Monounsaturated versus polyunsaturated dietary fat and serum lipids: a meta-analysis

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Authors' objectives
To assess the differential effect on serum lipids of a high-mono versus a high-poly fat diet, exchanging primarily oils while keeping total fat, saturated fat, fibre and dietary cholesterol (C) intake constant between intervention diets.

Searching
MEDLINE was searched from 1966 to 1994 using the keywords 'monounsaturate#' and 'polyunsaturate#'. Bibliographies of review articles and other studies were examined for additional material. Only studies published in the English language, and in peer-reviewed journals, were included.

Study selection
Study designs of evaluations included in the review
The included studies had to meet the following criteria: (1) dietary intervention trials with human participants randomised to a high-mono and high-poly fat diet; (2) at least two intervention diets similar in all respects except for levels of mono- and polyunsaturated fat intake; (3) end point data (mean plus/minus SD or SE) from dietary intervention periods for total-C, LDL-C, high-density lipoprotein (HDL)-C, and triglycerides; (4) a minimum of 10 participants on each diet.

Specific interventions included in the review
The study diets varied in their content of 3 different types of dietary fat: saturated, monounsaturated and polyunsaturated. Three combinations of diet were high-mono versus high-poly, high-mono versus high-saturated, and high-poly versus high-saturated. Studies including a high-saturated diet in the design had a comparable level of total fat, but were 6 to 16% higher in saturated fat content relative to unsaturated fat diets. On the high-mono versus high-poly diets, the level of substitution of monounsaturated for polyunsaturated fat ranged from 5 to 25% kcal (mean plus/minus standard deviation, 9.7 +/- 6.4% kcal). The average monounsaturated fat content in the high-mono diets was 19.4 +/- 6.1% kcal (range: 14-30% kcal). The average polyunsaturated fat content in the high-poly diets was 15.9 +/- 7.1% kcal (range: 10-30% kcal). Some, or all, foods were prepared for participants with a dietary fat composition determined by chemical analysis or diet composition analysis. Dietary fat composition was manipulated through the substitution of oils.

Participants included in the review
The participants included men and women aged between 18 and 78 years, recruited from academic institutions, clinical settings, religious groups and the military. Participants varied in whether there was a pre-specified level of total C, low-density lipoprotein (LDL)-C, or triglycerides for entry into the trial.

Outcomes assessed in the review
Mean lipid end points, including serum and plasma lipid levels, were assessed.

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
The data were extracted blinded to the authors' names. No other information was provided.
Methods of synthesis
How were the studies combined?
A standardised effect size (d) and 95% confidence levels (CIs) were calculated. The effect size represented the observed treatment difference in mean end point serum lipid levels, divided by the pooled within-group standard deviations of the serum lipid levels.

How were differences between studies investigated?
Heterogeneity was assessed although no details are provided of the statistical test used. Sensitivity analyses were performed but no significant effects were evident for any of the studies.

Results of the review
Fourteen randomised trials (439 patients) were included.

High-mono versus high-poly comparisons.

The pooled effect sizes for high-mono versus high-poly diets were: for total C, 0.07 (95% CI: -0.08, 0.21); LDL-C, -0.01 (95% CI: -0.16, 0.14); HDL-C, 0.03 (95% CI: -0.12, 0.17); and triglycerides, 0.14 (95% CI: 0.00, 0.29). These results indicate no significant differences in total C, LDL-C or HDL-C when monounsaturates and polyunsaturates are exchanged by using different plant and vegetable oils. Triglyceride differences between diets were of borderline statistical significance and were lower for the high-poly diets. There were no significant effects from heterogeneity among the studies (P>0.05).

A subset of 5 studies with the greatest monounsaturate versus polyunsaturate substitution were analysed to increase the sensitivity of the analysis to small dietary effects on serum lipids. Monounsaturate for polyunsaturate substitutions ranged from 10 to 25% kcal on the high-mono versus high-poly diets (mean plus/minus SD: 17.5+/- 6.5% kcal). Average levels of monounsaturated and polyunsaturated fat (plus/minus SD) were 26.7 (+/-5.3% kcal) and 7.4 (+/-3.0% kcal), respectively, in high-mono diets and 9.2 (+/-4.3% kcal) and 24.3 (+/-5.0% kcal) in high-poly diets. The pooled effect sizes were: for total C, 0.24 (95% CI: -0.07, 0.55); LDL-C, 0.14 (95% CI: -0.17, 0.45); HDL-C, 0.26 (95% CI: -0.04, 0.57); and triglycerides, 0.12 (95% CI: -0.19, 0.43). Effect sizes were larger in the subset but they remained insignificant. There were no significant effects from heterogeneity among the studies (P>0.05).

Unsaturated versus saturated fat.

A subset of 7 studies were analysed to assess the effects of replacing saturated fat with monounsaturated or polyunsaturated fat while holding levels of total fat constant.

The pooled effect sizes for the high-mono versus high-saturated contrast were: for total C, -0.64 (95% CI: -0.84, -0.44); LDL-C, -0.66 (95% CI: -0.85, -0.46); HDL-C, -0.07 (95% CI: -0.27, 0.13); and triglycerides, -0.06 (95% CI: -0.25, -0.14).

The pooled effect sizes for the high-poly versus high-saturated contrast were: for total C, -0.68 (95% CI: -0.87, -0.49); LDL-C, -0.66 (95% CI: -0.85, -0.46); HDL-C, -0.13 (95% CI: -0.32, 0.07); and triglycerides, -0.13 (95% CI: -0.33, -0.07).

Replacing saturated with monounsaturated or polyunsaturated fats, while holding total fat constant, significantly lowers total C and LDL-C but not HDL-C or triglycerides. There were no significant effects from heterogeneity among the studies (P>0.05).

Authors’ conclusions
The dietary exchange of oils high in monounsaturated or polyunsaturated fats, across a wide range of monounsaturate versus polyunsaturate % exchanges for diverse population groups, produced no significant differences in total C, LDL-C or HDL-C levels. Consistently lower levels of serum triglycerides were observed within this group of studies for the high-poly diets, and the overall pooled effect size was of borderline significance.
CRD commentary
The systematic review provides detailed descriptions of objective, interventions, participants, outcomes, study inclusion criteria, and statistical methodology for synthesising and assessing study differences. The details of the included studies and results of the analysis were clearly presented. The literature search strategy was outlined in reasonable detail, although the restriction to published English language studies may have limited the extent of its coverage and introduced a publication bias. The review provides no discussion of the validity criteria used to assess the primary studies, or the processes by which decisions of relevance and judgements of validity are made. There is limited information concerning the process of data extraction. These omissions, which do not exclude potential bias from the inclusion and interpretation of the primary studies in the review, reduce the strength of the evidence presented.

Implications of the review for practice and research
Further research should address the possibility that previously unidentified subgroups of the population differ in their response to changes in monounsaturated and polyunsaturate levels in their diets.

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Record Status
This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.