 45 to 60 mg per day for 7 to 18 year olds. With much of the literature indicating that at the very minimum a 60 mg per day amount is highly desirable. With that information we can see that in children that approximately one fourth or 25% are not receiving a good supply of vitamin C, and 10-20% are receiving amounts that is considered deficient.

“Our analyses revealed that a considerable number of children had low intakes of vitamin C. Among the seven to twelve-year-olds, 12% of boys and 13% of girls had mean vitamin C intakes that were less than 30 mg/day. Among 13 to 18-year-olds, 14% of boys and 20% of girls consumed less than 30 mg/day vitamin C. An even greater proportion of children had marginal vitamin C intakes. For both age groups, 21% of boys and 27% of girls daily consumed between 30 mg and 60 mg of vitamin C.”³

And another study in a primary health center in upstate New York found that a large number of children were not consuming an adequate number of servings of fruits and vegetables.

“Forty percent of the 2-year-old children and 50% of the 5-year-old children consumed less than two servings/day of fruits and vegetables. Vitamin C intake was most strongly correlated with consumption of citrus fruits and citrus fruit juices.”⁴

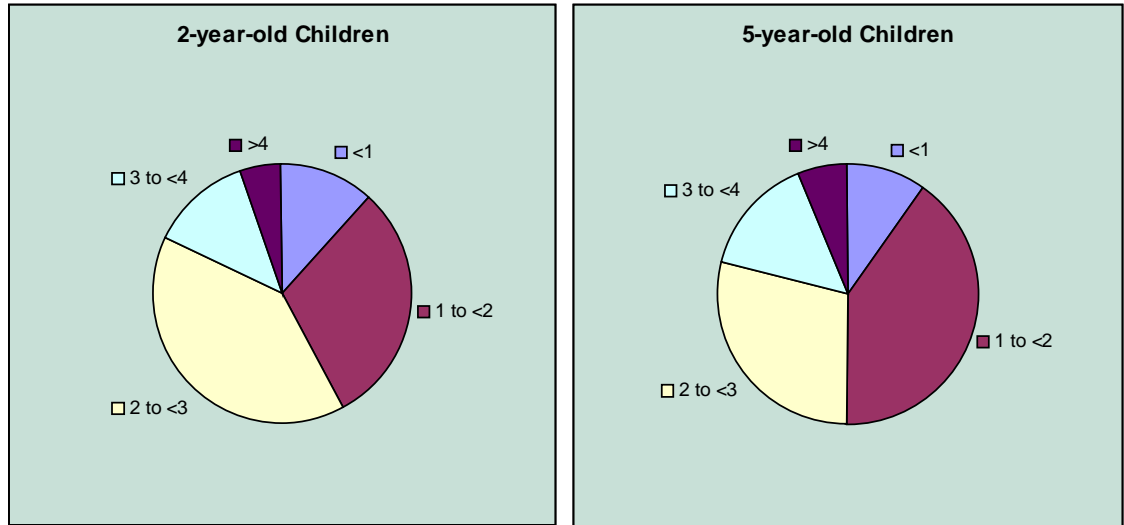


Fig 1. 5-A-Day Fruit and Vegetable Consumption. The children's consumption of fruits and vegetables (7-day mean number of fruit and vegetables servings/day) is shown separately for the two age groups.

Although 95% of the children consuming 2 or more servings per day of fruits and vegetables met the RDA for vitamin C, only 50% of those met that requirement if they consumed less than 2 servings per day. This indicates that 20 to 25 percent of the children are not getting the RDA of vitamin C in their diets.

Another study based on nonsmoking subjects who did not take vitamin C supplements that were recruited from a campus population at Arizona State University also showed a percentage of the population deficient and with marginal status for vitamin C. Here 13% of men were found to be deficient in vitamin C and 24% were found to have marginal vitamin C status. Similarly 9% of women were found to be deficient and 18% were found to have marginal vitamin C status.

“The Recommended Daily Allowance (RDA) for vitamin C is 60 mg/day, an amount associated with plasma vitamin C concentrations ranging from 28 to 34 $\mu\text{mol/L}$. Plasma vitamin C concentrations ranging from 11 $\mu\text{mol/L}$ to less than 28 $\mu\text{mol/L}$ represent marginal vitamin C status, which Jacob defines as a moderate risk of developing vitamin C deficiency due to low tissue stores. Plasma vitamin C concentrations less than 11 $\mu\text{mol/L}$ are indicative of vitamin C deficiency. The average daily intake of vitamin C in men in the United States is about twice the RDA, yet the prevalence of vitamin C deficiency and marginal vitamin C status in men is 13% and 24% respectively. Women consume an average of 90 mg vitamin C daily, and the prevalence of vitamin C deficiency and marginal vitamin C status in women is 9% and 18%, respectively. These data indicate that although the average vitamin C intake in adult men and women is adequate, vitamin C deficiency and marginal vitamin C status are strikingly prevalent in these populations.

Vitamin C rich fruits and vegetables represent the major dietary source of vitamin C; however, more than 80% of US adults consume 2 or fewer servings of fruits and vegetables daily, and 10% of adults do not consume fruits and vegetables daily. This is problematic because vitamin C is poorly retained in the body without continuous intake.”⁵

Again it is important to note that the authors state “vitamin C deficiency and marginal vitamin C status are strikingly prevalent in these populations”.

Another study shows that generally healthy, middle class patients that went into a health care facility for routine exams had surprisingly high rates of vitamin C deficiency.

“Modern societies with year-round access to fresh fruits and vegetables, most of which are rich sources of vitamin C, seldom develop scurvy, and the disease is usually considered in a historical context. However, examination of the recent medical literature suggests that scurvy continues to be observed in developed nations. . . . The number of these recent case reports is surprising, and little research has been conducted to determine the prevalence of vitamin C deficiency in the US population. This study showed that vitamin C deficiency was present at surprisingly high rates among generally healthy patients visiting a health care facility for routine health exams, gynecological exams, and pregnancy exams. . . . the present study demonstrated that vitamin C depletion and vitamin C deficiency was evident in an outpatient population (prevalence rates, 30.4% and 6.3%, respectively). Symptoms associated with vitamin C deficiency are subtle but physiologically relevant.”⁶

Another study of random adults in Alameda County, California also showed a significant portion of that population was in danger of vitamin C deficiency.

“Fourteen per cent of respondents appeared to have no regular source of vitamin C. This group includes persons who reported that they did not have at least two servings of fruit or vegetables almost every day, had none of the specified juices on an average day, and did not take vitamin C pills each day. Because of possible underreporting, 14 per cent is probably too high an estimate of persons who had inadequate vitamin C. However, there is cause for concern if any segment of the population lacks a regular source of vitamin C sufficient to meet nutritional needs.”⁷

So we can see that a significant portion of the general population has either a vitamin C deficiency or marginal vitamin C status. In addition, people who have a marginal vitamin C status can more rapidly develop a vitamin C deficiency than people who have adequate vitamin C levels.

“Subjects who began the study with marginal vitamin C status appeared to be at a high risk of rapidly developing a biochemical vitamin C deficiency on diets lacking vitamin C-rich fruits and vegetables. Because the prevalence of marginal vitamin C status may be as high as 20% to 30% in certain US populations, these data stress the importance of consuming vitamin C-rich fruits and vegetables daily. Subjects who began the study with adequate vitamin C status did not tend to develop

biochemical deficiency with dietary fruits and vegetables were restricted for 1 to 2 weeks.”⁸

So it is apparent from the medical literature that using the RDA as a standard there are a large percentage of the United States population that are not receiving a good supply of vitamin C and even a significant percentage that can be classified as deficient.

VITAMIN C FUNCTION

Vitamin C has a wide variety of functions in the body. They include its antioxidant function that protects free radicals from damaging vessel wall, DNA, and other structures. Vitamin C is essential in the formation of collagen, the most abundant protein built in our bodies and the major component of connective tissue. This connective tissue has structural and supportive functions which are indispensable to heart tissues, to blood vessels, and all tissues within the body. It is also important in the proper functioning of the immune system, iron absorption, carnitine synthesis, cholesterol metabolism, and in many other biological systems.

“It [Vitamin C] is an [enzyme](#) cofactor in the metabolism of tyrosine and the synthesis of carnitine, norepinephrine, and peptide hormones. It increases absorption of iron from the small intestine, and it functions as an antioxidant, reducing harmful free radicals and thereby decreasing damage to lips, lipoproteins, DNA, protein, and vessel walls.”⁹

“As a water-soluble antioxidant, vitamin C traps, for example, free radicals and reactive oxygen molecules. Vitamin C is also known to block the formation of carcinogenic [nitrosamines](#) and nitrites and to stimulate the immune system. Vitamin C protects against carcinogen-induced chromosomal breakage and there is some evidence that vitamin C may affect cell growth and differentiation. Further, it has been shown to function in sparing or reconstituting vitamin E for protection of lipid membranes.”¹⁰

“Ascorbic acid is increasingly recognized as an agent with broad biologic function and importance. Well-established functions include synthesis of hormones and neurotransmitters, cytochrome P-450 activity and detoxification of exogenous compounds, carnitine synthesis and cholesterol metabolism, as well as well-know antioxidant functions with protective results that may extend to cancer, coronary artery disease, arthritis, and aging. Several possible mechanisms of action of ascorbic acid in cancer prevention have been described extensively elsewhere. It plays a major and perhaps even predominant role in free-radical scavenging and protection against lipid peroxidation. It appears to have a role in sparing or reconstituting the active forms of vitamin E, and spares other important antioxidants. Several functions of vitamin C in the immune system have been described, including enhancement of leukocyte chemotaxis, stimulation of interferon production, and complement Clq activity. Its role in collagen synthesis and basement membrane integrity and in hyaluronidase inhibition may be important in inhibiting tumor spread and micrometastases.”¹¹

Vitamin C in fact does have quite a wide variety of function in the body impacting the immune system, cardiovascular health, and because of it’s antioxidant capabilities it plays a role in protecting us from cellular damage that may result in cancer.

VITAMIN C AND ANIMALS

Most animals do not require external sources of vitamin C ($C_6H_8O_6$) because they can derive it from glucose ($C_6H_{12}O_6$) using [enzyme](#) systems. Humans and a few other species such as primates, guinea pigs, the Indian fruit bat, and some birds lack this ability. Because of this inability to manufacture vitamin C, humans need to obtain their vitamin C from their diet.

“Plants and most animals can synthesize ascorbate from glucose but primates, guinea pigs, and fruit bats lost one of the necessary enzymes (L-gulono- γ -lactone oxidase) during their evolution and so require ascorbate in their diet. In fact, the gene that should encode this [enzyme](#) is still present in the human genome, but in a highly mutated inactive form.”¹²

This is important because while most animals manufacture their own vitamin C and obtain the health benefits, humans must continuously consume this vital nutrient.

MODERN DIET

With so many convenient food choices available, and with less time to prepare meals and snacks, it seems that many people simply forget about fruits and vegetables. Too often, fast foods, frozen meals and packets of snack foods replace healthy choices such as fresh vegetables and fruits. Because of these tasty, convenient, nutritionally poor foods western societies have set themselves up for nutritional deficiencies that could easily be compensated for by eating plenty of vegetables and fruits.

“The current leading causes of death in the United States are cardiovascular disease and cancer; both of these have been linked to dietary intake and may have their origin in childhood. Because food preferences and eating habits may be established during childhood, parents should emphasize high-vitamin C vegetables and fruits when planning their children’s meals and snacks.”¹³

And unfortunately often times any fruit and vegetable selections that made are not good sources of vitamin C.

“Lettuce, onions, apples, and bananas – some of the most frequently consumed vegetables and fruits reported here – are not rich in vitamin C.”¹⁴

It is important that people consume certain foods on a daily basis to ensure that they have a good supply of vitamin C.

“Important sources of vitamin C include fruits and vegetables such as lemons, oranges, broccoli, brussel sprouts, cauliflower, strawberries, and cabbage. Milk, meats, fish, and fowl have negligible amounts of vitamin C”¹⁵

WHO IS AT RISK FOR SCURVY?

Scurvy is rare in industrialized nations because there are ample sources of vitamin C in easily accessible foods and also in vitamin C supplements that much of the general public uses. Still the scurvy is recognized to occur for a number of reasons that cause people to eat inadequate amounts of fresh fruits and vegetables.

“One group comprises adults living alone, most commonly (“bachelor” or “widower” scurvy), but sometimes women, who have a deficient intake because of such factors as poverty, poor access to groceries, reclusiveness, dementia, or nutritional ignorance. They mostly prepare their own meals, but those who dine in restaurants do not order fresh fruits and vegetables. Other patients with scurvy avoid these “acid” foods because of purported allergies to them, or because they produce or exacerbate gastrointestinal symptoms, such as [dyspepsia](#), dysphagia, diarrhea, and heartburn. Some of these patients have underlying alimentary disorders such as ulcerative colitis, Whipple’s disease, peptic ulcers, and gastroesophageal reflux, and occasionally advice from clinicians to avoid fruits and vegetables because of abdominal complaints has led to “[iatrogenic](#) scurvy.” Vitamin C deficiency has also occurred when poor or absent dentition has been made consumption of fruits and vegetables difficult. Sometimes people shun these foods just because they don’t like the taste, and others because of bizarre dietary beliefs, including food fads.”¹⁶

“It is well established that the elderly individuals, whether institutionalized or not, have lower vitamin C blood levels than younger adults. Plasma and leukocyte vitamin C levels decrease with aging and elderly people require higher vitamin C intakes to reach the same vitamin C blood levels found in young adults.”¹⁷

“Other groups at risk for low vitamin C status include: women on oral contraceptives, pregnant or lactating women, hospitalized patients, and alcoholics.”¹⁸

So we can see there are wide ranges of groups including the elderly, alcoholics, hospitalized patients, pregnant or breast-feeding women, and others groups that are risk for vitamin C deficiency.

CASES OF SCURVY

Although overt scurvy is fairly rare it does occur especially in certain high-risk groups. The medical literature contains actual cases of scurvy and their rapid improvement upon recognition and treatment with vitamin C.

“We report a case of scurvy occurring in a 5-year-old boy who had regular access to medical care. His presentation with rheumatic complaints and skin lesions resulted in confusion with possible immunologic or neoplastic disease. ... A previously healthy 5-year-old white boy with and unremarkable medical history developed a limp. ... On the day before his referral he developed gingival bleeding. ... in the most recent 5 months, his diet consisted of biscuits, Pop-Tarts® (Kellogg’s C, Battle Creek, Mich), cheese pizza, and water. He refused fruits, vegetables, and juices, and his mother had been unsuccessful in administering chewable vitamin supplements. ... These laboratory findings were diagnostic of scurvy. After administration of ascorbic acid, his pain improved rapidly, and he again began to walk.”¹⁹

“A 6-year-old white boy was referred to the Children’s Hospital in New Orleans, Louisiana, USA, in December, 1996, for evaluation of hip pain and a limp for 6 weeks. ... A further history from his parents revealed that his diet had consisted of cookies, yogurt, whole milk, biscuits, and water for the past 12 months. He did not eat any fruit, vegetables, meat, or fish. ... Scurvy is still found intermittently in developed countries, especially among food faddists, alcoholics, the elderly, and men who live alone. Infants fed exclusively on cows’ milk formula, and children with neurodevelopment disabilities and pshychomotor retardation are at additional risk. ... Scurvy can mimic many other medical diseases such as [vasculitis](#), blood dyscrasias, deep vein thrombosis, and rheumatic disorders. ... The present case clearly shows that despite advances in medicine, living conditions, and nutrition, scurvy still can occur and highlights the need for continued medical awareness of this potentially life-threatening disease by all health professionals.”²⁰

“The patient was a 12-year-old white girl whose main complaint was pain in the [proximal](#) part of the lower limbs as well as functional impotence during the past 2 months. The pain had worsened progressively and 2 days before consultation she was almost unable to walk. Four to six months before the diagnosis the patient intake consisted of whole milk, yogurt, custard pudding, cookies, and pasta soup. She did not eat any fruits, legumes, vegetables, meat, or fish. This diet was considered normal by the mother. ... The patient was treated with 3,360 $\mu\text{mol}/24\text{h}$ (600 mg/day) of vitamin C orally and an assorted diet with fruits and vegetables. She recovered very quickly, with disappearance of the functional impotence and reduction of the gingivitis and perifollicular hemorrhages.”²¹

“A 23-year old man was admitted to the hematology clinic for evaluation of perifollicular hemorrhages, arthralgias, myalgias, fatigue, and sudden difficulty to stand and walk, all of 3-weeks duration. On questioning about his dietary habits, we found that for the past 10 months the patient had consumed sandwiches, tea, chocolate, beer, or eaten fast foods and had eaten fruits or vegetables rarely. ... Within 72 hours after beginning therapy with parenteral ascorbic acid (250 mg per day) the patient showed dramatic clinical improvement. The purpuric skin lesions began to fade and the gingival erosions began to heal.”²²

So we can see through actual case histories that there are cases of scurvy that still occur in the present day. And as stated by one researcher, which despite advances in medicine, living conditions, and nutrition that scurvy can still occur and that we need to pay attention to this serious condition. And since this condition can easily be mistaken for other conditions, and the general belief that scurvy no longer exists, we have to ask just how many misdiagnoses occur.

“Compared to overt scurvy, subclinical scurvy may be diagnosed even less readily because its symptoms are non-specific. For example, marginal vitamin C status results in vague symptoms such as fatigue, irritability, and impaired lung function.”²³

Also, again an emphasis has to be made on eating plenty of fruits and vegetables instead of consuming vitamin deficient foods that are convenient and cleverly marketed in today's society. Adequate vitamin C intake on a daily basis can easily reverse problems of scurvy and subclinical scurvy.

SMOKING AND VITAMIN C

Cigarettes contain more than 4000 chemical compounds and at least 400 toxic substances. While the smoker is inhaling, a cigarette burns at 700 degrees Celsius at the tip and around 60 degrees in the core. This heat breaks down the tobacco to produce various poisons. As a cigarette burns, the residues are concentrated towards the butt and inhaled by the user. Smoking has a well-recognized negative impact on health. Part of the reason for its harmful affects maybe its reduction of circulating vitamin C levels.

“Smoking dramatically lowers blood ascorbate levels, as does aspirin consumption, oral contraceptives, acute and chronic diseases, and a variety of other stresses.”²⁴

As such smokers require an increased amount of vitamin C to attain the status of non-smokers. It's also interesting to note that use of aspirin and oral contraceptives also have a negative impact on vitamin C levels. Considering that much of the population uses oral contraceptives and still more use aspirin not only for pain relief, but also for the supposed benefits in prevention of heart disease.

“It is clear that the vitamin C status of smokers needs to be improved. Individuals who smoke required over 200 mg vitamin C daily to maintain serum vitamin C concentrations at a level equivalent to nonsmokers consuming the RDA for vitamin C.”²⁵

Unfortunately adults are not the only group to engage in this high-risk activity. Many children are directly exposed to the toxic affects of smoking which also adversely affects their vitamin C levels.

“Approximately 3,000 children begin smoking every day in the United States, imposing exogenous oxidative stress on their bodies. Every puff of cigarette smoke contains 10^{14} low-molecular-weight free radicals. Antioxidants such as vitamin C may have a protective effect against oxidative damage by scavenging oxidants in blood plasma and in tissues. Serum concentrations of vitamin C among smokers are about 25% lower than those of non-smokers, and Kallner et al. reported that metabolic turnover of vitamin C was 40% higher among smokers than non-smokers. Children and adolescents who use tobacco products place themselves at risk for vitamin C [hypovitaminosis](#) and have the greatest need for dietary intervention.”²⁶

And not only does direct smoking affect vitamin C levels, the more parents smoke, the less of the vitamin youngsters have in their bloodstreams, says Richard Strauss of the University of Medicine and Dentistry of New Jersey. His research published in *Pediatrics* is the first major scientific study on how passive smoke affects vitamin metabolism in children and adolescents. Passive smoke already has been linked to lower levels of vitamin C in adults.

“Exposure of children to ETS (Environmental Tobacco Smoke) leads to significant alterations in serum ascorbic acid levels in addition to the previously described respiratory ailments associated with ETS. This report is the first large study to document direct metabolic consequences of ETS in children. This study is, therefore, in direct contrast to continued assertions by the tobacco industry that ETS causes no damage. Because ascorbic acid protects against plasma lipid and low-density lipoprotein oxidation, and also appears to be important in protecting DNA from oxidative damage, this report further highlights the potential dangers of ETS to children.”²⁷

VITAMIN C DEFICIENCY AND DISEASES

How do low levels of vitamin C impact our health and what disease states result from insufficient vitamin C levels?

“The recent scientific literature indicates that beyond merely protecting against scurvy vitamin C contributes to many aspects of human health. The main areas of research reviewed include: 1. Vitamin C requirements of smokers. The data indicate that the vitamin C requirements of smokers is higher by at least 60 mg per day (up to 140 mg per day) than that of nonsmokers. 2. Important functions of the body such as immune response, pulmonary function, and iron absorption are related to vitamin C intakes. Daily vitamin C intake of at least 150-200 mg per day enhance these functions. 3. Vitamin C may play critical roles in the prevention of CHD [Coronary Heart Disease], cancer and cataract. Based on the available data, vitamin C intakes of at least 80-120 mg per day are associated with lowering the risk of these chronic diseases. The literature documents that these and much higher intake levels of vitamin C are safe.”²⁸

CANCER

Without major advances in cancer prevention, one out of three Americans now living will eventually get cancer. In 1995 alone, the estimated number of cases diagnosed was 1,252,000. The estimated number of deaths resulting from cancer in 1995 was 547,000, making cancer the second leading cause of death in the United States. We often look to high tech medicine to find cures for cancer, however we often overlook the simple things that we can do on a daily basis that has a major impact on this disease. Consumption of vitamin C rich fruits and vegetables are a way that we can significantly reduce cancer. Studies show risk reductions of 21% to 39% in all types of cancers in patients taking more vitamin C than those with lower consumption rates. An amazing 64% reduction in lung cancer rates occurring in one study.

“A multitude of epidemiologic studies have shown that increased consumption of fresh fruit and vegetables is associated with a reduced risk of most types of cancer. Fruit and vegetables contain many constituents that may contribute to protection against cancer, including antioxidant vitamins. ... Kromhout et al reported a significant 64% risk reduction of lung cancer with vitamin C intakes > 83 mg/d. ... Pandley et al observed a significant 39% lower risk of all cancers in men consuming > 113 mg of vitamin C/d than those consuming 82 mg/d.

A vitamin C intake > 50 mg/d from the diet plus regular supplements, totaling approximately 300 mg/d, was found to be associated with a moderate 21% risk reduction of all cancers in men compared with a dietary intake of < 49 mg/d, although no significant effect was observed in women.”²⁹

In many studies analyzing vitamin C and cancers of the stomach, esophagus, oral cavity, and pharynx there were major reductions in disease of these areas in patients that had higher levels of vitamin C as compared to those who did not. Studies indicate an enormous 69% and 79% reduction in risk of these types of cancers.

“In a comprehensive review of vitamin C and cancer risk, Block found “extremely strong and consistent” evidence of a protective effect against cancers of the stomach, esophagus, oral cavity, and pharynx: 17 of 19 studies showed statistically significant associations between low intake of dietary vitamin C and increased risk of cancer at these sites. . . . A recent study by Kune et al compared 41 men from Melbourne, Australia with oral or pharyngeal cancer to 398 male controls. This study found a significant risk reduction of oral/pharyngeal cancer of 79% in the patients having a vitamin C intake of > 106 mg/day with no further risk reduction in the patients with vitamin C intake of > 201 mg/day. In an area of China with a high rate of stomach cancer, serum levels of vitamin C were assayed out of a population of 3,433 subjects. Histological diagnosis was made employing a gastric mucosa tissue sample as collected by gatroscopy. Subjects with low vitamin C serum levels had a 50% higher risk for gastric metaplasia, which is considered to be a pre-cancerous lesion. . . . A recently published study on gastric cancer and micronutrients conducted during 1988 and 1989 in Barcelona, Spain found that subjects in the uppermost quartile of dietary vitamin C intake showed a statistically significant gastric cancer risk reduction of 69%. Finally, a Swedish study pointed out that vitamin C intake in the highest quartile vs. the lowest quartile 20 years prior to cancer manifestations was significantly associated with reduction in the risk of gastric cancer.”³⁰

In a large study of 136,000 males in the United States there was an increased risk of 1.7 times for those who consumed fruit less than 3 times a week as compared to those who consumed fruit 5-7 times a week.

“Long-de and Hammond examined data from a prospective study in which 136,000 white males in the United States provided information on their frequency of consumption of fruit and green salad; 671 lung cancer deaths were seen over the subsequent 11-y follow-up. Men who consumed fruit less than three times per week had 1.7 times the lung cancer risk of those who ate it 5-7 times per week, a statistically significant increase. ... Pancreatic cancer is the fifth most common cause of cancer mortality in the United States and is a disease with extremely poor prognosis. In the current state of our ability to treat this disease prevention is of primary importance. All five pancreas cancer studies have found statistically significant protective effects of fruit, and in some instances for vegetables as well. The one study that calculated a vitamin C index found a significant twofold reduction in risk associated with high intake. ... seven investigators have reported on vitamin C dietary intake and stomach cancer risk. All seven have found statistically significant protective effects of approximately two-fold ... Verreault et al examined 189 women with invasive cervical cancer and population controls. Low intake of vitamin C was associated with a statistically significant twofold increased risk. The effect of fruit juices was even stronger. The effect of carotene and dark green vegetables was in the same direction, although weaker.”³¹

Here we see that daily consumption of vitamin C can play a key role in prevention of pancreatic cancer, which is a form of cancer that is not very treatable. One study showed a two times reduction in risk of getting pancreatic cancer when taking in high amounts of vitamin C. Vitamin C also has a major impact on stomach and cervical cancer.

“In terms of attributable risk, the authors conclude that “if all postmenopausal women in the population modify their saturated fat intake to (that of the lower one-fifth of the population), the current rate of breast cancer would be reduced by 10% in postmenopausal women ... were to increase fruit and vegetable intake to reach an average daily consumption of vitamin C (equivalent to that of the highest one-fifth of the population), risk of breast cancer ... would be reduced by 16%.” The effects were approximately additive, and simultaneously make both changes would reduce the risk by 24%”³²

Even in a disease like breast cancer if there was an increased consumption of vitamin C and reduction in consumption of saturated fat there would be a large 25% decrease in breast cancer.

CHILDHOOD BRAIN TUMORS

In one interesting study there was a 3 times increase in children who later developed brain tumors who's mothers had low vitamin C levels during pregnancy.

“Thomas Sinks and John R Wilkins III interviewed parents of 100 children with brain tumors and 200 matched control subjects, regarding the mothers’ diets during pregnancy. A statistically significant threefold increased risk of delivering a child who later developed a brain tumor was associated with a low maternal intake of vitamin C during pregnancy, an effect that remained after adjustment for other factors.”³³

HEART DISEASE

In 1998 cardiovascular diseases claimed 949,619 lives (40.6 percent of all deaths or 1 of every 2.5 deaths) making this the number one killer in the United States.

“In an analysis of data from the U.S. First National Health and Nutrition Examination Survey (NHANES I) and its 10-year follow-up study, Enstrom et al found strong inverse relationships between vitamin C intake and all-cause mortality and cardiovascular mortality especially in men. This study included more than 11,000 people and assessed vitamin C intake from both diet and supplementation. At the highest level of vitamin C consumption (> 50 mg/day from diet plus regular use of supplements), men had an almost 50% lower rate of death from cardiovascular disease and women had a 35% lower rate.”³⁴

This large and lengthy study shows that vitamin C can have a significant impact on this major disease reducing the death rate by 50% in men and 35% in women.

STROKE

Stroke killed 158,448 people in 1998. It is the third largest cause of death, ranking behind "diseases of the heart" and all forms of cancer. Stroke is a leading cause of serious, long-term disability in the United States.

“In another recently published study of a 20 year follow-up cohort of randomly selected 730 male and female elderly people living in different areas of Britain, those in the highest tertile of vitamin C intake, which was > 44.9 mg per day, had a 50% lower risk of experiencing a stroke.”³⁵

In this study the risk of stroke was cut in half by the people who consumed a larger amount of vitamin C.

CATARACT

Cataract is a major cause of blindness through out the world. It accounts for 50% of significant visual impairment among adults in developed nations. In the United States alone more than 1 million cataract operations are performed annually at a cost exceeding 5 billion dollars.

“Several epidemiological studies have investigated the association of vitamin C intake with the incidence of cataract. Two case-controlled studies indicated a strong inverse association between high intakes of vitamin C and cataract. Robertson et al found that intakes of >300 mg vitamin C/d were associated with a 70% reduced risk of cataract. Similarly, Jacques and Chlack found that daily intakes of >490 mg were associated with a 75% lower risk of cataract than intakes <125 mg/d. ... Two studies, one of them involving > 50,000 women, indicated that vitamin C has a positive effect on cataract risk when supplements were taken for > 10 y; risk reductions of 45% and 77-83% were reported.”³⁶

In these studies vitamin C had a major impact on cataract. Reducing the incidence of this disease in one study by an enormous 70 percent.

I N F E C T I O N

Our immune system provides us with incredible protection against illness. It includes a complex array of organs, tissues, fluids, and cells sharing a common goal to keep us free from disease. The billions of white blood cells that join forces with the countless macrophage, phagocyte, and other cells to ward off foreign invader cells illustrate the phenomenal power of the immune system. It is an intricate, internal army that works for all of us around the clock.

“Vitamin C supplementation has been shown to reduce the severity of symptoms associated with the common cold. In people who experience extreme physical stress, vitamin C may be of benefit in preventing respiratory infections. A double-blind trial conducted in South Africa showed that marathon runner consuming 1 g vitamin C per day had a significantly lower rate of post-race respiratory infection as compared to those consuming 500 mg/day. ... In HANES II serum vitamin C levels were negatively associated with chronic bronchitis indicating that vitamin C intake might be of value in subjects with chronic respiratory problems.”³⁷

Shown here vitamin C has an affect on our immune system that helps protect us again infection.

S P E R M Q U A L I T Y

Infertility, which affects as many as 1 in 6 couples, is defined as the inability of a couple to conceive a child after one year of unprotected sex. Nearly 1/3 of the time the infertility is due to the sperm quality of the male.

“A recently published review concluded that vitamin C appears to improve human fertility by various mechanisms. The result of controlled human studies also support a possible role of vitamin C in human fertility. Fraga et al have demonstrated that dietary vitamin C protects human sperm against endogenous oxidative DNA damage. A placebo-controlled study in 75 smokers found a significant dose-dependent improvement of six sperm qualities after 4 weeks of daily supplementation with vitamin C. Sperm quality increased in the 200-mg group by 15% and in the 1,000 group by 40%.”³⁸

With large amount of vitamin C there is a significant 40% increase in the quality of sperm. This provides a simple low-tech method of helping a significant percentage of the population with fertility problems.

SAFETY

Researchers from the University of Pennsylvania recently reported that in a test tube study vitamin C might have carcinogenic properties. The lead investigator in this study, Dr. Ian Blair, was quoted in the press as having said, "Absolutely, for God's sake, don't say vitamin C causes cancer." But unfortunately the press went forward and reported that vitamin C causes cancer. This irresponsible reporting has done nothing but cause more mistrust and confusion, when in fact there are many studies that show that vitamin C is very safe and as we have seen very effective in preventing disease.

“Several reviews have concluded that vitamin C is safe even when consumed at high levels of intake for long periods of time. There are also no clinical data, which suggests that the enhancement of non-heme iron absorption by vitamin C in individuals with low iron status could be a critical factor in the possible increased risk of heterozygous hemochromatosis-related cardiovascular disease. The committee that prepared the 1989 RDAs pointed out that many people habitually take vitamin C supplements at dosages of 1 g/day without apparent adverse effects.”³⁹

There are literally tens of thousands of articles in the medical literature, many of which are human studies, reporting numerous health benefits for vitamin C. People have been taking megadoses of vitamin C for decades. Dr. Linus Pauling who won two Nobel Prizes reportedly took more than 15 grams (15,000 mg) of vitamin C daily and lived well into his nineties.

CONCLUSION

Modern medicine has focused on drugs and high-tech solutions in an attempt to cure diseases that have afflicted many people. Unfortunately the affects of modern diet and low consumption of vitamins and minerals has been largely ignored except in the cases of overt nutritional deficiencies which the RDA is intended to prevent. And as we have seen even these small amounts are not being met by a significant percentage of the population because of a modern diet that is focused on high calorie, low nutrition, and convenient junk foods.

We need a national effort to emphasis the elimination of all these junk foods in our diets and promote the consumption of fruits and vegetables and other healthy foods. If we focus our attention on prevention we will see a significant reduction in the diseases that afflict western societies. We have to recognize that there are no big problems in life, but only an accumulation of thousands of small problems. Cancer, heart disease, cataract don't just appear one day out of the blue. These problems are an accumulation of years of life style choices. If we address our diet and lifestyle on a daily basis then we will have a major impact on our health and future disease states. And one of the most important ways to have a positive impact on our health is paying attention to our diets and getting large amounts of vitamin C.

DEFINITIONS

dyspepsia – The impairment of the power of function of digestion, usually applied to a discomfort of the upper central region of the abdomen following meals.

enzyme – A protein molecule produced by living organisms that catalyses chemical reactions of other substances without itself being destroyed or altered upon completion of the reactions.

hemorrhage – The escape of blood from the vessels or bleeding. Small hemorrhages are classified according to size as petechiae (very small), purpura (up to 1 cm) and ecchymoses (larger). The massive accumulation of blood within a tissue is called a haematoma.

hypovitaminosis – A condition due to a deficiency of one or more essential vitamins.

iatrogenic – Induced inadvertently by the medical treatment or procedures or activity of a physician.

nitrosamine – Molecules of which many are carcinogens or suspected carcinogens.

petechiae – Small red spots on the skin that usually indicate a low platelet count.

proximal – Nearest to, closer to any point of reference.

scurvy – Disease caused by Vitamin C deficiency.

vasculitis - Inflammation of a vessel.

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