
Association of dietary, circulating, and supplement fatty acids with coronary risk: a systematic review and meta-analysis

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CRD summary

This large review concluded that the evidence did not clearly support guidelines that encouraged high consumption of polyunsaturated fatty acids and low consumption of saturated fats. The observational nature of much of the evidence suggests that caution is needed in interpreting the results, and the authors' conclusions may be too strong and may not reflect the advice of some guidelines.

Authors' objectives

To review the evidence on the association between fatty acids and coronary disease.

Searching

MEDLINE, Science Citation Index, Cochrane Central Register of Controlled Trials (CENTRAL), EMBASE and BIOSIS were searched, without language restrictions, to July 2013. A search strategy was presented. Relevant journals, review articles and reference lists of included articles were searched. Authors of included studies were contacted to identify other studies.

Study selection

Prospective cohort studies or randomised controlled trials (RCTs) that reported dietary fatty acid intake, fatty acid biomarkers, or a fatty acid intervention were eligible. Studies had to report the association between the fatty acid and the risk of coronary disease, defined as fatal or non-fatal myocardial infarction, coronary heart disease, coronary insufficiency, coronary death, angina, angiographic coronary stenosis or sudden cardiac death. Cohort studies had to have at least one year of follow-up and recruit from the general population without existing disease or patients with stable cardiovascular disease.

Just over half the studies were conducted in Europe, and most of the others were conducted in North America. Forty studies were of healthy participants, 10 recruited people with elevated cardiovascular risk factors, and 22 recruited people with cardiovascular disease.

The authors did not state how many reviewers selected the studies.

Assessment of study quality

Study quality was assessed using the Newcastle-Ottawa scale for cohort studies (maximum score 9; scores of 7 or 8 were considered medium quality), and the Cochrane risk of bias tool for RCTs.

It was unclear how many reviewers performed the assessment.

Data extraction

The association between fatty acid and coronary disease was extracted from each paper using the relative risk of coronary disease, and its 95% confidence interval, between the highest and lowest thirds of the fatty acid distribution. Results that were presented as risks per standard deviation, or risks by quartile or quintile, were converted into the desired form by assuming that the fatty acid had a normal distribution. Odds ratios and hazard ratios were assumed to be equivalent to relative risks. Where results that had been adjusted for confounding factors were presented the most thoroughly adjusted results were used.

Two reviewers extracted the data, with discrepancies resolved by consensus or by a third reviewer.

Methods of synthesis

The relative risks were pooled using both random-effects and fixed-effect meta-analyses. For the correlation between dietary fatty acid and circulating fatty acid, Spearman correlation coefficients were pooled using random-effects meta-

analysis.

Heterogeneity was assessed using Cochran's Q and I². The impact on heterogeneity of a range of study-level characteristics (reported in the paper) was assessed using meta-regression and subgroup analyses. Publication bias was assessed using funnel plots and Egger's test.

Results of the review

Dietary fatty acid intake: There were thirty-two included cohort studies (530,525 participants), with follow-up ranging from five to 23 years. Thirteen studies were of high quality, and the rest of medium quality. There was potential for bias due to patient selection and self-reporting of diet.

High levels of saturated fat intake had no effect on coronary disease (RR 1.03, 95% CI, 0.98 to 1.07; 20 studies). Monounsaturated (nine studies), alpha-linoleic (seven studies) and omega-6 (six studies) fatty acids were found to have no association with disease. Omega-3 fatty acids were associated with a statistically significant reduction in risk (RR 0.87, 95% CI 0.78 to 0.97; 16 studies). Trans fatty acids increased the incidence of coronary disease (RR 1.16, 95% CI 1.06 to 1.27; five studies). There was evidence that the numbers of events and geographical location might alter these results.

Fatty acid biomarkers: Nineteen cohort studies were included, of which 17 were of circulating fatty acid composition (25,721 participants), with follow-up ranging from 1.3 to 30.7 years. Six studies were of high quality, nine were of medium quality, and two were of low quality.

Saturated fatty acids were not associated with coronary disease (RR 1.06, 95% CI 0.86 to 1.30; eight studies). Similarly, no associations were found with monounsaturated (six studies), alpha-linoleic (eight studies), long-chain omega-3 (four studies), omega-6 (two studies) and trans (four studies) fatty acids. The results were presented for a number of subtypes of fatty acid; most were not statistically significant, but high levels of the subtypes of omega-3 were associated with a reduction in disease.

Fatty acid supplementation: There were 27 included RCTs (103,052 participants), with follow-up ranging from 0.1 to eight years. Some trials were at an unclear or high risk of bias, particularly for blinding of participants.

There was no statistically significant evidence that alpha-linoleic (four studies) or long-chain omega-3 (17 studies) fatty acid supplementation reduced the incidence of disease. Omega-6 showed the largest reduction in risk, but this was not statistically significant (RR 0.86, 95% CI 0.69 to 1.07; eight studies).

Generally, there was no evidence of publication bias.

Authors' conclusions

The evidence did not clearly support cardiovascular guidelines that encouraged high consumption of polyunsaturated fatty acids and low consumption of total saturated fats.

CRD commentary

This review addressed a relevant public health question using appropriate inclusion criteria. A suitable search was conducted, but unpublished material may have been missed. It was unclear whether action was taken to reduce reviewer error and bias in study selection and quality assessment. The study data were pooled using appropriate meta-analyses.

The review included a large number of studies, and they were generally of medium-to-high quality. The authors identified some potential limitations including: selective reporting of extreme results for specific fatty acids, bias due to most participants receiving only a single assessment of fatty acid, bias due to self-reporting of diet, and, in the cohort studies, confounding due to unmeasured diet and lifestyle factors.

Although the size of the review is in its favour, the limitations suggest that caution is required in interpreting the results, particularly where they conflict with existing research. The authors' conclusions may therefore be too strong, and may not represent the advice given in some cardiovascular guidelines.

Implications of the review for practice and research

Practice: The authors suggested that nutritional guidelines on fatty acids and cardiovascular disease could be reappraised.

Research: The authors suggested that further trials of omega-3 and omega-6 supplementation were warranted. One large trial of omega-3 supplements was in progress.

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Bibliographic details

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