The effectiveness of exercise interventions for people with Parkinson's disease: a systematic review and meta-analysis

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CRD summary
The authors concluded that exercise interventions for people with Parkinson's disease can be effective in improving physical functioning, health-related quality of life, leg strength, balance and walking speed, although results should be interpreted with caution due to some inherent difficulties in evaluating this topic area. Overall, this was a well-conducted review and the authors' conclusion is likely to be reliable.

Authors' objectives
To evaluate the effectiveness of exercise interventions for people with Parkinson's disease.

Searching
CINAHL, EMBASE, AMED, PubMed, SPORTDiscus and The Cochrane Library were searched for English-language papers. Searches spanned 1974 to December 2006. Additional papers were sought from reference lists and internet sources. Search terms were reported.

Study selection
Randomised controlled trials (RCTs) of exercise/physical activity interventions alongside any comparator in people with Parkinson's disease were eligible for inclusion in the review if they focusing on at least one outcome from physical performance or functioning, falls or health-related quality of life. In crossover studies, outcomes had to be reported for the first assessment period in order to be included. A variety of outcome measures were used, including some related to depression. Where reported, most included studies had a larger proportion of male participants. Mean age ranged from 63 to 76 years. Various prescriptions of exercise-based interventions were included; many were delivered by physiotherapists in an outpatient setting over four to 12 weeks. The reporting of theory base was variable. Comparators (where reported) included active interventions, no intervention and usual care. Follow-up in most studies was less than six months.

Studies were selected by one reviewer; uncertainties were discussed and agreed upon with a second reviewer.

Assessment of study quality
Study quality was assessed using a modified version of the Jadad scale, which awarded one point each to achieve a composite score up to a maximum of 5 in terms of randomisation method and concealment, blinding, reporting of losses to follow up, and the use of intention to treat analysis. Study power and reporting of sample size calculation were used to assess external validity. Two reviewers independently carried out the validity assessment; discrepancies were resolved by discussion.

Data extraction
Two reviewers independently extracted data for the review. Discrepancies were resolved by discussion. Data were extracted to facilitate vote counting (which summarised the direction of effects as positive, negative or equivocal), or to calculate the standardised mean difference (SMD) and 95% confidence interval (CI).

Methods of synthesis
A mixed-methods approach was used to synthesise the data. Vote counting was used for the narrative synthesis. A random-effects meta-analysis (DerSimonian and Laird) was used to pool standardised effect sizes for the two most frequently reported outcomes (physical functioning and health-related quality of life). The $X^2$ test was used to explore statistical heterogeneity.

Results of the review
Fourteen studies were included in the analysis (n=495). Samples sizes ranged from 11 to 142. Overall methodological
quality was considered to be moderate.

**Physical functioning**: Pooled data from seven trials (n=360) showed a statistically significant improvement in physical functioning as a result of the exercise intervention (SMD -0.47, 95% CI -0.82 to -0.12). Statistically significant heterogeneity was found (p=0.045).

**Health-related quality of life**: Pooled data from four trials (n=292) showed a statistically significant improvement in health-related quality of life as a result of the exercise intervention (SMD -0.27, 95% CI -0.51 to -0.04). There was no statistically significant heterogeneity between the trials.

Improvements were also reported for leg muscle strength, balance and walking speed following the exercise interventions. There was no improvement for depression or falls incidence.

**Authors' conclusions**
Exercise was effective in improving physical functioning, health-related quality of life, leg strength, balance and walking speed, although results should be interpreted with some caution. There was insufficient evidence to evaluate the effects upon falls and depression.

**CRD commentary**
The review question was clear and supported by clear inclusion criteria. The search strategy appeared to cover several appropriate sources. The authors acknowledged that the restriction to English-language papers may have introduced language bias and so relevant studies could have been missed. It was not clear to what extent unpublished material was sought, so the potential for publication bias could not be ruled out. The review process was largely carried out with adequate attempts to minimise other sources of error and bias. An appropriate validity assessment was conducted for the included study designs and some aspects that pertained to public health interventions (for example, the importance of assessing differential effects and theoretical grounding of interventions) were commented upon. An appropriate meta-analytic technique was applied in the presence of heterogeneous studies. The authors acknowledged the potential limitations of vote counting in their discussion of narrative results. Overall, this was a well-conducted review and the authors' cautious conclusion is likely to be reliable.

**Implications of the review for practice and research**
**Practice**: The authors did not state any implications for practice.

**Research**: The authors stated that future research should report more clearly on the components of the exercise intervention and the targeted stage of disease. Theory-driven interventions were needed, along with sufficiently powered studies and those that reflected the general Parkinson's disease population in terms of gender and ethnicity.

**Funding**
Devon and Cornwall Workforce Development Confederation and Plymouth Teaching Primary Care Trust (Clinical Academic Fellowship Scheme). Department of Health (Personal Award Scheme Researcher Development Award)

**Bibliographic details**

**PubMedID**
18181210

**DOI**
10.1002/mds.21922

**Original Paper URL**
Indexing Status
Subject indexing assigned by NLM

MeSH
Exercise Therapy /methods /statistics & numerical data; Humans; Motor Activity; Parkinson Disease /therapy; Postural Balance; Quality of Life; Randomized Controlled Trials as Topic /statistics & numerical data; Treatment Outcome

AccessionNumber
12008103851

Date bibliographic record published
03/11/2008

Date abstract record published
25/11/2009

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.