

Letters

GUIDELINES

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THE GOOD AND HARM OF VITAMIN C

To the Editor: Victor Herbert recently discussed the beneficial and harmful aspects of vitamin C supplementation.¹ In his brief discussion of the possible benefits, he neglected to mention the effect of vitamin C on the common cold. Over 20 placebo-controlled studies have consistently shown that vitamin C (1 to 6 g/day) alleviates the symptoms of the common cold.^{2, 3} Most of these studies were double-blind, and the subjects were randomly allocated to the study groups. Therefore, the observed benefit may reliably be attributed to vitamin C supplementation. Yet, there are many other conditions for which vitamin C may be beneficial. For example, vitamin C participates in the catabolism of cholesterol to bile acids, and in guinea pigs the reduction of vitamin C intake causes hypercholesterolemia.^{4, 5} A number of intervention studies have found that vitamin C supplementation decreases elevated cholesterol levels in human subjects.^{4, 5} None of the intervention studies was referred to by Herbert.

If about 1 g/day of vitamin C were harmful to the general population, this would have been observed in the numerous epidemiological and interventional studies that have been carried out. Such doses have not been harmful, but rather they appear to be beneficial.²⁻⁷ Still, even though 1 g/day of vitamin C is not harmful to the general population, it is possible that such a dose is harmful to specific subgroups. In this respect Herbert's comments are valid; he points out that patients suffering from iron overload may constitute one of these subgroups.¹ However, the harmful effect of vitamin C on subjects with iron overload and the rationale of treating such patients with the combination of vitamin C and desferrioxamine have been known for a long time.^{8, 9} In healthy subjects, the concentration of free iron ions in plasma is extremely low, below the detection limit of current methods.¹⁰ Therefore, vitamin C in plasma does not promote the formation of free radicals, but efficiently reacts with radicals formed by other mechanisms, thereby inhibiting lipid peroxidation and other harmful effects.^{3, 11}

The effect of vitamin C on iron absorption is not as simple as suggested by Herbert.¹ In order to quantify the

effect of vitamin C supplementation on iron status, Cook et al.¹² administered 2 g/day of the vitamin to 9 subjects for 2 years. There were no indications of iron accumulation. However, this study was not mentioned by Herbert.¹

In addition to the interaction of vitamin C with iron, Herbert presented a list of other possible harms from vitamin C supplementation.¹ He did not explicitly refer to the original publications, but took the list from another review.¹³ The list contains the claim, originally made by Herbert himself, that vitamin C causes breakdown of vitamin B₁₂.¹⁴ However, it was shown over 10 years ago that the reported decrease in vitamin B₁₂ level was due to methodological shortcomings,^{15, 16} and the vitamin B₁₂ level is not decreased in patients that have been given as much as 4 g/day of vitamin C.¹⁷

Herbert also claims that vitamin C may cause miscarriages.^{1, 13} This suggestion is based on a brief Russian publication from 27 years ago.¹⁸ Twenty women whose menstruation was delayed by 10 to 15 days were given 6 g/day of vitamin C, and 16 of them started to menstruate within 3 days.¹⁸ Pauling wrote a letter to the authors inquiring whether any direct test of pregnancy was carried out, but as a reply he received only a copy of the publication.⁷ Thus, there is no evidence that the women were pregnant initially; possibly they just had irregular menstruation.

Five decades ago Levey and Suter¹⁹ reported that vitamin C potentiates the diabetogenic action of alloxan in rats. Blood sugar level was determined 3 days after injecting alloxan, or alloxan with vitamin C (0.2 g/kg), to the rats. Hyperglycemia was observed in 50% of the rats treated with alloxan and vitamin C, in contrast to 17% of the rats treated with alloxan alone.¹⁹ The authors concluded from their own previous work that "ascorbic acid alone does not produce hyperglycemia."¹⁹ This old experiment with alloxan-treated rats is the basis for Herbert's belief that large doses of vitamin C, alone, may reduce insulin production in human subjects.^{1, 13}

Rivers reviewed 74 publications dealing with the proposed toxicity of vitamin C and concluded that "large quantities of ascorbic acid will not result in calcium-oxalate stones, increased uric acid excretion, impaired vitamin B₁₂ status, iron overload, systemic conditioning, or increased mutagenic activity in healthy individuals."²⁰ In another review, Marks concluded that "a large number of adverse reactions have been alleged to occur with the use of large doses of ascorbic acid, but almost without exception further study has demonstrated that the allegations are without foundation . . . an overview of all the information shows that the safe daily level is at least 100 times the RDA."²¹ The RDA level for vitamin C is 60 mg/day.²² Hence, these two reviewers and several others have reached very different conclusions about vitamin C toxicity when compared to Herbert.¹

Thus, Herbert's conclusions that there are no reliable data to show that vitamin C supplementation may provide any benefits and that vitamin C supplements may instead be highly harmful are largely based on a biased selection of references.

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Harri Hemilä, Ph.D.
Department of Public Health
SF-00014 University of Helsinki
Helsinki, Finland