A meta-analysis of the effect of soy protein supplementation on serum lipids


CRD summary
This review investigated the effect of soy protein supplementation on serum lipids. It concluded that soy protein supplementation lowers total cholesterol, low-density lipoprotein cholesterol and triglycerides, and slightly increases high-density lipoprotein cholesterol. These conclusions are appropriate considering the strength of the evidence.

Authors' objectives
To investigate the effect of soy protein supplementation on serum lipids.

Searching
The MEDLINE database was searched (1966 to February 2005) for studies published in English. Search terms were reported. Reference lists of studies and review articles were also searched.

Study selection
Randomised controlled trials (RCTs) in adults (18 years or older) that had limited intervention differences between groups to soy protein supplementation, in the form of isolated soy protein, were eligible for inclusion. The included trials were required to use concurrent control groups. Trials had to report changes in serum lipids (triglycerides, total low-density lipoprotein and/or high-density lipoprotein cholesterol) from baseline to follow-up, with corresponding variances or sufficient data to estimate them.

The study designs included were factorial, Latin square, parallel and crossover trials and these varied in duration from three to 52 weeks. In the included trials, soy protein doses were between 20 and 106.2 g/day and isoflavone doses were between 2 and 192.4 mg/day. Most trials were conducted in North America and Europe. The mean age of participants ranged from 22.1 to 66.6 years. The proportion of participants with hypercholesterolaemia ranged from 0 to 100%. The included trials reported net changes in total cholesterol, low-density lipoprotein cholesterol, high-density lipoprotein cholesterol and triglycerides.

Two reviewers independently decided whether papers were eligible for inclusion. Disagreements were resolved by conferring with another reviewer.

Assessment of study quality
The authors did not state that they assessed validity.

Data extraction
Mean baseline and net change values for serum lipid levels (including total, high-density lipoprotein and low-density lipoprotein cholesterol and triglycerides) were extracted with their corresponding 95% confidence interval (CI) or standard error. The mean baseline cholesterol and triglycerides were combined for the intervention and control groups, weighted by number of participants. For parallel and factorial trials, net changes were calculated by the difference of the changes of the mean values. For the crossover trials, the net changes were calculated as the mean difference of values at the end of the intervention and control periods.

Data were extracted by two independent investigators into an abstraction form using a standardised protocol. Disagreements were resolved by discussion with an additional investigator.

Methods of synthesis
Studies were weighted by the reciprocal of the total variance for change in serum cholesterol and triglycerides levels, and pooled using DerSimonian and Laird random-effects models. A sensitivity analysis was conducted to examine the influence of exclusion criteria on effect sizes. A priori subgroup analyses were performed according to mean baseline total and low-density lipoprotein level, gender menopausal status in women, sample size, study design and soy protein.
and isoflavone doses. Publication bias was investigated using a funnel plot and the Begg rank correlation test.

**Results of the review**

Forty-one RCTs were included (n=1,756) comprising of 18 crossover trials (n=421), four Latin square trials (n=66), 17 parallel trials (n=1,185) and two factorial trials (n=84). There was no evidence of publication bias.

Pooled analyses showed soy protein supplementation was associated with a significant reduction in mean total cholesterol (-5.26 mg/dl, 95% CI: -7.14, -3.38), low-density lipoprotein cholesterol (-4.25 mg/dl, 95% CI: -6.00, -2.50) and triglycerides (-6.26 mg/dl, 95% CI: -9.14, -3.38) and a significant increase in high-density lipoprotein cholesterol (0.77 mg/dl, 95% CI: 0.20, 1.34).

In subgroup analyses, soy protein supplementation was associated with a reduction in total and low-density lipoprotein cholesterol levels in all subgroups, with a slightly greater effect in participants with a mean baseline total cholesterol level of less than 240 mg/dl and low-density lipoprotein level of less than 160 mg/dl compared to those with elevated cholesterol levels. The effect of soy protein supplementation on high-density lipoprotein cholesterol was slightly greater in participants with an elevated cholesterol at baseline (at least 240mg/dl).

The amount of soy protein and isoflavone supplementation was significantly inversely related to net changes in cholesterol, low-density lipoprotein cholesterol and triglycerides. Net change in high-density lipoprotein was positively related with amount of soy protein and isoflavones.

The sensitivity analyses showed similar results.

**Authors’ conclusions**

This meta-analysis indicates that soy protein supplementation lowers total cholesterol, low-density lipoprotein cholesterol and triglycerides, and slightly increases high-density lipoprotein cholesterol.

**CRD commentary**

This review addressed a clear research question and searched an appropriate database for relevant studies. The authors did not attempt to identify unpublished studies, which may have introduced publication bias (but the authors did not find evidence of this). The search was also restricted to studies in English, which may have introduced language bias. Study selection and data extraction was performed in duplicate, minimising the potential for error and bias. Validity of the primary studies was not assessed. Study design was restricted to RCTs, the majority of which were double-blinded, so synthesis of these is likely to be reliable. Sensitivity analyses did not suggest statistical heterogeneity. The authors’ conclusions are appropriate considering the strength of the evidence.

**Implications of the review for practice and research**

Practice: The authors stated that this review supports the notion that soy protein should be an important part of dietary intervention for prevention and treatment of hypercholesterolaemia. Given the relatively small effect of soy protein on lipids, reduced intake of saturated and trans-unsaturated fat and cholesterol, as well as increased intake of unsaturated fat, should be the focus of dietary interventions to reduce serum lipid levels.

The authors did not state any implications for further research.

**Funding**

National Institutes of Health, Maryland, National Heart, Lung and Blood Institute, R01 HL68057; Building Interdisciplinary Research Careers in Women's Health Scholarship, K12 HD43451.

**Bibliographic details**


**PubMedID**
16923451

DOI
10.1016/j.amjcard.2006.03.042

Indexing Status
Subject indexing assigned by NLM

MeSH
Adult; Aged; Biomarkers /blood; Cardiovascular Diseases /blood /etiology /prevention & control; Dietary Supplements; Dyslipidemias /blood /complications /diet therapy; Female; Humans; Lipids /blood; Male; Middle Aged; Prognosis; Randomized Controlled Trials as Topic; Soybean Proteins /therapeutic use; Vegetable Proteins /therapeutic use

AccessionNumber
12006004685

Date bibliographic record published
06/12/2007

Date abstract record published
27/05/2009

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.