The effects of exercise on mood in older adults: a meta-analytic review

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Authors' objectives
To use meta-analytic techniques to test four hypotheses: (1) exercise improves mood in the elderly; (2) studies with longer training protocols produce the greatest improvements in mood; (3) studies in participants with the poorest initial health status produce the largest effect sizes; and (4) studies reporting significant fitness gains are associated with the largest effect sizes.

Searching
PsycLIT, ERIC, SPORTDiscus, Dissertation Abstracts, HealthSTAR and MEDLINE were searched for articles in the English language that were available before March 1998. Examples of the key terms used for exercise, elderly and mood were given in the report, and a complete list is available from the author. Psychological Abstracts, the Social Sciences Citation Index and relevant journals (unspecified) were handsearched. References in the related literature were also checked. Published and unpublished studies were eligible for inclusion.

Study selection
Study designs of evaluations included in the review
The eligibility criteria for study design were not reported, although the preamble implies that all available studies were included. Studies with insufficient data to calculate the effect size (ES) were excluded. The included studies were comparative studies of exercise versus a control group, studies that compared pre- to post-test changes in mood, and correlational studies.

Specific interventions included in the review
Studies that investigated the effects of physical activity or exercise were eligible for inclusion. The activity or exercise used in the included studies were classified as cardiovascular exercise, resistance training, or a combination of these (see Other Publications of Related Interest no.1).

Participants included in the review
Studies in older adults (mean age greater than 65 years, or age range with a lower boundary at least 60 years) were eligible for inclusion. The participants in the included studies were healthy and active, healthy and sedentary, and those with disease.

Outcomes assessed in the review
Studies that tested the effect on some construct of mood were eligible for inclusion. Studies were included that assessed the positive affect and/or negative affect.

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 reviewers performed the selection.

Assessment of study quality
The authors did not exclude studies from the review on the basis of methodological rigour. Instead, studies were coded (a priori) for the following design and descriptive characteristics: publication status (published or unpublished), comparison group activity (for experimental versus control ES only), and for a number of threats to internal validity which were unspecified (see Other Publications of Related Interest no.2). The primary author coded all the studies, including threats to internal validity.

Data extraction
The authors do not state how the data were extracted for the review, or how many of the reviewers performed the data extraction.

It was reported that the primary author coded all the studies, but it is unclear whether the coding was distinct from the data extraction. The studies were coded for certain characteristics based on prior decisions about potential moderator variables for the exercise-mood relationship in the elderly. These included participant characteristics, exercise characteristics, mood assessment characteristics, and design and descriptive characteristics. Full details were given in the paper. Coder-drift was assessed by recoding a random sample of 10 studies. A mean agreement rate of 0.9 was required to be acceptable.

Methods of synthesis
How were the studies combined?
The studies were combined by a meta-analysis of the ESs. A total of 168 ESs were calculated from the 32 studies (see Other Publications of Related Interest no.3). These were divided into 61 ESs from experimental- versus control-group comparisons, 83 ESs from gains (pre- post-) comparisons, and 24 ESs from correlational studies. Improvements in mood (positive or negative affect) from each individual study were made consistent in direction (by multiplying negative values by -1), so that global improvements in mood were represented by positive ES values. The ESs were corrected for positive bias and weighted by the inverse of the variance (see Other Publications of Related Interest no.4). The average ESs were calculated for each level of moderator variable. Only moderator levels with at least five ESs were included in the meta-analyses.

How were differences between studies investigated?
A statistical Q test for homogeneity was applied whenever the ESs were pooled. Three databases (experimental-versus-control, gains, and correlational) were constructed and analysed independently. First, all ESs were pooled and tested for homogeneity. If statistically significant heterogeneity was detected, the moderator variable effects were examined using a further Q test. Significant heterogeneity indicated that a particular moderator variable contributed to differences among the ESs, in which case a further test was applied to examine homogeneity within the levels of that moderator variable (see Other Publications of Related Interest no.4). Since there was a lack of information to calculate ES variances among correlational studies, a one-way analysis of variance was used to test moderator variable homogeneity.

Results of the review
Thirty-two studies (168 ESs) were included. The number of participants in the included studies was not stated.

The coder-drift was acceptable. The investigation of moderating variables for all comparisons was discussed at length in the paper. The results summarised below are limited to the main findings.

Experimental versus control group ES.
Overall (61 ESs), the mean ES for mood was 0.24 (standard deviation, SD 0.50), which was significantly greater than zero. Heterogeneity between the ESs was significant. Ten ESs from studies which used a comparison group that initially had better mood at pre-test, were removed from the analysis; this resulted in a mean ES of 0.34 (SD 0.45, p < 0.05). However, heterogeneity between the ESs was still significant. Examination of the moderator variables showed significant variability in the ES associated with comparison group activity, frequency of exercise, time per session, weeks of participation, intensity of exercise, exercise-group fitness increase, and comparison-group fitness increase. The largest ESs were associated with protocols of 1 to 6 weeks and 7 to 12 weeks, which were significantly greater than protocols of more than 12 weeks. The smallest difference in mood occurred in studies where there was an increase in fitness in the comparison group.

Gains ES (pre-test post-test comparisons).
Overall (83 ESs), the mean ES for global mood in exercise was 0.38 (SD 0.38, p < 0.05). Heterogeneity was not statistically significant. The average ES was significantly greater in all exercise groups versus all control groups. Training protocols lasting 1 to 6 weeks were associated with larger effects than longer protocols. Exercise was found to be associated with significantly improved mood across all levels of initial health status (healthy and active, healthy and
sedentary, and mixed, i.e. disease and healthy-sedentary).

Correlational ES.

Overall (24 ESs), the mean ES was 0.46 (SD 0.27, p<0.05), indicating better mood in elderly people who participate in exercise or physical activity compared with those who do not. The small number of studies precluded in-depth analyses.

Authors' conclusions
Exercise was associated with improved mood in the elderly in studies comparing exercise with a control group, in studies comparing pre- to post-test changes in mood, and in correlational studies. Overall, the results were consistent across ES groupings.

CRD commentary
The review addressed a clear question in terms of the participants, intervention and outcome. A range of sources was searched to identify relevant studies, but a restriction to English language articles means that language bias is a possibility. Details of how the studies were selected and the data were extracted were lacking; it is therefore not possible to judge how robust these procedures were. The review was based entirely on statistical analysis, and the statistical methods were described and referenced. However, no details of the individual studies included in each meta-analysis were provided, to enable the reader to judge how appropriate the authors' coding and pooling were. Only statistically-significant heterogeneity was examined. While it was reported that the studies were coded for a number of threats to internal validity, these threats were not named, the results were not shown, and the internal validity of the included studies does not appear to have been considered in the analyses.

The authors' conclusions appear to be consistent with the results presented. However, the interpretation of treatment effects expressed in standardised units is problematic, particularly where, as in this review, there are few details of the study populations from which the data were derived.

Implications of the review for practice and research
Practice: The authors state that their results provide considerable support for the beneficial effects of exercise on mood in the elderly.

Research: The authors state that future research should focus on examining the effects of positive affect and other effects of strength training for the elderly, particularly regarding optimal intensity, frequency and duration of resistance-training programmes, especially in segments of the population with disease. There is a lack of studies examining the effects of a combined cardiovascular and strength training protocol. Research must make more of an attempt to use groups that are equivalent at baseline on the mood measure of interest.

Bibliographic details

Other publications of related interest

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Record Status
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.