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## Effects of walnut consumption on blood lipids and other cardiovascular risk factors: a meta-analysis and systematic review

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### CRD summary

This review concluded that, in short-term studies, a diet high in walnuts reduced total cholesterol and low-density lipoprotein cholesterol and did not appear to adversely affect body weight. Further research was needed to assess the long-term effects. The evidence came from small studies, mainly of eight weeks or less, but the conclusions were suitably cautious and are therefore reasonable.

### Authors' objectives

To assess the effects of walnut consumption on blood lipids.

### Searching

MEDLINE and the Cochrane Database of Systematic Reviews were searched to May 2008. The search terms were reported. Bibliographies of identified studies and reviews were checked. The search was limited to articles in English.

### Study selection

Controlled trials that assessed the effects of a walnut-enriched diet, compared with control, and reported on at least one blood lipid outcome were eligible for inclusion. The amount and frequency of walnuts included in the diet had to be stated. Studies that assessed the effects only after a meal, and those comparing the effects to those of other nuts, were excluded. The outcomes of interest were the mean serum total cholesterol, low-density lipoprotein (LDL) cholesterol, high-density lipoprotein (HDL) cholesterol, and triglyceride concentrations. Other outcomes were weight change, markers of inflammation, oxidative stress, endothelial function, and antioxidant capacity.

Some of the included studies recruited people with normal blood cholesterol, others with modest hypercholesterolaemia. Some studies included people who were overweight or obese or who had diabetes or metabolic syndrome. Mean ages ranged from 24 to 66 years; between 28% and 100% were men; and where reported the body mass index ranged from 20 to 36. Baseline total cholesterol ranged from 159mg to 277mg per dL. Treatment lasted from four to 24 weeks. Walnuts contributed from 5% to 24% of the total calories in the diet. Control diets included low fat, Mediterranean, average for the country, and cholesterol lowering diets.

Study selection was carried out by one author and checked independently by a second author.

### Assessment of study quality

Study quality was assessed using the Jadad scale, with up to five points for the criteria of randomisation, blinding, and treatment of withdrawals and dropouts. The method of monitoring compliance was also included in the quality assessment.

The authors did not state how many reviewers performed the validity assessment.

### Data extraction

Mean changes from baseline to follow-up, were calculated for the intervention and control groups. Where only the mean difference was reported the control group's mean change was set at zero and the walnut group's mean change was set at the reported difference. In these cases studies were excluded from the pooled calculation of percentage change. Standard errors and confidence intervals were converted to standard deviations for the analyses. All serum lipids were converted into mg per dL. If more than one time-point for follow-up was reported the closest time-point to those used in the other studies was used.

The authors did not state how the data were extracted for the review, nor how many reviewers performed the data

extraction.

### Methods of synthesis

A random-effects model was used to calculate the weighted mean difference (WMD) with 95% confidence interval (CI). The percentage change between baseline and follow-up was calculated. The Cochran Q test and the I<sup>2</sup> statistic were used to assess heterogeneity. Sensitivity analyses were undertaken to evaluate the effects of outliers, effect modifiers (percentage of energy from fat, follow-up time, baseline comorbidities, and type of control diet), and study quality (Jadad score of three or higher, excluding studies with poor compliance) and including only randomised controlled trials (RCTs).

Publication bias was assessed using the Egger and Begg-Mazumdar tests.

### Results of the review

Thirteen studies (365 participants) were included, two were parallel RCTs (80 participants), ten were crossover RCTs (267 participants) and one was not a RCT (18 participants). One study lasted 24 weeks whilst all the others ranged from four to eight weeks. Scores for quality were generally low with only four studies scoring three or more on the Jadad scale.

A walnut diet, compared with the control, decreased total cholesterol (WMD -10.29mg/dL, 95% CI -14.76 to -5.83; 11 studies) and LDL cholesterol (WMD -9.23mg/dL, 95% CI -13.10 to -5.36; 11 studies). There was no effect on HDL cholesterol (13 studies), nor triglycerides (12 studies). In sensitivity analyses the results were similar to the overall analysis for participants with hypercholesterolaemia (six studies), RCTs only (12 studies), and high-quality studies (three studies).

No studies reported any significant weight gain. Four studies reported withdrawals from the walnut diet and the reasons included canker sores, gastrointestinal distress, and intolerance to walnuts. Tests showed no heterogeneity between studies, and no evidence of publication bias.

### Authors' conclusions

In short-term trials, highly walnut-enriched diets reduced total and LDL cholesterol and did not appear to adversely affect body weight; longer trials were needed.

### CRD commentary

The aims of the review were clearly stated for the intervention, outcomes, and study design. The sources searched were somewhat limited and it is possible that studies were missed, but tests showed no evidence of publication bias. Only those studies reported in English were sought and language bias may have affected the review. The methods used for study selection aimed to reduce reviewer error and bias, but those used for data extraction and quality assessment were not described, which makes it impossible to comment on them. Study quality was assessed and the results were used to inform the analysis. The methods of analysis were appropriate. Studies were mainly RCTs with the inclusion of one of another design. Subgroup analyses investigated this and other differences between studies. The authors commented that the included studies were of small size and short duration.

The authors' conclusions were suitably cautious, and are therefore reasonable.

### Implications of the review for practice and research

**Practice:** The authors stated that walnuts could be incorporated into the diet to improve blood lipids and cardiovascular risk.

**Research:** The authors stated that larger and longer trials were needed to assess the effects of walnut diets on blood lipids and cardiovascular risk.

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