Vitamin C supplementation lowers serum low-density lipoprotein cholesterol and triglycerides: a meta-analysis of 13 randomized controlled trials

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CRD summary
The review concluded that supplementation with at least 500mg/day of vitamin C for at least four weeks can result in significant decreases in low-density lipoprotein cholesterol and triglyceride; there was a non-significant elevation of serum high-density lipoprotein cholesterol. A lack of study quality assessment and other methodological problems limited the reliability of the author's conclusions.

Authors' objectives
To investigate the effects of vitamin C supplementation on low-density lipoprotein (LDL) cholesterol, high-density lipoprotein (HDL) cholesterol and triglycerides in patients with hypercholesterolaemia.

Searching
MEDLINE was searched from 1970 to June 2007 for published full-length journal articles in any language. Search terms were reported. Manual searches of review articles and retrieved papers were conducted.

Study selection
Randomised controlled trials (RCTs) in participants with hypercholesterolaemia (total serum cholesterol >200mg/dL) who received oral vitamin C supplementation (at least 500mg/day) compared with control were eligible for inclusion. Trial interventions had to be given for between four and 24 weeks. Trials had to report outcomes on mean LDL cholesterol, HDL cholesterol or triglyceride changes in both treatment and control groups.

The included trials evaluated vitamin C at a dose of between 500mg/day and 2,000mg/day given for between four and 24 weeks. Baseline LDL cholesterol ranged from 121mg/dL to 220mg/dL, baseline HDL cholesterol ranged from 33mg/dL to 60mg/dL and baseline triglyceride ranged from 151mg/dL to 427 mg/dL. The proportion of males varied from zero to 100%. Mean age ranged from 48 to 82 years.

The author did not state how many reviewers were involved in study selection.

Assessment of study quality
The author did not state that they assessed validity.

Data extraction
Data was extracted on the pre- and post-treatment LDL cholesterol, HDL cholesterol and triglycerides and used to calculate net changes and 95% confidence intervals (CIs).

The author did not state how many reviewers were involved in data extraction.

Methods of synthesis
A random-effects meta-analysis was undertaken, which pooled net changes for LDL cholesterol, HDL cholesterol and triglycerides. Publication bias was assessed using funnel plot analysis.

Results of the review
Thirteen RCTs were included in the review: five cross-over trials and eight parallel design trials (number of participants unclear). Trial sample sizes ranged from 18 to 138 participants.

Compared with control, the vitamin C supplementation group had a statistically significantly lower net change in LDL cholesterol (net change -7.90, 95% CI -12.3 to -3.5; n=638 participants), total cholesterol (net change -10.67, 95% CI...
-14.0 to -7.3; n=1,119 participants) and triglycerides (net change -20.1, 95% CI -33.3 to -6.8; n=555 participants).

There was a non statistically significant increase in HDL cholesterol (net change 1.1, 95% CI -0.2 to 2.3; n=692 participants).

Funnel plot assessment showed no evidence of publication bias for any of the outcomes apart from HDL cholesterol.

Authors' conclusions
Supplementation with at least 500mg/day of vitamin C for a minimum of four weeks can result in significant decrease in LDL cholesterol and triglyceride concentrations; there was a non-significant elevation of serum HDL cholesterol.

CRD commentary
Inclusion criteria for the review were clearly defined; one relevant database was searched and manual searches were undertaken. Publication bias was assessed and was not detected except in the analysis of HDL cholesterol. The author attempted to minimise language bias by including articles in any language. It appeared that there were no attempts to minimise reviewer error and bias during study selection and data extraction. Quality assessment was not reported. The author acknowledged that many of the trials had small sample sizes. There were differences in trial duration, dosages and participant characteristics, which the author recognised and did not explore further. Trial outcomes were assessed using random-effects meta-analysis. Statistical heterogeneity was not discussed.

Overall, the lack of quality assessment and analysis of statistical heterogeneity and the small sample sizes of the included trials limit the reliability of the author's conclusions.

Implications of the review for practice and research
The author did not state any implications for practice and further research.

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