Aerobic exercise and resting blood pressure among women: a meta-analysis
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Authors' objectives
To examine the effects of aerobic exercise on resting systolic and diastolic blood pressure among adult women.

Searching
The following databases were searched for English language studies: MEDLINE (January 1966 to January 1998), Current Contents (January 1994 to January 1998), and Sport Discus (January 1975 to January 1998) (Keywords provided). The references and citations of articles identified were also searched. Abstracts from conference proceedings were excluded.

Study selection
Study designs of evaluations included in the review
Randomised controlled studies.

Specific interventions included in the review
Aerobic exercise (length of training programme ranged from 10 to 52 weeks; percentage of maximum oxygen consumption ranged from 40 to 80%; duration of training ranged from 10 to 60 minutes per session).

Participants included in the review
Women aged 18 years or older.

Outcomes assessed in the review
Primary outcome: net change in blood pressure was calculated as the difference (exercise minus control) of the changes (initial minus final) in the mean values. Secondary outcomes: net changes in body weight, percent body fat, and maximum oxygen consumption.

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

Assessment of study quality
Study quality was assessed using a tool including 3 items: randomisation, blinding, and withdrawals and drop-outs. All assessment was done by one reviewer while blinded to the author's name and affiliation, journal, date of publication, financial support and acknowledgements.

Data extraction
Data were extracted by one reviewer twice approximately 2 weeks apart. The coding sheet was then modified until there was intrarater consistency between both coding sessions.

Methods of synthesis
How were the studies combined?
Pooled effect size was calculated by assigning weights equal to the inverse of the total variance for net change in blood pressure. Bootstrap resampling (5,000 iterations) was used to estimate 95% confidence intervals around the mean effect size. A fixed-effect model was used because there was no statistically significant heterogeneity.

How were differences between studies investigated?
CA chi-squared test was used to test statistical heterogeneity across the studies. Subgroup analyses were conducted according to study characteristics (country, percent drop-out, study quality), physical characteristics of subjects (age, weight, percent fat, maximum oxygen consumption, initial blood pressure), assessment of blood pressure (position, instrument used) and training programme characteristics (length, frequency, intensity, duration, total minutes of training, mode, compliance).

Results of the review
Ten RCTs (an initial total of 504 exercise and 228 control women).

Study quality ranged from 0 to 4.

Primary outcome: No statistically significant heterogeneity was observed for net changes in either systolic or diastolic blood pressure (p=0.70 and p=0.95 respectively). Overall, an approximate 2% decrease in resting systolic and 1% decrease in resting diastolic blood pressure were observed (systolic -2 mmHg 95% bootstrap CI: -3 to -1 mmHg; diastolic -1 mmHg 95% bootstrap CI: -2 to -1 mmHg).

Secondary outcomes: Net changes in body weight in the exercise groups decreased by approximately 2% (mean -2 kg, 95% bootstrap CI: -3 to -1 kg) and percent body fat by -1% (95% bootstrap CI: -2 to -1%). Maximum oxygen consumption increased by approximately 14% (mean 3.8 ml/kg/min 95% bootstrap CI: 3 to 5 ml/kg/min).

Subgroup analyses: For resting systolic and diastolic blood pressure, greater and statistically significant decreases were observed when studies were conducted in countries other than the United States. No other statistically significant differences were observed for resting systolic blood pressure. For resting diastolic blood pressure, greater decreases were observed when subjects were <50 years of age; blood pressure was measured in the supine versus sitting position; blood pressure was measured electronically versus manually. Use of a random-zero sphygmomanometer yielded smaller decreases in resting diastolic blood pressure compared with other instruments used.

Authors' conclusions
Aerobic exercise results in small reductions in resting systolic and diastolic blood pressure among adult women. However, a need exists for additional, well-designed studies on this topic, especially among hypertensive adult women.

CRD commentary
This is a methodological sound review. The literature search were comprehensive though EMBASE database was not included. Non-English language studies and conference abstracts were excluded. Language bias may be a possible explanation for the observation that studies conducted in other countries reported greater effect size than studies conducted in the United States. Study quality and heterogeneity were assessed, and details of the included studies presented. The author's conclusion is supported by the evidence presented in the review.

Implications of the review for practice and research
Practice: The author mentioned that the clinical importance of the small changes in blood pressure may be questioned, but it is arguable that regular aerobic activity may be associated with other benefits. For example, regular aerobic exercise may reduce risk of cardiovascular disease even if blood pressure is not lowered.

Research: The author suggested there is a need for additional, well-designed studies on this topic, especially among hypertensive adult women.

Bibliographic details
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.