Dietary calcium and blood pressure: a meta-analysis of randomized clinical trials

Authors' objectives
To assess the effect of dietary calcium supplementation on blood-pressure.

Searching
MEDLINE was searched from January 1982 to December 1993. Additional material was obtained by handsearching major journals, reviewing abstracts from scientific meetings, and examining previous review articles. No restriction on publication language was stated.

Study selection
Study designs of evaluations included in the review
Randomised clinical trials (RCTs) were included. Trials were excluded from the pooling if the calcium supplementation was part of a multifactorial trial.

Specific interventions included in the review
Calcium supplements (calcium carbonate, gluconate, yeast and calcium-rich diets). Calcium doses ranged from 0.4 to 2.16 g.

Participants included in the review
Both normotensive and hypertensive participants were included.

Outcomes assessed in the review
Systolic and diastolic blood-pressure 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 state that they assessed validity.

Data extraction
Two reviewers independently abstracted the data from the identified studies. A third reviewer examined the duplicate abstraction forms for inconsistencies, and any discrepancies were resolved by consensus.

Methods of synthesis
How were the studies combined?
Studies of normotensive and hypertensive participants were grouped separately. Data were pooled for all trials using weighted averages, with weights equal to the inverse of the variance of the observed effect. Trials were excluded from pooling if the calcium supplementation was part of a multifactorial trial, or if the data presentation posed analytical problems. Two methods were employed to establish whether other factors such as age, sex, calcium dose and trial duration, modified the effects of calcium on blood-pressure: (1) non-parametric Spearman correlation coefficients were calculated, and (2) linear regression analyses of the estimate of the effect of each factor were carried out to provide an analysis weighted by sample size.

How were differences between studies investigated?
Trials in normotensive and hypertensive participants were analysed separately, as well as together, as were trials of parallel and crossover design.

**Results of the review**

Twenty-nine RCTs (n=1,410) were included. The follow-up ranged from 1 week to 4 years. Thirteen trials studied normotensive participants (n=963) and 16 studied hypertensive participants (n=447); of these, 3 trials studied both normotensive and hypertensive patients.

Normotensive persons: only 2 out of 13 trials demonstrated a significant decrease in both systolic and diastolic blood-pressure. Four trials demonstrated a significant effect for either systolic or diastolic blood-pressure, but not both. The remaining 7 trials failed to show either a significant beneficial effect or direct association between calcium intake and blood-pressure.

Hypertensive persons: 1 of the 16 studies demonstrated a significant decrease (p=0.01) in both systolic and diastolic blood-pressure, 2 papers had mixed results, and 13 reported no significant reductions in blood-pressure.

Pooled results: data were pooled from 28 arms or strata from 22 trials (n=1,231; normotensive persons, n=835; hypertensive persons, n=396). The weighted average changes in blood-pressure for normotensive and hypertensive participants combined were -0.89 mmHg (95% confidence interval, CI: -1.74, -0.05) and -0.18 mmHg (95% CI: -0.75, 0.40) for systolic and diastolic blood-pressure, respectively. Excluding the largest trial, which reported negative findings, did not change the results.

Pooled data for normotensive participants alone showed a systolic blood-pressure change of -0.53 mmHg (95% CI: -1.56, 0.49) and a diastolic blood-pressure change of -0.28 mmHg (95% CI: -0.99, 0.42); for hypertensive persons these were -1.68 mmHg (95% CI: -3.18, -0.18) and 0.02 mmHg (95% CI: -0.96, 1.00), respectively.

No consistent associations between the effect of calcium on blood-pressure and age, sex, calcium dose, or trial duration were demonstrated, although there was a significant negative correlation between systolic blood-pressure and age, and a significant positive correlation between systolic blood-pressure and the percentage of men studied.

**Authors' conclusions**

The pooled estimate shows a statistically-significant decrease of systolic blood-pressure with calcium supplementation, both for hypertensive persons, and for hypertensive and normotensive persons combined. However, the effect is too small to support the use of calcium supplementation for preventing or treating hypertension.

**CRD commentary**

There was little detail about the searches, and no information was given about a validity assessment. The results were presented clearly and the authors investigated whether factors such as age, gender, calcium dose and trial duration were associated with changes in blood-pressure.

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