Impact of progressive resistance training on lipids and lipoproteins in adults: a meta-analysis of randomized controlled trials
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CRD summary
The review results suggested that progressive resistance training reduced total cholesterol, total cholesterol/high-density lipoprotein cholesterol (HDL-C), non-HDL-C, low-density lipoprotein cholesterol (LDL-C) and triglycerides in adults who undertook progressive resistance training. The authors' conclusions should be interpreted with caution, considering the variation between studies and uncertain quality of included studies.

Authors' objectives
To examine the effects of progressive resistance training on lipids and lipoproteins in adults.

Searching
PubMed, EMBASE, SPORTDiscus, Cochrane Central Register of Controlled Clinical Trials (CENTRAL), Current Contents and Dissertation Abstracts International were searched from 1955 to 2007 for studies in any language; some search terms were reported. Reference lists of retrieved articles and reviews were searched.

Study selection
Randomised controlled trials (RCTs) with progressive resistance training of four weeks or more in adults (over 18 years) were eligible for inclusion. One or more of the following lipids and lipoproteins had to be assessed in the fasting state: total cholesterol; high-density lipoprotein cholesterol (HDL-C); ratio of total cholesterol/HDL-C; low-density lipoprotein cholesterol (LDL-C); and triglycerides. Non-HDL-C (total cholesterol minus HDL-C) was also a primary outcome. Studies with additional interventions beyond progressive resistance training were excluded.

Most included studies were of patients who were previously not physically active. Around half the studies were of apparently healthy patients. Some studies were only of patients with diabetes or obesity. Mean age of participants was around 53 years. Training programmes ranged from eight to 78 weeks duration and exercises were performed two to three times per week; interventions in most of the studies were supervised. Triglyceride levels was the most commonly reported outcome.

Assessment of study quality
Two reviewers assessed study quality using the Jadad scale of randomisation, blinding and withdrawals/dropouts. Studies received a score between 0 and 5.

Data extraction
Treatment effects for lipid and lipoprotein variables were calculated by subtracting change score in the exercise group from change score in the control group. Variances were calculated from pooled standard deviations of change scores. Where change score standard deviations were not available, they were calculated from 95% confidence intervals (CI) or pre and post standard deviation values. Authors were contacted for further details when published data were insufficient for pooling.

Two authors independently extracted data. Disagreements were resolved by consensus.

Methods of synthesis
Results were pooled using random-effects meta-regression (intercept-only model); the authors listed pre-specified potential predictors. The slope of unstandardized regression coefficients (B) along with 95% CIs were calculated. Heterogeneity based on a fixed-effect model was assessed using the Q and I² statistics. Potential publication bias was assessed using random-effects meta-regression.
Results of the review
Twenty-nine RCTs were included in the review (n=1,329). Sample sizes ranged from eight to 143 participants. Study quality ranged from 1 to 5 out of five (median 2).

Statistically significant reductions after progressive resistance training were found for total cholesterol (-5.5 mg/dL, 95% CI -9.4 to -1.6), total cholesterol/HDL-C (-0.5, 95% CI -0.9 to -0.2), non-HDL-C (-8.7 mg/dL, 95% CI -14.1 to -3.3), LDL-C (-6.1 mg/dL, 95% CI -11.2 to -1.0) and triglycerides (-8.1 mg/dL, 95% CI -14.5 to -1.8), but not HDL-C (0.7 mg/dL, 95% CI -1.2 to 2.6).

No statistically significant publication bias was found, but a large and statistically significant (p<0.001) amount of heterogeneity was observed across all lipid and lipoprotein outcomes (I² range: 72% to 89%). The authors reported that they were unable to identify any significant sources of heterogeneity.

Statistically significant benefits were also found both for changes in percentage body fat and in lean body mass, but not for body weight or body mass index. Statistically significant associations were found between decreases in total cholesterol and decreases in body mass index, increases in upper body strength, fewer exercises and greater dropout rates.

Authors' conclusions
Results suggested that progressive resistance training reduced total cholesterol, total cholesterol/HDL-C, non-HDL-C, LDL-C and triglycerides in adults.

CRD commentary
The review addressed a clear question and was supported by appropriate inclusion criteria. It appeared that comparator groups received no intervention, but this was unclear. Attempts to identify all relevant studies in any language were undertaken by searching electronic databases and checking references. Suitable methods were employed to reduce risks of reviewer error and bias throughout the review. Although study quality was assessed, individual results were not presented, which made it difficult to assess reliability of included studies. Use of the Jadad scale was questionable as an assessment of blinding appeared inappropriate considering the interventions and outcomes used. Suitable methods were used to pool data, but significant heterogeneity was evident. The authors' conclusions should be interpreted with caution as they were based on statistically and clinically heterogeneous studies of uncertain quality.

Implications of the review for practice and research
Practice: The authors stated that the greatest overall benefits on lipids and lipoproteins may best be derived from participation in both aerobic exercise and progressive resistance training.

Research: The authors stated a need for research into why HDL-C may be improved as a result of aerobic exercise, but not progressive resistance training. The authors added that associations observed in their meta-regressions need to be tested in large, well-designed randomised controlled trials (with more comprehensive reporting of interventions and outcomes).

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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.