Effects of supervised exercise on lipid profiles and blood pressure control in people with type 2 diabetes mellitus: a meta-analysis of randomized controlled trials

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CRD summary
This review concluded that structured exercise decreased low-density lipoprotein cholesterol, increased high-density lipoprotein cholesterol and was effective in improving blood pressure control in adults with type 2 diabetes. Clinical diversity among the trials included in this review, and their low methodological quality, suggest that the authors’ conclusions may not be reliable.

Authors’ objectives
To determine the effect of structured exercise interventions on lipid profiles and blood pressure control of adults with type 2 diabetes.

Searching
MEDLINE, EMBASE and Cochrane Central Register of Controlled Trials (CENTRAL) were searched to August 2012 for publications in English. Search terms were reported. Bibliographies of major textbooks, review articles, and included study articles were handsearched, and contact was made with experts to locate further studies.

Study selection
Randomised controlled trials that compared the effects of structured exercise interventions (defined in the review) versus placebo in adults (aged over 18 years) with type 2 diabetes were included. Eligible interventions had duration of eight weeks or more. Primary outcomes were: blood pressure (systolic and diastolic) and lipid profile; secondary outcomes were glycated haemoglobin (HbA1c), body mass index, body weight and waist circumference.

The included trials were conducted worldwide. They often had multiple interventions arms and most included aerobic exercise; others included resistance exercise or a combination of both. Mean participant age ranged from 45 to 72.7 years, and the average duration of diabetes experienced ranged from zero to 9.8 years (where reported). A small proportion of the trials (14%) included a dietary co-intervention. Mean baseline HbA1c levels ranged from 6.8 to 12.5%.

The authors did not report the number of reviewers involved in the study selection process.

Assessment of study quality
Quality was assessed using a previously published tool. Criteria related to: randomisation; allocation concealment; similarity of groups at baseline; eligibility criteria; blinding of outcome assessors, patients and care providers; point estimates; and intention-to-treat analysis.

Two reviewers independently assessed study quality; any disagreements were resolved through consensus and discussion with a third reviewer.

Data extraction
Means and standard deviations were extracted on the outcomes to calculate weighted mean differences and 95% confidence intervals. The Compendium of Physical Activities was used to estimate the exercise intensity of interventions using metabolic equivalents (otherwise known as METs). Exercise volume was calculated by multiplying the intensity in METs by total time spent exercising.

Two reviewers independently extracted data; any disagreements in were resolved by discussion with a third reviewer.

Methods of synthesis
Weighted mean differences and their 95% confidence intervals were pooled using fixed-effect models, or random-effects models where there was statistical heterogeneity (assessed using $I^2$). Where duplicate articles were published on
the same trial, data from the longest follow-up duration were included in the meta-analysis. Any heterogeneity was explored using meta-regression, according to various study population and intervention characteristics. Publication bias was assessed using funnel plots, trim and fill methods and Egger's test. Further details were reported in the review paper.

**Results of the review**

Forty-two randomised controlled trials with 58 treatment arms were included in the review (reportedly including 2,808 patients). The quality of the trials was generally low; 5.6% reported allocation concealment, 9.3% had blinded outcome assessors, and 35.2% used intention-to-treat analyses. Mean intervention duration ranged from eight to 108 weeks; mean intensity ranged from 4.5 to 27 METs (hours per week).

Compared with placebo, structured exercise interventions were associated with statistically significant greater reductions in systolic blood pressure (WMD -2.42, 95% CI -4.39 to -0.45; 31 studies) and diastolic blood pressure (WMD -2.23, 95% CI -3.21 to -1.25; 29 trials). A slight increase in high-density lipoprotein cholesterol was observed with the intervention groups over placebo groups, although this difference was of borderline statistical significance (WMD 0.04, 95% CI 0.02 to 0.07; 36 trials). No significant differences between the groups were observed for changes in levels of low-density lipoprotein cholesterol (25 studies).

High levels of heterogeneity were shown in these meta-analyses ($I^2$ range: 62.4 to 94.3%); this heterogeneity was partially explained by age, dietary co-intervention and the duration/intensity of the exercise. Evidence of publication bias was shown for some outcomes, including systolic blood pressure, and both low-density and high-density lipoprotein cholesterol. Further results were reported in the review.

**Authors’ conclusions**

Structured exercise decreased low-density lipoprotein cholesterol, increased high-density lipoprotein cholesterol and was effective in improving blood pressure control in adults with type 2 diabetes.

**CRD commentary**

The review question was clear and supported by reproducible inclusion criteria. Relevant sources of data were accessed, though the restriction to studies in English meant that relevant studies may have been missed. Efforts were taken to minimise reviewer error and bias during data extraction and quality assessment; it was unclear whether a similar effort was taken during study selection. Relevant quality assessment criteria were used, and most of the trials were shown to be of low quality. Study details were presented, and revealed clinical diversity across included trials. Substantial statistical heterogeneity was also shown in the meta-analyses, and it was only partially explained by some of the covariates examined. The authors also stated that caution should be paid to the extrapolation of the results related to cardiovascular risks.

Clinical diversity among the trials included in this review, and their low methodological quality, suggest that the authors’ conclusions may not be reliable.

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

**Practice:** The authors stated that primary care physicians should recommend regular exercise to patients with diabetes (who are able to safely exercise).

**Research:** The authors did not state any implications for further research.

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None stated.

**Bibliographic details**


**PubMedID**
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.