Responses of blood lipids to aerobic, resistance, and combined aerobic with resistance exercise training: a systematic review of current evidence

Tambalis K, Panagiotakos DB, Kavouras SA, Sidossis LS

CRD summary
This review concluded that high-intensity aerobic exercise increased high-density lipoprotein cholesterol levels in adults, and there was some evidence that resistance and combined exercise reduced low-density lipoprotein cholesterol levels. Given the limitations with the review process and synthesis of heterogeneous studies, the authors’ conclusions should be interpreted with caution and may not be reliable.

Authors’ objectives
To evaluate the effect of aerobic, resistance, and combined exercise on blood lipid and lipoprotein concentrations.

Searching
PubMed was searched for articles from 1990 to December 2006 published in English. Search terms were reported and review articles and references from the original articles were also searched.

Study selection
Studies of aerobic, resistance, or combined exercise of no less than 12-weeks duration in sedentary, healthy, adults with hyperlipidaemia or normal lipidaemia, who were aged 18 years and older, were eligible for inclusion. Eligible studies were required to report at least one of the following outcomes, in a fasting state, at baseline and post-intervention: triglycerides, serum total cholesterol, low-density lipoprotein (LDL) cholesterol, or high-density lipoprotein (HDL) cholesterol. The authors stated that due to the limited data available, some previous trials conducted between 1994 and 2006 were also included. Studies that included exercise combined with dietary measures or replacements were excluded.

The majority of included studies were of men or women only, aged between 18 and 87 years. Most of the participants were white, some were obese or overweight, and some had abnormal blood lipid readings. Exercise programmes varied in intensity, frequency, and duration, lasting between two months and two years. Aerobic studies were categorised as moderate or high intensity. Most of the programmes included walking, jogging, swimming, or cycling. Some studies did not include a control group.

The authors did not state how many reviewers selected studies for inclusion.

Assessment of study quality
The authors did not state that they assessed validity.

Data extraction
The percentage changes in triglycerides and total, HDL, and LDL cholesterol were extracted either compared with control in randomised controlled trials (RCTs) or from baseline in studies without control groups.

Methods of synthesis
The data were presented as a narrative synthesis and in tables, grouped by type of exercise programme. The influence of gender and age were examined.

Results of the review
Eighty-four studies, with approximately 6,300 participants, were included and 58 were RCTs. Sample sizes ranged from 10 to 492 participants and the majority included less than 100 participants. There were some discrepancies in the number of studies reported in the text and those reported in the tables. There were also some discrepancies in the age ranges reported in the tables and those in the text, and these are not reported.
Moderate-intensity aerobic exercise (28 studies): Six of 28 studies (21.4%) showed a statistically significant increase in HDL cholesterol in men and women of all ages: mean improvement 9.8% (range 3 to 25; p<0.05). Two of 26 studies showed statistically significant decreases in LDL cholesterol (10% and 11%) and total cholesterol (7% and 8%) in women. Three of 27 studies showed significant reductions in triglycerides (range from 18% to 25%) in men and women.

High-intensity aerobic exercise (25 studies, 37 study arms): An increase in HDL cholesterol (range 2% to 21%, p<0.05) was found in 22 of 37 study arms, in men and women. Reductions in triglycerides (range 2% to 20%) were found in 12 of 35 study arms (34%), mainly in men. Eight of 35 study arms (22%) showed a reduction in total cholesterol (range 2% to 12%) in men and women. Seven of 35 study arms reported reductions in LDL cholesterol levels (range 6% to 21%) in men and women.

Resistance exercise (23 studies): Nine of 23 studies (39%) showed significant reductions in LDL cholesterol (range 5% to 23%) in men and women. Six of 23 studies (23%) showed a significant reduction in total cholesterol (range 5% to 14%) in women only. Three of 23 studies (13%) showed a reduction in triglyceride levels (range 11% to 28%) in women only. Studies comparing the impact of different types of exercise (aerobic and resistance) on lipid profile had inconsistent findings.

Combined aerobic and resistance exercise (eight studies): Three studies showed statistically significant improvements in LDL cholesterol levels (range 4% to 34%) and three studies showed significant improvements in HDL cholesterol (range 3.5% to 23%) in both men and women. Two studies each showed decreased levels of total cholesterol (range 10% to 25%) and triglyceride levels (8% to 42%) in middle-aged and elderly participants. Two studies assessing aerobic, resistance, and combined exercise showed no statistically significant differences between the intervention and control groups on lipid profile.

Authors’ conclusions
High-intensity aerobic exercise increased HDL cholesterol levels in adults independently of their gender and age, and there was some evidence that resistance and combined exercise lowered LDL cholesterol levels.

CRD commentary
The review question was clear and was supported by appropriate inclusion criteria. The authors suggested that the main focus of the review was on RCTs, but other study designs were included. The literature search was limited to one electronic database and references from original articles, and was restricted by language, which means that publication and language bias may have been introduced. Validity was not assessed, which means that the quality of the included studies is unclear. The authors did not state how many reviewers selected studies for inclusion nor how many extracted the data, which means that reviewer error and bias cannot be ruled out. The authors acknowledged some limitations with the included studies, such as differences in their methods, baseline lipid levels, exercise protocols, and sample sizes. Given these differences, a narrative synthesis was appropriate.

The authors’ conclusions appear to reflect the evidence, but given the limitations with the review process and synthesis of heterogeneous studies, the authors’ conclusions should be interpreted with caution.

Implications of the review for practice and research
The authors did not state any implications for practice nor research.

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