

## Issue 68

### In a nutshell

Epidemiological studies show that higher levels of vitamin C and iron intake are both associated with lower levels of blood lead.

A small clinical trial of vitamin C supplementation suggest that high doses of vitamin C can reduce blood lead levels, at least in the short term, but that lower doses do not.

## Vitamin C, iron and lead

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## NUTRITION RESEARCH REVIEW

### Study one: epidemiology

There is a relationship between blood lead and ascorbate levels, according a newly published analysis derived from the third NHANES study.

Subjects: Cross sectional probability sample of 4,213 youths (6-16 years) and 15,365 adults (over 17 years) in the US-based NHANES national dietary survey conducted between 1998 and 1994. None had a history of lead poisoning.

Method: Epidemiological study looking at dietary history and blood examination. The analysis was controlled for potential confounders, including iron intake.

Results: There was a dose-response relationship between serum ascorbic acid and blood lead level in adults ( $p < 0.001$ ) but not in youths.

On the other hand, stratified analysis showed relationships in both adults and youths. The top tertile of serum vitamin C levels was associated with an odds ratio for elevated blood lead (compared with the lowest tertile) of OR = 0.11 (95% confidence interval: 0.04-0.35,  $p = 0.002$ ). For adults, the top two tertiles

of serum vitamin C (compared with the lowest) had a two thirds less rate of elevated blood lead ( $p < 0.03$ ).

Ref: JAMA. 1999;281:2289-2293

### Study two: controlled clinical trial

A randomised, placebo-controlled study from Texas found that high dose mega-supplementation with vitamin C directly lowers blood lead levels in smokers.

Subjects: 75 adult men who smoked (at least one pack of cigarettes/day), with no clinical signs of ascorbic acid deficiency or lead toxicity.

Method: Randomisation to receive either placebo, 200mg or 1000mg ascorbic acid/day for four weeks.

Results: Blood ascorbate levels rose sharply in supplemented groups. There was a significant decrease in blood lead levels in the 1000mg vitamin C supplemented group after one week - an 81% decrease in blood lead level ( $p < 0.001$ ), but no significant impact in the 200mg/day supplemented group.

Ref: Am Coll Nutr 1999;18:166-70

### Study three: vitamin C and iron

Both lower vitamin C and iron intake are associated with higher blood lead levels in elderly men, according to a recent American study.

Subjects: The Normative Aging Study involving 747 men (mean age 67 years) during 1991-1995.

Method: Dietary intake was assessed and compared with blood lead, amongst other parameters.

Results: Controlling for smoking status, both iron and vitamin C intake were correlated with blood lead levels.

The highest quintile of vitamin C intake (>338 mg/day) was associated with mean blood lead 1.7 µg/dL lower than the lowest quintile (<110 mg/day).

The highest quintile of iron intake (>23.4 mg/day) was associated with mean blood lead 1.1 µg/dL lower than the lowest quintile (<10.9 mg/day).

Ref: *Am J Epidemiol* 1998;147:1162-74

### Comments

The two epidemiological studies summarised here make it clear that there is a relationship between vitamin C and lead levels, both based on dietary intake (which can at best only be estimated to a rough degree of accuracy) and serum levels.

What these results do not confirm, however, is whether the relationship is causal or incidental, or perhaps mediated through some intermediary measure, such as another nutrient. This is particularly possible with iron, given that vitamin C increases absorption of non-haem iron and that iron competitively inhibits absorption of many cationic minerals, including lead.

The controlled trial, however, addresses the relationship more directly and with positive outcome.

Two things were particularly notable in these results:

- how swiftly increased vitamin C intake lowered blood lead levels.
- that only megadoses of vitamin C were effective in doing so.

The study was only short term, and it will be interesting to see results from longer term supplementation trials.

Given the acknowledged role of lead toxicity in adversely affecting psychoneurological development, particularly in children, such studies will obviously be of great importance. This is especially so since in many countries the children most likely to be affected by lead toxicity are those of lower socioeconomic status, whose vitamin C intakes may also be lower than more fortunate children.

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