Dietary lipids and blood cholesterol: quantitative meta-analysis of metabolic ward studies

Authors' objectives
To determine the quantitative importance of dietary fatty acids and dietary cholesterol to blood concentrations of total, low-density lipoprotein (LDL) and high-density lipoprotein (HDL) cholesterol.

Searching
Studies were identified by searching MEDLINE, scanning relevant reference lists, and handsearching nutrition journals for published reports of dietary intervention studies. No other search criteria are specified, but they are available on request from the authors.

Study selection

Study designs of evaluations included in the review
Intervention studies conducted under controlled conditions, which ensured compliance with diets and persisted for at least two weeks, were included. These included crossover, parallel, latin square and sequential design. Studies were excluded if they were of participants selected for some disorder, if the dietary changes were deliberately confounded by other interventions, or if there were no data available about dietary fatty acids or dietary cholesterol.

Specific interventions included in the review
Solid-food diets and liquid-formula diets. No specific details are provided.

Participants included in the review
The participants were healthy volunteers. The review analyses their age, weight and dietary intake, but no other details are provided.

Outcomes assessed in the review
Changes in blood total cholesterol (mmol/L) concentrations in plasma and serum, and LDL and HDL cholesterol were measured.

How were decisions on the relevance of primary studies made?
The authors do not state how the papers were selected for the review, or how many of the authors performed the selection.

Assessment of study quality
The authors do not report the criteria used to assess validity, or how the validity assessment was performed.

Data extraction
There is limited discussion of the methods of data extraction. For some studies, the mean weight, age or dietary cholesterol had to be estimated from median or mid-range values.

Methods of synthesis
How were the studies combined?
Multi-level regression analyses that included age, weight and dietary intake of nutrients, as well as one term per study to ensure that people within any one study were compared directly only with each other. Regression slopes were estimated and compared for the solid-food diets for each design and all designs, and for liquid diets.

How were differences between studies investigated?
Differences were examined through subgroup analyses and sensitivity analyses of different diets (solid-food and liquid-formula diets) and study designs (crossover, parallel, latin square and sequential). In addition, differences in participant characteristics were examined through multi-level multivariate analyses techniques.

**Results of the review**

Eighty reports (15,944 patients) were included. Of these, 72 reports (15,680 patients) among 129 groups of participants in 395 experiments assessed solid-food diets (109 randomised crossover, 57 matched or randomised parallel, 77 non-randomised latin square and 152 non-randomised sequential), while 8 reports (264 patients) with 32 experiments analysed liquid diets.

Isocaloric replacement of 60% of saturated fat (British diets) by complex carbohydrates for 10% of dietary calories would reduce blood total cholesterol by 0.52 (standard error, SE=0.03) mmol/L and LDL cholesterol by 0.36 (SE 0.05) mmol/L, irrespective of sex, age and body weight. In contrast, replacing an intake of complex carbohydrate with polyunsaturated fat for 5% of dietary calories would have the effect of reducing blood total cholesterol by a further 0.13 (SE 0.02) mmol/L and LDL cholesterol by 0.11 (SE 0.02) mmol/L. Intake of monounsaturated fat had no significant effect on total or LDL cholesterol despite raising HDL cholesterol by a similar amount to polyunsaturates.

**Authors' conclusions**

The combined effect of changing the type, but not the amount, of dietary fat by replacing 10% of dietary calories from saturates (60% of saturates) by monounsaturates (5%) and by polyunsaturates (5%), together with consuming 200 mg less dietary cholesterol (60% of dietary cholesterol) would be a reduction in blood cholesterol of about 0.8 mmol/l (i.e. 10 to 15%), with 80% of the reduction in LDL cholesterol. Such changes are likely within just a few weeks. The effects on vascular disease would depend on the relative importance at different ages of the benefits of reducing LDL and the hazards of reducing HDL cholesterol this requires further study.

**CRD commentary**

The review appears to provide a reasonably good synthesis of the evidence. The review methodology failed to state the criteria used for assessing the validity of the primary studies, or the process by which decisions of relevance, judgements of validity or the method of data extraction are made. The scope of the search strategy could not be assessed from the review, but details are available from the authors. Methods of pooling and assessing study heterogeneity appear appropriate and results are clearly presented.

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