Effect of dietary fiber intake on blood pressure: a meta-analysis of randomized, controlled clinical trials

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CRD summary
This review assessed the effect of dietary fibre on blood-pressure (BP) and concluded that increased consumption of dietary fibre may reduce BP in patients with hypertension. A smaller, non-conclusive reduction in BP was observed in patients with normal BP, although further trials were recommended. This was a relatively well-conducted systematic review and the conclusions are likely to be reliable.

Authors' objectives
To assess the effect of dietary fibre intake on blood-pressure (BP).

Searching
MEDLINE was searched for studies published in English up to February 2004; the search terms were reported. The reference lists of the included studies were also reviewed in an attempt to find other relevant studies.

Study selection
Study designs of evaluations included in the review
Randomised controlled trials (RCTs) with either a parallel or crossover design were eligible for inclusion.

Specific interventions included in the review
Studies that assessed dietary fibre intake, where there were no significant differences between the treatment and control groups other than the amount of dietary fibre consumed, were eligible for inclusion. The mean difference in fibre intake between the intervention and control groups ranged from 3.8 to 125 g/day (median difference 10.7 g/day), and the duration of the intervention ranged from 2 to 26 weeks. The type of fibre consumed included fruit, vegetables, cereal, pectin, guar gum and pills. In 2 studies of patients with hypertension, antihypertensive drugs were given.

Participants included in the review
Studies of participants of at least 16 years of age were eligible for inclusion. The actual participants were aged between 16 and 85, and the majority were white. Trials were conducted in the USA, Holland, UK, Australia, Denmark, Norway, Sweden, Finland, France, Canada and India. Five trials included only patients with hypertension; the remaining trials included mostly participants with normal BP.

Outcomes assessed in the review
Studies that reported the net change and corresponding standard error in systolic or diastolic BP (SBP and DBP, respectively), or appropriate data to calculate these values, were eligible for inclusion.

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

Assessment of study quality
The studies were assessed for blinding procedure. The authors did not state how the papers were assessed for validity, or how many reviewers performed the validity assessment.

Data extraction
Two reviewers independently extracted the data. Any disagreements were resolved through discussion, or with input
by another reviewer where necessary. The mean baseline SBP and DBP and net change in BP at the end of the intervention period were calculated for each study. Variance of the net change was presented using confidence intervals (CIs), standard errors or standard deviations.

**Methods of synthesis**

How were the studies combined?

Studies were weighted using the variance for the net change in BP and were pooled using fixed-effect and random-effects models. Results based on the use of the random-effects model were presented. Publication bias was assessed using funnel plots.

How were differences between studies investigated?

The DerSimonian Q test was used to assess statistical heterogeneity. Subgroup analyses were performed based on participant characteristics (with or without hypertension), biological plausibility (intervention lasting less than 8 weeks versus more than 8 weeks), amount of fibre supplementation (7.1 g/day or less, 7.2 to 18.9 g/day, or at least 19 g/day), type of fibre (fruit and vegetables, cereal or pills) and study design (parallel versus crossover).

**Results of the review**

Twenty-five RCTs, with a total of 1,477 participants, were included in the review.

In terms of study quality, about half (13 out of 25) of the included studies were double-blind, nine were single-blind and the others were considered to be open.

There was no statistically significant difference in SBP between high and low fibre intake (25 trials; -1.15 mmHg, 95% CI: -2.68, 0.39).

High dietary fibre intake significantly reduced DBP compared to low fibre (25 trials; -1.65 mmHg, 95% CI: -2.70, -0.61).

Subgroup analyses.

For patients with hypertension (5 trials), there was a statistically significant decrease in both SBP and DBP in the increased fibre group compared with the control group (respectively: -5.95 mmHg, 95% CI: -9.50, -2.40; -4.20 mmHg, 95% CI: -6.55, -1.85). There was no significant heterogeneity between the 5 trials. There was no statistically significant difference between treatments for SBP or DBP in the trials of patients without hypertension (n=20).

Studies with a duration of 8 weeks or longer (13 trials) reported a statistically significant decrease in both SBP and DBP in the increased fibre group compared with the control group (respectively: -3.12 mmHg, 95% CI: -5.68, -0.56; -2.57 mmHg, 95% CI: -4.01, -1.14). There was no statistically significant difference between fibre intakes in SBP or DBP in trials with a duration of less than 8 weeks (12 trials).

In studies with a fibre supplementation of 7.1 g/day or less (11 trials), only DBP was statistically significantly reduced with the high fibre intake (-1.77 mmHg, 95% CI: -3.32, -0.21). In studies with a supplementation of 7.2 to 18.9 g/day (8 trials), both SBP and DBP were statistically significantly reduced (respectively: -3.40 mmHg, 95% CI: -6.14, -0.67; -1.97 mmHg, 95% CI: -3.79, -0.14). In studies with a supplementation of 19 g/day or more (6 trials), there was no statistically significant difference between the increased fibre group and the control group.

When studies were subgrouped by the type of fibre, there was no statistically significant difference between the increased fibre group and the control group in studies that were supplemented with fruit and vegetables (4 trials) and cereal (9 trials). Studies in which fibre was provided by means of a pill (n=8) found a statistically significant decrease in DBP (-2.44 mmHg, 95% CI: -4.26, -0.62), but there was no statistically significant difference in SBP.

There was a statistically significant decrease in DBP in trials in which weight reduction was noted in the intervention group (9 trials; -2.56 mmHg, 95% CI: -4.69, -0.42), but there was no statistically significant difference in SBP.
There was a statistically significant decrease in DBP in parallel group trials (n=17; -1.96, 95% CI: -3.31, -0.62), but there was no statistically significant difference in SBP.

The funnel plots did not indicate the presence of publication bias.

Authors’ conclusions
Increased dietary fibre consumption may reduce BP in patients with hypertension. A smaller, non-conclusive reduction in BP was observed in patients with normal BP. Further clinical trials with a larger sample size and longer period of intervention, to examine the effect of dietary fibre intake on BP, are recommended.

CRD commentary
The review question was clear in terms of the study design, participants, intervention and outcomes of interest. Limiting the search to English language articles listed in one electronic database or reference lists increased the potential for language bias and publication bias. However, the authors assessed publication bias and did not find any evidence of it. The authors did not state how studies were selected for the review, therefore the potential for reviewer bias and error cannot be assessed for this part of the study process. The data extraction was conducted independently by two reviewers, thereby reducing the potential for reviewer bias and error. The quality assessment appeared to be limited to blinding; the lack of a more comprehensive quality assessment might have reduced the reliability of the conclusions of the review. Adequate details of the included studies were presented. Appropriate measures of effect were calculated and the authors assessed statistical heterogeneity. A number of appropriate subgroup analyses were performed. The authors' conclusions appear to follow from the evidence presented. Despite some methodological limitations, this was a relatively well-conducted systematic review and the conclusions are likely to be reliable.

Implications of the review for practice and research
Practice: The authors stated that increased intake of fruit and vegetables may provide the best means to supplement dietary fibre intake because of the additional beneficial health effects, aside from any reduction in BP. For patients unable or unwilling to increase consumption of fruit and vegetables, fibre administered in pill form is an alternative option.

Research: The authors stated that additional adequately powered, double-blind, clinical trials with longer follow-up are warranted to test the effect of increased dietary intake on BP in persons with pre-hypertension. They also recommended investigating the effect of different types (water-soluble versus insoluble) and sources (fruit or vegetable versus cereal) of dietary fibre.

Funding
National Heart, Lung and Blood Institute of the National Institutes of Health, grant numbers HL60300 and HL68057; Tulane-Charity-LSU General Clinical Research Centre, grant number RR05096.

Bibliographic details

PubMedID
15716684

Indexing Status
Subject indexing assigned by NLM

MeSH
Blood Pressure; Dietary Fiber /administration & dosage; Humans; Hypertension /diet therapy; Randomized Controlled
Trials as Topic

Accession Number
12005000297

Date bibliographic record published
30/09/2006

Date abstract record published
30/09/2006

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.