The effects of endurance training on functional capacity in the elderly: a meta-analysis
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Authors' objectives
To examine the effects of endurance training on functional capacity (maximum oxygen consumption, MOC) in the elderly.

Searching
MEDLINE and the TEXSEARCH system (Texas A&M University) were searched; search terms are reported but search dates are unclear. Bibliographies of retrieved articles were examined, and selected journals relating to the elderly were handsearched. Only studies published in the English language appear to have been included.

Study selection

Study designs of evaluations included in the review
Studies comparing an experimental and a control group were included. It is unclear whether any of the studies are randomised, and the sources of the controls for these studies are not described. 14 of the 29 included studies were before-and-after studies, which did not use a control group.

Specific interventions included in the review
Exercise sessions. Six exercise regimens were employed in the included studies: walking, jogging, cycle ergometry, stair climbing, and a combination of walking, jogging, and cycling.

Participants included in the review
Studies were included if the mean age of the participants was greater than or equal to 60 years. This resulted in an overall mean age across all studies of 68.2 years (plus or minus 4.5 years). Overall 68% of participants were male.

Outcomes assessed in the review
Change in MOC were assessed.

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

Assessment of study quality
Studies were examined according to whether or not a control group was used. The authors do not state how the papers were assessed for validity, or how many of the authors performed the validity assessment.

Data extraction
The data from each study were coded and entered onto a computer spreadsheet. The effect size was calculated by dividing the difference between the pre- and post-exercise training MOC by the pre-training standard deviation (SD). For the before-and-after studies, the pre-training mean and SD were substituted for the control group mean and SD.

Methods of synthesis
How were the studies combined?
Meta-analysis: the individual effect sizes were weighted by the number of participants in the study, averaged and tested for significance using a Z-statistic. The results of the studies were also combined using stepwise regression, to determine whether the components of the exercise training had an effect on the outcome measure.
How were differences between studies investigated?

Analysis of variance (ANOVA) was used to examine the effects of various study characteristics on outcome. These were: study design (whether or not a control group was used), pre-screening for heart disease, type of training modality, method used to set exercise training intensity, and the method used to determine MOC.

Results of the review

Twenty-nine studies involving 1,496 participants were included.

The weighted mean effect size was 0.65 SD units, which was significantly different from 0 (p<0.0001). This meant that exercise training significantly increased MOC by an average of approximately two-thirds of a SD. ANOVA showed the mean value for MOC to be higher in the experimental than in the pre-training and control groups (p<0.05).

No significant differences were found between studies employing pre-screening methods or control groups and those that did not, and those estimating and directly measuring MOC. No differences were found in studies using different methods to assess exercise intensity.

The regression model, which examined the effect of training parameters on the outcome, found that the length of training regimen accounted for the greatest variation (39%), followed by pre-training MOC (12%) and duration of exercise bouts (8%). Age was found to be inversely related to pre-training MOC and change in MOC.

Authors' conclusions

Exercise training significantly improves MOC in older people, with the magnitude being slightly less than that observed in younger people involved in similar exercise training regimens. The magnitude of the improvement is inversely related to the individual's age and can be predicted by, e.g. duration of exercise bouts and length of training regimen. The 'standard' exercise prescription of 30 minutes 3 times per week is sufficient to induce beneficial training adaptations in older people.

CRD commentary

While the review suggests that exercise training can increase MOC, the specific conclusions regarding precise timing and duration of exercise are not robust. This is because there is little assessment of validity or discussion of the likely biases of the primary studies. In addition, the search is limited and there are no details or examination of the baseline characteristics of the participants in the primary studies. It is, therefore, difficult to assess the generalisability of the results.

The clinical significance of the summary findings is also unclear, i.e. what effect, if any, will an increase in maximum oxygen uptake of two-thirds of a standard deviation have on health, physical functioning or quality of life.

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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.