Vegetarian diets and blood pressure: a meta-analysis
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CRD summary
This review concluded that consumption of vegetarian diets was associated with lower blood pressure. Lack of clarity about the quality of included studies, publication bias, and potential methodological limitations in the review process, mean that a cautious interpretation of the authors' conclusion is warranted.

Authors' objectives
To evaluate the association between vegetarian diet and blood pressure.

Searching
MEDLINE and Web of Science were searched for articles published in English from 1900 up to November 2013. A search strategy was presented. Reference lists of retrieved articles were searched for further studies.

Study selection
Eligible for inclusion were controlled trials or observational studies of participants (older than 20 years) who received interventions or exposure relating to a vegetarian diet. Vegetarian diets could be: semi-vegetarian (generally excluding meat); vegan diets (with no animal products); or vegetarian diets with some dairy (lacto-), egg (ovo-) or fish (pesco-) products. Studies had to provide data to allow the calculation of mean differences in systolic/diastolic blood pressure. Studies of twins or of dietary interventions delivered alongside multiple other interventions were excluded.

Included studies (trials and observational studies) were conducted worldwide. Included trials were conducted in the USA, Australia, and Finland, and were conducted for six weeks or more (mean duration 15.7 weeks); included participants had a mean age of 44.5 years (range 38 to 54.3 years). Observational studies included participants with a mean age of 46.6 years (range 28.8 to 68.4 years). Some participants were taking antihypertensive medication.

Two independent reviewers selected the studies for inclusion.

Assessment of study quality
It appeared that some quality assessment was carried out for study methodology and sample size. Specific criteria were not reported.

The authors did not state how many reviewers carried out the quality assessment.

Data extraction
Data were extracted to calculate mean differences and 95% confidence intervals for systolic and diastolic blood pressure. Authors were contacted to retrieve missing information, where necessary.

The authors did not state how many reviewers carried out the data extraction.

Methods of synthesis
Mean differences were pooled in random-effects meta-analyses and 95% confidence intervals were presented.

Subgroup analyses were carried out according to mean age, sex, body mass index, diet type, sample size, duration of vegetarian diet consumption, antihypertensive medication use, baseline hypertensive status, and location (country). Heterogeneity was quantified using $I^2$. Meta-regression was conducted to explore sources of variation. Sensitivity analysis was performed to evaluate the impact on the overall result of removing one study at a time.

Funnel plots and the Egger test were used to assess publication bias, and the trim and fill method was used to adjust for publication bias.

Results of the review
Seven clinical trials (311 participants, range 11 to 113) and 32 observational cross-sectional studies (21,604 participants) were included in the review. All clinical trials were open (non-blinded); six were randomised controlled trials. The following results focus on the results of clinical intervention trials.

Vegetarian diets were associated with a mean reduction in systolic blood pressure (-4.8mmHg, 95% CI -6.6 to -3.1; I²=0%; seven trials) and diastolic blood pressure (-2.2mmHg, 95% CI -3.5 to -1.0; I²=0%; seven trials) compared with omnivorous diets. The authors reported that meta-regression analysis of the trials did not suggest any significant effect of potential sources of heterogeneity (data were not shown); subgroup analysis revealed no heterogeneity. Lower blood pressure was evident in all subgroups, although the differences were not statistically significant in some cases. Sensitivity analysis did not materially alter the main results. There was some evidence of publication bias.

Results from the observational studies were reported in the paper.

**Authors’ conclusions**
Consumption of vegetarian diets was associated with lower blood pressure.

**CRD commentary**
The review question was clear and inclusion criteria were adequately specified. The search contained a limited number of sources. This, together with language and publication restrictions, meant that relevant studies may have been missed. There was evidence of publication bias in the analysis of clinical trials. The review process was only partially reported, which meant that there was some potential for reviewer error and/or bias.

Quality assessment criteria and results were not clearly reported, so it was not possible to judge the reliability of included studies. Study details were presented. A number of appropriate sub-group and sensitivity analyses were carried out.

The authors’ conclusion reflects the evidence presented, but lack of clarity about quality of the included studies and other potential methodological limitations reported above, mean that a cautious interpretation of this conclusion is warranted.

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

**Practice**: The authors stated that vegetarian diets could be a useful non-pharmacologic means for reducing blood pressure.

**Research**: The authors stated that further studies were needed to clarify which types of vegetarian diets were most strongly associated with lower blood pressure. Research on the implementation of these diets was needed, either as preventive public health initiatives for hypertension or within a clinical setting.

**Funding**
Japan Society for the Promotion of Science.

**Bibliographic details**

**PubMedID**
24566947

**DOI**
10.1001/jamainternmed.2013.14547

**Indexing Status**
Subject indexing assigned by NLM

**MeSH**
Blood Pressure /physiology; Diet, Vegetarian; Humans; Hypertension /diet therapy

**AccessionNumber**
12014015889

**Date bibliographic record published**
03/03/2014

**Date abstract record published**
10/03/2014

**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.