**Garlic supplementation and serum cholesterol: a meta-analysis**

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**CRD summary**
This review found insufficient evidence for the effectiveness of garlic supplementation for modifying serum cholesterol in both healthy adults and patients with cardiovascular disease. On the basis of the results of the trials included in the review, the authors' conclusions reflect the evidence presented and are likely to be reliable.

**Authors' objectives**
To critically summarise the evidence on the effect of garlic on serum cholesterol

**Searching**
The Cochrane Library, MEDLINE, Scopus and informaworld databases were searched up to March 2008. Search terms were reported. Reference lists of retrieved articles were also searched. There were no language restrictions. In addition, a handsearch of journals focusing on complimentary and alternative medicine and cardiovascular-related topics was performed. Local manufacturers and distributors of garlic-containing products were also contacted for published and unpublished trials.

**Study selection**
Randomised controlled trials (RCTs) investigating all forms and doses of garlic preparation compared to placebo for the prevention and treatment of cardiovascular disease were eligible for inclusion. Healthy subjects and patients with cardiovascular disease were included. Trials using garlic in combination with other treatments were excluded, as were studies of single-dose administrations of garlic.

All but one of the included trials compared garlic supplementation with placebo. Garlic supplementation included tablets, capsules and powder. Formulations and doses varied across the studies. The patient populations were heterogeneous and included both hypercholesterolaemic patients and healthy subjects. Outcomes evaluated included total serum cholesterol and other parameters relating to cholesterol levels.

The authors did not state how the papers were selected for the review, or how many reviewers performed the selection.

**Assessment of study quality**
The methodological quality of the studies was assessed using a modified version of the Jadad scale. Studies were assessed according to appropriateness of randomisation, allocation concealment, double-blinding and attrition rates in the groups.

Two reviewers independently assessed study quality using a standard form and resolved any disagreements by discussion.

**Data extraction**
Data for only pre-defined continuous outcomes were extracted using a standardised data extraction form.

The reviewers did not state how the data were extracted for the review, or how many reviewers performed the data extraction.

**Methods of synthesis**
The pooled weighted mean difference (WMD) and corresponding 95% confidence intervals (CI) were calculated. The reviewers used $I^2$ statistics to calculate heterogeneity in the meta-analysis. When heterogeneity was detected among the included studies, a random-effects model was used. Analyses were conducted for the following comparisons: all garlic preparations versus placebo; garlic preparations versus placebo in healthy subjects; and garlic preparations versus...
placebo in hypercholesterolaemic patients. Studies identified as outliers were explored as potential causes of differences among studies in sensitivity analyses. Sub-group analyses were conducted to analyse possible differences in effects among garlic preparations.

**Results of the review**

Thirteen RCTs (n=1,056) were included. Trial length varied from 12 weeks to 24 weeks. Eleven trials scored the maximum 4 points on the modified Jadad rating scale for methodological quality; no study was considered to be of poor quality.

All garlic preparations versus placebo: There were no statistically significant changes in serum levels of total cholesterol, low-density lipoprotein-cholesterol, triglyceride or apolipoprotein B.

Garlic preparations versus placebo in healthy patients: There was a statistically significant beneficial increase in high-density lipoprotein-cholesterol (WMD 0.05 mmol/L; 95% CI: 0.03, 0.07 mmol/L). There were no statistically significant effects of garlic compared to placebo observed for serum levels of total cholesterol, low-density lipoprotein-cholesterol or triglycerides.

Garlic preparations versus placebo in hypercholesterolaemic patients: There was a statistically significant detrimental decrease in high-density lipoprotein-cholesterol (WMD 0.06 mmol/L; 95% CI: -0.12, -0.004 mmol/L). There were no statistically significant effects of garlic compared to placebo observed for serum levels of total cholesterol, low-density lipoprotein-cholesterol or triglycerides.

Subgroup analyses of standardized garlic preparations compared to placebo did not show any effects of garlic on any outcome measure tested (levels of serum total cholesterol, high-density lipoprotein-cholesterol, low-density lipoprotein-cholesterol or triglycerides).

The I² values showed moderate to high heterogeneity among the studies for all outcome measures.

**Authors’ conclusions**

The available evidence from well-conducted randomised controlled trials does not show any marked beneficial effects of garlic supplementation on serum cholesterol in both healthy adults and patients with cardiovascular disease. There was considerable heterogeneity in the results of the included trials, which means the results of the trials should be interpreted with a considerable degree of caution.

**CRD commentary**

The review question was clear and supported by appropriate inclusion and exclusion criteria with respect to study design, participants and treatments. The search included appropriate databases and was designed to minimise language bias. Steps were taken to minimise reviewer bias and errors in all parts of the review process but not reported for study selection. Standard statistical methods were used to pool the data. Potential sources of heterogeneity were appropriately explored. Given the substantial clinical heterogeneity of the populations enrolled and the differences in garlic dose across the included studies, the reviewers' decision to pool the results in a meta-analysis may not have been appropriate. However, the authors' conclusions regarding both the effectiveness of garlic supplementation and the potential causes of heterogeneity of the trials reflect the evidence presented and are likely to be reliable.

**Implications of the review for practice and research**

Implications for practice: The authors stated that recommendations by proponents of complimentary and alternative medicine on increasing garlic consumption to reduce risk of cardiovascular disease should be viewed with caution, as any effect is modest and should be weighed against effects such as body odour, bad breath and gastrointestinal disturbances. Patients on warfarin should also be aware of a potential interaction between garlic and warfarin which may lead to prolonged bleeding.

Implications for research: The authors stated that the pooled results of the review should be interpreted with a substantial degree of caution because of the considerable heterogeneity observed in the results of the included trials. Improvements in the quality of trial design (particularly by improving the power of trials to detect differences between garlic and placebo) and the use of garlic products with standardised active compounds should reduce this heterogeneity.
in the results.

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