A systematic review of the outcomes of cardiovascular exercise programs for people with Down syndrome

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CRD summary
The authors concluded that whilst the review supported the use of cardiovascular exercise programmes for people with Down syndrome, the evidence was limited and further research is required to confirm the review findings. Overall, this was a well-conducted and reported review and the authors’ cautious conclusions are likely to be reliable.

Authors' objectives
To evaluate the benefits and risks of cardiovascular exercise programmes for people with Down syndrome.

Searching
MEDLINE, EMBASE, AMED, PsycINFO, SPORTDiscus, Ausport Med, ERIC, CINAHL, the Cochrane Library, CENTRAL and ProQuest Digital Dissertations were searched from inception to October 2004; the search terms were reported. The reference lists of identified studies were screened, and references and authors’ names were tracked using the Science Citation Index. In addition, researchers of published studies were contacted. No language restrictions were applied.

Study selection
Study designs of evaluations included in the review
Randomised and non-randomised prospective controlled clinical trials that scored at least 4 points on the PEDro scale, and reviews that included meta-analysis, were eligible for inclusion in the review. No meta-analyses were included in the review.

Specific interventions included in the review
Studies that evaluated aerobic exercise programmes that adhered to American College of Sports Medicine guidelines for increasing cardiovascular fitness were eligible for inclusion. These guidelines recommended cardiovascular programmes for people with Down syndrome, with aerobic exercise sessions lasting 20 to 60 minutes and being conducted three to seven times per week at an intensity of 55 to 90% of peak heart rate or 40 to 85% of maximal oxygen uptake reserve. In all of the included studies, exercise programmes consisted of sessions of low-impact exercises (including brisk walking, rowing, cycling or jogging) that generally lasted 30 minutes and were conducted three times a week for between 10 and 16 weeks. Programmes included motivational strategies in all studies; one study also included a progressive resistance exercise programme. The interventions were usually conducted in small groups (5 to 7 participants) with a ratio of one supervisor to 2 to 4 participants. Two studies were conducted in a laboratory setting and two in a community setting. Control interventions were no regular physical training.

Participants included in the review
Studies of participants with a diagnosis of Down syndrome were eligible for inclusion. The participants in the included studies appeared to vary in the range of intellectual impairment (scores suggested they had mild to severe impairment) and most (70%) were male. The majority of the studies involved adolescents and young adults; one study included older participants aged 28 to 55 years. All of the studies excluded people with previous cardiac, metabolic disease and orthopaedic problems.

Outcomes assessed in the review
Studies that assessed changes in body structure or function, activity limitation, or societal participation were eligible for inclusion. The review assessed relative maximal oxygen consumption (VO2) peak, peak minute ventilation, maximum workload achieved, time to exhaustion, body weight and adverse effects.

How were decisions on the relevance of primary studies made?
Two reviewers independently selected studies and resolved any disagreements by consensus.

Assessment of study quality
Two reviewers independently assessed study validity using the following criteria of the PEDro scale: random allocation; allocation concealment; baseline similarity of the treatment groups; blinding of the participants, therapists and outcome assessors; follow-up greater than 85% for at least one key outcome; intention-to-treat analysis; statistical analysis of treatment differences; and the reporting of point estimates with measures of variability for at least one key outcome. Any disagreements were resolved by consensus. For each criterion that was met, the study was awarded a point; studies could score a total of between 0 and 10 points. However, it was not expected that any of the studies would have blinded participants or clinicians, so a maximum of 8 points was expected.

Data extraction
Two reviewers independently extracted the data using a standardised form. For each study, effect sizes (Cohen’s $d$) with 95% confidence intervals (CIs) were obtained for each outcome of interest. Effect sizes were classified as advised by Cohen as small ($<0.2$), medium (0.5) and large ($>0.8$).

Methods of synthesis
How were the studies combined?
Effect sizes from individual studies were combined using a fixed-effect meta-analysis in the absence of significant statistical heterogeneity. Pooled effect sizes ($d$) were calculated with 95% CIs.

How were differences between studies investigated?
Statistical heterogeneity was assessed using the Q statistic. Clinical heterogeneity was also examined with respect to programme content and setting, characteristics of the participants, and outcome measures. A pre-specified sensitivity analysis was used to examine the effect of omitting the largest trial that provided both cardiovascular and strength training.

Results of the review
Four controlled clinical trials ($n=107$) were included in the review: 3 randomised controlled trials (RCTs; $n=82$) and a non-randomised controlled trial ($n=25$).

Out of a maximum possible 8 points, the RCTs scored 6 and the non-randomised study scored 5. None of the studies reported either blinding of the outcome assessor or adequate allocation concealment.

Compared with control, exercise programmes significantly improved the relative VO2 peak ($d=0.75$, 95% CI: 0.34, 1.15; based on 4 studies, $n=107$), peak minute ventilation ($d=0.71$, 95% CI: 0.15, 1.28; based on 3 studies, $n=55$), maximum workload achieved ($d=0.96$, 95% CI: 0.45, 1.47; based on 2 studies, $n=68$) and time to exhaustion ($d=0.72$, 95% CI: 0.29, 1.15; based on 3 studies, $n=93$).

There was no significant difference between exercise and control for body weight ($d=0.09$, 95% CI: -0.39, 0.57; based on 2 studies, $n=68$).

No evidence concerning the effects of cardiovascular exercise programmes on psychological functioning, functional activities, societal participation, or self-perceived quality of life in individuals with Down syndrome was found. None of the studies reported any unexplained withdrawals or negative effects. One study assessed electrocardiographic symptoms and reported no unusual symptoms during exercise testing.

The exclusion of the largest study ($n=52$), which used a combination of cardiovascular and resistance training, made no difference to the results for time to reach exhaustion, maximal workload or body weight. However, it did reduce the treatment effect on relative VO2 peak ($d=0.52$, 95% CI: -0.40, 1.43).
Authors’ conclusions
The review supports the use of cardiovascular exercise programmes for people with Down syndrome, but the evidence was limited and further research is required to confirm the review findings.

CRD commentary
The review addressed a clear question that was defined in terms of the participants, intervention, outcomes and study design. The strategy undertaken to identify trials was extensive and included attempts to minimise language bias. Two reviewers independently selected studies, assessed validity and extracted the data, thus reducing the potential for reviewer bias and errors. Only studies that met pre-specified validity criteria were included. The validity of the studies was assessed using specified criteria and the results of the assessment were reported.

Statistical and clinical heterogeneity were considered prior to performing a meta-analysis. However, data from both randomised studies and a non-randomised study were pooled and the influence of randomisation on the results was not examined. Overall, this was a well-conducted and reported review, and the authors’ cautious conclusions reflect the limited evidence and are likely to be reliable.

Implications of the review for practice and research
Practice: The authors stated that because the evidence on adverse effects was limited, clinicians should be cautious when starting exercise regimens. The review’s findings suggested that exercise sessions should last about 30 minutes, have an intensity of 50 to 75% of VO2 peak, and be conducted three times a week for between 12 and 16 weeks.

Research: The authors stated that well-conducted RCTs are required to evaluate the effects of cardiovascular exercise programmes on activity and social participation. Future studies should address both the long-term effects of these programmes and the effects of longer term exercise training regimens. Furthermore, the effect of participant age, gender or concurrent health problems on programme outcomes, or their ability to participate in these programmes, should be investigated.

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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.