Plasma lipid and lipoprotein responses to dietary fat and cholesterol: a meta-analysis
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Authors’ objectives
To assess the effects of dietary change on concentrations of very-low-density lipoprotein (VLDL) cholesterol and triacylglycerol in addition to serum total cholesterol, low-density lipoprotein (LDL) cholesterol and high-density lipoprotein (HDL) cholesterol.

Searching
MEDLINE was searched from January 1966 to February 1994 for English language studies, using the keywords ‘diet’, ‘dietary cholesterol’, ‘dietary fat’, ‘fatty acid’, ‘serum (plasma) cholesterol’, ‘serum (plasma) lipoproteins’, ‘LDL’, ‘HDL’, ‘VLDL’, ‘triacylglycerol’ and human. Additional studies were located from references of primary studies and published narrative reviews, and through searches of indexes of review publications such as Nutrition Abstracts and Reviews, Nutrition Reviews, and World Review of Nutrition and Dietetics.

Study selection
Study designs of evaluations included in the review
Studies were included if they reported single- or multiple-group repeated measures comparisons. Studies were excluded from the review if they were: letters to editors; reviews of related literature; epidemiological studies; lacking detail of dietary manipulation; nonexperimental single- or comparison-group designs; other descriptive non-intervention studies; large clinical trials involving multiple interventions; or reporting data on weight reduction diets, fish oils, trans-fatty acids and hydrogenated fats.

Specific interventions included in the review
Manipulated dietary components including one or more of the following: cholesterol, total fat (% of energy), saturated fatty acids (SFAs), polyunsaturated fatty acids (PUFAs), and monosaturated fatty acids (MUFAs) (% of energy).

Participants included in the review
Adults aged over 18 years were included; of these, approximately 70% were men and the age ranged from 18 to 69 years (average 37 years).

Outcomes assessed in the review
Group means (plus or minus standard deviations) or standard errors of measurement for quantitative measures of any, or all, of the following response variables: serum total cholesterol, LDL cholesterol, HDL cholesterol, VLDL cholesterol and serum triacylglycerol.

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
Internal validity was assessed on a scale of high, medium and low. Studies with high internal validity used a control group or random assignment of participants to groups, or used repeated measures designs with multiple observation and treatments and control for confounding variables. Medium internal validity was assigned to studies using matching or pre-treatment equation procedures, or repeated measures at a limited number of time points with limited control for confounding variables. Studies were classified as having low internal validity if they used cross-sectional single-group, pre- and post-intervention designs with limited control for confounding variables. In addition, studies were weighted for sample size and inversely weighted to control for nonindependence. Independent coders assessed the papers for validity on standardised forms.
Data extraction
The data were extracted by independent trained coders, whose levels of agreement were monitored using a standardised coding form.

Methods of synthesis
How were the studies combined?
The studies were combined using stepwise weighted least-squares regression analysis to identify the best linear prediction equations for each response measure, evaluating the combined and independent contributions of specified dietary changes.

How were differences between studies investigated?
Differences between the studies were investigated by a sensitivity analysis.

Results of the review
Two hundred and twenty-four studies (8,143 patients) were included.

The change in serum total cholesterol was explained (74% of the variance accounted for) by changes in SFA (% of total energy), PUFA (% of total energy) and dietary cholesterol (mg). A 1% change in total energy from SFA will cause a 49.1-micromol/L change (95% confidence interval, CI: 42.8, 56.9, P<0.00005) in serum cholesterol, while a 1% change in total energy from PUFA will produce a 23.3-micromol/L change (95% CI: -31.7, -14.8, P<0.00005), and a change of 1 mg/day in dietary cholesterol will produce a 0.57-micromol/L change (95% CI: 0.38, 0.76, P<0.00005). Apart from PUFA, none of the dietary change variables provided a significant explanation of the change in VLDL cholesterol (14% of the variance accounted for).

The change in LDL cholesterol was explained (65% of the variance accounted for) by changes in SFA and PUFA. A 1% change in total energy from SFA will cause a 46.5 mmol/L change (95% CI: 38.7, 54.8, P<0.00005) in LDL cholesterol, while a 1% increase in total energy from PUFA will produce a 12.93 mmol/L change (95% CI: -23.6, -2.0, P<0.0197).

Changes in SFA and total fat provided the best explanation of changes in HDL cholesterol (41% of the variance accounted for). A 1% change in total energy from SFA will cause a 7.4-micromol/L change (95% CI: 4.06, 10.8, P<0.00005) in HDL cholesterol, while a 1% change in energy from total fat will produce a 5.0-micromol/L change (95% CI: 2.17, 7.76, P=0.0004).

Changes in PUFA and total fat explained 36% of the variance in triacylglycerol. A 1% change in total energy from PUFA will cause a 12.0-micromol/L change (95% CI: -17.1, -7.0, P<0.00005) in triacylglycerol, while a 1% change in energy from total fat will produce a 10.4 micromol/L change (95% CI: -14.3, -6.4, P<0.00005).

Other factors thought to influence these relationships, such as interactions of dietary factors, initial dietary intakes, serum concentrations, study and patients' characteristics, had limited effect.

Authors' conclusions
Compliance with current dietary recommendations (30% of energy from fat, with less than 10% from saturated fat and less than 300 mg cholesterol/day) will reduce plasma total and LDL cholesterol concentrations by approximately 5%, compared with amounts associated with average American diets.

CRD commentary
This is a well conducted and presented review. The objective, interventions, participants, outcomes, inclusion and validity criteria, search strategy, methods of synthesis and assessment of heterogeneity, and results are stated fairly clearly. Unfortunately, the review fails to provide adequate details of the primary studies included, and gives a limited description of the process by which decisions of relevance, judgements of validity and data extraction are undertaken.
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