



# Vitamin C & Bioflavonoids

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Literature Education Series On Dietary Supplements

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Human beings cannot manufacture their own vitamin C and must rely on outside sources (food and supplements) to obtain it. In fact, we would all do well to make sure that we would actually obtain adequate vitamin C, considering this nutrient's extremely important role in relation to human health. This role includes its necessity for the formation of collagen protein found in skin, connective tissue, cartilage and bone; it is also an antioxidant nutrient. It is essential for wound healing, affects immune responses, helps maintain strength in blood vessels, helps protect the body against infections, bacterial toxins, viruses, influences formation of hemoglobin, absorption of iron from intestinal tract, and deposition of iron in liver tissue, and assists in the secretion of hormones from adrenals. A deficiency of vitamin C may result in symptoms such as pink or hemorrhagic skin follicles, hemorrhages in the eye, inflamed gums, joint pains, excessive hair loss, easy bruising and bleeding gums.<sup>1</sup>

## Bioflavonoids

Bioflavonoids (citrus, hesperidin and rutin), sometimes called vitamin P, are substances that are found wherever vitamin C is found in nature. For example, the white material found under the skin of an orange actually contains bioflavonoids. Bioflavonoids have been shown to improve the therapeutic action of vitamin C. In particular, bioflavonoids seem to have a synergistic role with vitamin C in strengthening capillary walls. This is an important consideration for individuals who bruise easily since brittle, fragile capillaries burst easily upon impact causing the characteristic discoloration of bruising. For similar reason, individuals who suffer from hemorrhoids or varicose veins also should make sure that they have adequate quantities of bioflavonoids in their diet.

Rutin in particular is a bioflavonoid that has an affinity for blood vessels.

## Other potential roles

In addition to the aforementioned basic functions, vitamin C (and often bioflavonoids) has also been studied for its potential role in a number of different ailments and health conditions. These include allergies, angina, atherosclerosis, stress, rheumatoid arthritis, asthma, cancer, herpes, cataract, emphysema, the common cold, colitis, recurring ear infections, gingivitis, glaucoma, hemorrhoids, high cholesterol, high blood pressure, lupus, macular degeneration, menopause, and urinary tract infections.

## Allergies

As stated in the first paragraph, vitamin C has a role to play in supporting the health of the adrenal glands. As a matter of fact, it is depleted from the adrenal glands upon the secretion of corticosteroids.<sup>2</sup> It also helps to increase corticosteroid production and decreases the body's sensitivity to the antigen.<sup>3</sup> This decreasing of antigen sensitivity was examined in one study where the researcher stated, "Allergic and sensitivity reactions are frequently ameliorated and sometimes completely blocked by massive doses of ascorbate. [aka, vitamin C]."<sup>4</sup> As a matter of fact, maintaining vitamin C intake is so important for individuals with allergies, that in one study people with seasonal allergic-type symptoms who had the lowest intakes of vitamin C had more than fivefold increased risk of bronchial reactivity (e.g., asthma).<sup>5</sup> Daily doses of vitamin C for people suffering with allergies should be no less than 2000 mg.

## Angina

Those pesky little free radicals really get around. They seem to be involved in almost every cardiovascular condition, and angina is no exception.<sup>6 7</sup> Consequently, it's not surprising that vitamin C and other antioxidants, which neutralize free radicals, are beneficial in the prevention and treatment of angina. In fact, studies have shown that men and women with lower blood levels of vitamin C have a higher risk for angina.<sup>8 9 10 11</sup> Furthermore, research has also shown that vitamin C supplementation, with or without other

antioxidants, has been able to reduce the

### Atherosclerosis

It's not surprising that vitamin C and other antioxidants, which neutralize free radicals, are beneficial in the treatment of atherosclerosis (as well as in the treatment of angina, a possible consequence of atherosclerosis). In one study, as little as 500 mg of vitamin C daily improved endothelial function of the arteries in patients with coronary artery disease.<sup>12</sup>

Besides the free radical angle, there are other mechanisms by which vitamin C may be involved in preventing atherosclerosis. For example, one researcher for the Tulane University School of Medicine has stated that vitamin C deficiency is known to cause a disturbance of cholesterol metabolism<sup>13</sup>—certainly a potential risk factor where atherosclerosis is concerned. That same researcher has also pointed out that suboptimal blood levels of vitamin C also causes increased blood histamine levels. In turn, high histamine levels causes separation of cells in the arteries which, combined with the vitamin C depletion, cause damage to the arteries and predispose people to atherosclerosis.<sup>14</sup>

### Stress

Like the B-complex vitamins, vitamin C is also a nutrient required for stressful situations, and to support adrenal function. In fact, the adrenal glands contain a higher concentration of vitamin C than any other organ in the body, and during emotional or physical stress, these glands release the vitamin and adrenal hormones into the blood. Some stresses even increase vitamin C needs.<sup>15</sup> Research has shown that stress causes 40 to 60% of vitamin C to be delivered to the adrenal glands.<sup>16</sup> As a matter of fact, in one study, serum levels of vitamin C were found to have dropped significantly in individuals who had a stroke—and the stress of the event resulted in a depletion of both pituitary and adrenal glands levels of vitamin C.<sup>17</sup> Research indicates that vitamin C supplementation was able to prevent death due to adrenal insufficiency caused by shock in guinea pigs.<sup>18</sup> The stress of surgery in lung cancer patients was found to increase the need for vitamin C supplementation.<sup>19</sup> Typically, 1500 mg or more grams of vitamin C daily is recommended for stressed-out individuals.

### Rheumatoid Arthritis

Research indicates that vitamin C levels are lower in rheumatoid arthritis patients than in normal subjects.<sup>20</sup> The same is true in juvenile rheumatoid arthritis.<sup>22</sup> Furthermore, vitamin C helps to maintain the integrity of connective tissue—an important consideration for arthritis sufferers.

### Asthma

Research suggests that a diet low in vitamin C may be a risk factor for asthma.<sup>23</sup> In fact, vitamin C levels of asthmatic children were found to be significantly lower

than that for non-asthmatic children.<sup>24</sup> Since evidence is accumulating that asthma may, in part, be a result of free radical reactions, and since vitamin C is an antioxidant that can help protect against these reactions,<sup>25</sup> the importance of maintaining a healthy level of vitamin C intake should be emphasized. In fact, a review of scientific literature regarding vitamin C in asthma and allergy has revealed a number of studies that support the use of vitamin C. Significant results include positive effects on lung function tests, improvements in reactions to allergens, improvements in white blood cell function, and a decrease in respiratory infections.<sup>26</sup> However, the same review revealed studies that did not show a beneficial role for vitamin C in asthma or allergy. Nonetheless, the general results are promising. Of particular interest is a study where 2000 mg of vitamin C was able to block exercise-induced asthma in 8 of 20 patients.<sup>27</sup>

### Cancer

A survey of over 6000 people found that vitamin C levels were lower in all cancer groups, and especially low in those dying from stomach cancer.<sup>28</sup> Other research has also shown low levels of vitamin C in individuals with cervical cancer<sup>29 30</sup> and laryngeal cancer.<sup>31</sup> Some research has shown that supplementation with vitamin C in 10 gram daily doses was able to increase the survival time of terminal cancer patients,<sup>32</sup> although similar research has not found this same relationship.<sup>33 34</sup> Both animal and human studies have shown that vitamin C is capable of blocking the formation of carcinogenic nitrosamines to protect against stomach cancer.<sup>35 36 37 38</sup>

### Herpes

Vitamin C levels have been found to be low in the saliva of individuals with certain herpes infections.<sup>39</sup> Consequently, it is not surprising treatment of type 1 herpes virus-infected cells with vitamin C (together with copper) completely inhibited virus plaque formation.<sup>40</sup> Similar research has shown that vitamin C was able to inactivate the herpes virus.<sup>41</sup> Perhaps the most impressive vitamin C research is a study which patients with recurrent oral herpes who were treated with 600 mg vitamin C and 600 mg bioflavonoid complex given three times daily, experienced optimum remission of symptoms in about 3-6 days—and no adverse reactions were reported by any of the patients who participated in this investigation.<sup>42</sup> I've found that even higher doses of vitamin C and bioflavonoids are beneficial—3000-6000 mg daily has shown positive results. Also, since the type 1 herpes virus is often implicated in canker sores, supplementation with vitamin C seems prudent.

### Cataract

There is a significant amount of research that validates the use of vitamin C for cataract prevention. In one study involving tens of thousands of female registered nurses, the risk of cataract was 45% lower among

women who used vitamin C supplements for 10 or more years.<sup>43</sup> In another study involving 247 women, the use of vitamin C supplements for 10 or more years was associated with a 77% lower prevalence of early cataracts, and an 83% lower prevalence of moderate cataracts compared with women who did not use vitamin C supplements.<sup>44</sup> The statement made by researchers in a European journal probably says it best: "According to actual theories the use of sun-glasses with UVB-filters, and antioxidant diet supplementation [including vitamin C] seems to be useful in prevention of age-related cataract."<sup>45</sup>

### Emphysema

A European study suggested that vitamin C could be useful for prevention of the oxidant-mediated lung injury related to inflammation, which may help prevent pulmonary emphysema.<sup>46</sup> Other studies have shown similar results.<sup>47</sup> Furthermore, animal research shows the development of lung disease similar to human bronchitis and emphysema from exposure to nitrogen dioxide and ozone, and both vitamins C and E can protect human cells against the oxidative damage caused by these pollutants.<sup>48</sup> Finally, consider one of vitamin C's primary roles: the formation of collagen, the single most important protein of connective tissues.<sup>49</sup> Now consider the words of one researcher: "The most important primary cause of generalized pulmonary emphysema is in all probability the loss of mechanical stability of the connective tissue framework in [certain parts of the lung]."<sup>50</sup> Clearly, vitamin C helps support connective tissue integrity, and may therefore reduce the likelihood of developing emphysema via this mechanism.

### The Common Cold

Since the late, great Nobel Laureate, Linus Pauling first discussed that megadoses of vitamin C might be an effective treatment for the common cold, the medical world has published study after study attempting to prove or disprove Pauling's claim. In some cases, the studies were flawed since the amounts of vitamin C used were hardly megadoses, and were not sufficient to elicit a response.

Placebo-controlled studies have shown that vitamin C supplementation decreases the duration and severity of common cold infections. However, the magnitude of the benefit has substantially varied, hampering conclusions about the clinical significance of the vitamin. In one published review, 23 studies with regular vitamin C supplementation were analyzed to find out factors that may explain some part of the variation in the results. It was found that on an average, vitamin C produces greater benefit for children than for adults. Perhaps of greatest significance, the dose also affects the magnitude of the benefit, there being on average greater benefit from at least 2000 mg daily compared to 1000 mg daily. For example, in five studies with adults administered 1000

mg daily of vitamin C, the median decrease in cold duration was only 6%, whereas in two studies with children administered 2000 mg daily, the median decrease was four times higher, 26%. The studies analyzed in this review used regular vitamin C supplementation. The authors of the review, however, noted that, "it is conceivable that therapeutic supplementation starting early at the onset of the cold episode could produce comparable benefits."<sup>51</sup>

In fact, this is exactly what took place in the most recent study (October 1999) involving 252 adult subjects with a cold or flu who were treated with hourly doses of 1000 mg of vitamin C for the first 6 hours, and then 3 times daily thereafter. A control group of 463 subjects were treated with pain relievers and decongestants. The results were that overall reported flu and cold symptoms in the vitamin C group decreased 85% compared with the control group after the administration of megadose Vitamin C. The researchers in this study concluded: "Vitamin C in megadoses administered before or after the appearance of cold and flu symptoms relieved and prevented the symptoms in the test population compared with the control group."<sup>52</sup>

I've also found effective results with the common cold when supplementing with higher doses of vitamin C. I recommend 1000-2000 mg every 2 hours (reduce dose if experiencing loose bowels).

### Colitis

Research has shown that in the inflamed mucous membranes in ulcerative colitis patients, total vitamin C content was decreased by 73%.<sup>53</sup> As a matter of fact, the low intake of vitamin C among ulcerative colitis patients has led some researchers to suggest that supplementation with vitamin C may be useful in these patients.<sup>54</sup> This especially makes sense when you consider that excessively produced free radicals can induce various diseases such as Crohn's disease and ulcerative colitis, and that the body has a self-defense system against these oxidative injuries that includes antioxidants such as vitamin C.<sup>55</sup> In one study, colorectal biopsies from patients with ulcerative colitis treated with vitamin C were examined. The results were that the vitamin C inhibited free radical activity by 60%.<sup>56</sup> In animal studies, vitamin C was also able to inhibit free radical oxidation in the intestine.<sup>57</sup>

### Ear Infections (recurring)

Vitamin C is well known for its role in immunity. A deficiency in vitamin C suppresses the immune response, and increases the likelihood for frequent infections.<sup>58</sup> When children with ear infections were treated with vitamin A, vitamin C and vitamin E, a high response was achieved in reducing infection.<sup>59</sup> Patients with dysfunctioning neutrophils (i.e., white blood cells necessary for removing or destroying bacteria) and recurrent ear infections were treated with

vitamin C. The results were that the patients showed a complete restoration of neutrophil function and a long-lasting clinical remission.<sup>60</sup> Although there are many forms of vitamin C, for children the chewable type is often easiest for them to consume. Just make sure it doesn't contain added refined sugar. For the little ones, I usually recommend 250 to 500 mg, two to three times daily.

#### Gingivitis

One of vitamin C's primary roles involves the formation of collagen, the single most important protein of connective tissues<sup>61</sup>—including the connective tissue found in the gums. In fact, one of the possible symptoms of a vitamin C deficiency is the bleeding of gums, especially during the brushing of teeth. Consequently, it is not surprising that research has found a relationship between early stages of gingivitis and reduced levels of vitamin C—particularly where bleeding gums are concerned.<sup>62</sup>

#### Glaucoma

Research has found that as glaucoma gets worse, the antioxidant activity of eye fluids decreases—including vitamin C activity.<sup>63</sup> This suggests that reduced vitamin C levels may play a role in glaucoma. Unfortunately, this situation is often made worse when glaucoma patients are treated with cortisol drops, which further reduces the concentration of vitamin C in the eye.<sup>64</sup> Research has shown, however, that when vitamin C was administered along with glycerol, a reduction in intraocular pressure occurred.<sup>65</sup>

#### Hemorrhoids

Some individuals have found ongoing vitamin C supplementation to have a beneficial role in the prevention of hemorrhoids. This makes sense when considering its well-known function of maintaining the integrity of blood vessels.<sup>66</sup> In addition, bioflavonoids, which are often found occurring with vitamin C in nature, work synergistically with vitamin C in helping to strengthen blood vessels. Bioflavonoids are found particularly in citrus and in blue, purple, and red fruits and vegetables, such as blueberries, blackberries, plums, purple cabbage, and so on. Bioflavonoid-containing foods should be included in the daily diet, but supplemental quantities are always helpful too. A good recommendation is 1000-2000 mg of citrus bioflavonoids daily. Furthermore, many individuals have found that another type of bioflavonoid known as rutin has been particularly helpful in supplemental form for hemorrhoids.

#### High Cholesterol

Some research has shown that vitamin C supplementation resulted in a reduction in cholesterol levels in people with elevated cholesterol.<sup>67</sup> Some decreases have also occurred in LDL cholesterol.<sup>68</sup> Recommendations typically begin with 1000 mg daily, although a review of the research with vitamin C and

heart disease has suggested that most protection against heart disease from vitamin C is likely to occur with as little as 100 mg per day.<sup>69</sup>

#### High Blood Pressure

Vitamin C's role in maintaining the health of arteries is well established.<sup>70</sup> Furthermore, a review of vitamin C research indicates that most studies have reported a relationship between increased blood and dietary levels of the vitamin to a reduction in blood pressure.<sup>71</sup> This relationship however, might result from diets high in fruit and vegetables rather than from vitamin C itself. Nonetheless, the relationship exists, and certainly lends credence to the use of vitamin C for arterial health, and potentially reducing blood pressure. A recommendation would be at least 1000 mg of vitamin C daily.

#### Lupus

Risk factors for Systemic lupus erythematosus (SLE) include low blood levels of antioxidant nutrients.<sup>72</sup> This makes sense when considering that free radicals are thought to promote SLE.<sup>73</sup> Furthermore, antioxidant levels have been reported to be low in people with SLE, though this finding was not statistically significant in one trial.<sup>74</sup> Interestingly, when animals are fed antioxidant-deficient diets, they develop a condition similar to SLE. Supplementation with antioxidants such as vitamins C and E, beta-carotene, and selenium has helped animals with existing SLE.<sup>75</sup> Human research is not clear on whether supplementation with antioxidants may or may not help SLE patients. Nonetheless, one antioxidant vitamin, vitamin C, may be beneficial to supplement in any case. Although no specific published research has been conducted to identify an antioxidant-related therapeutic role for vitamin C in SLE patients, the collagen-promoting and connective tissue repair role of this nutrient is well established,<sup>76</sup> and makes sense for use in SLE, given the connective tissue-affected nature of the disease.

#### Macular Degeneration

Free radicals can cause oxidative damage to the macula. As a matter of fact, sunlight (a major source of free radical radiation) triggers oxidative damage in the eye, which in turn can cause macular degeneration.<sup>77</sup> Consequently, it's not surprising to learn that animals given antioxidants, which protect against oxidative damage, have a lower risk of macular degeneration.<sup>78</sup> Furthermore, people with high blood levels of antioxidants also have a lower risk.<sup>79</sup> Perhaps most significant is that those with the highest levels of the antioxidants selenium, vitamin C, and vitamin E may have a 70% lower risk of developing macular degeneration.<sup>80</sup> Also, people who eat fruits and vegetables high in beta-carotene, another antioxidant, are also at low risk.<sup>81</sup> Recommended daily doses of these antioxidant nutrients are selenium - 200 mcg, vitamin C - 2000-3000 mg, vitamin E - 400-800 IU,

and beta-carotene - 25,000 IU.

### Menopause

One preliminary trial conducted in 1964 reported that 1,200 mg each of vitamin C and the bioflavonoid hesperidin, taken over the course of the day helped relieve hot flashes.<sup>82</sup> Since that time, there have not been any other studies to try and duplicate the original results.

### Urinary Tract Infections

As previously expressed, a deficiency in vitamin C suppresses the immune response, and increases the likelihood for frequent infections.<sup>83</sup> For this reason, it makes sense to maintain good vitamin C status to help prevent urinary tract infections (UTI) and other infections. In addition, vitamin C may have value as part of a treatment strategy for UTI. The reason for this is that vitamin C has been shown to inhibit the growth of *E. coli*, the most common bacterial cause of UTIs.<sup>84</sup> However, no controlled studies have demonstrated the effectiveness of vitamin C for this purpose in actually treating UTI. In addition, ingestion of 4,000 mg or more of vitamin C per day results in a slight acidization of the urine<sup>85</sup> creating an “unfriendly” environment for certain bacteria. I recommend the use of vitamin C crystals during UTI, rather than better absorbed timed- released forms of this vitamin, since more of the acidic crystals are likely to end up in the urine.

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