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The Effects of Different Types of Exercises on Cognition in Older Persons with Mild Cognitive Impairment: A Systematic Review and Meta-Analysis

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Akalp, K; Ferreira, J; Soares, C; Ribeiro, M; Teixeira, A.

Corresponding author:
Kaan Akalp

dakalp@hotmail.com

Author Affiliation:
University of Coimbra, Faculty of Physical Education and Sport Science, University of Coimbra, 3040-248 Coimbra, Portugal.

ADMINISTRATIVE INFORMATION

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Review Stage at time of this submission - Completed but not published.

Conflicts of interest - None declared.

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Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 14 May 2024 and was last updated on 24 May 2024.

INTRODUCTION

Review question / Objective What types of exercises have a greater impact on cognition, inflammatory markers, and neuroprotective blood markers in older persons with mild cognitive impairment?

Rationale World Health Organization indicates an acceleration in the aging pace which may cause an increment in neurodegenerative diseases. Exercise is a cost-effective strategy to prevent cognitive decline and regular exercise is suggested by the American Academy of Neurology against cognitive decline. However, there is no consensus on what type of exercise should be utilized. Several studies comparing the effects of exercise demonstrated different results. While some studies showed that aerobic exercise had a superior effect, other studies indicated that resistance exercise or multimodal exercise, which combines resistance and aerobic exercise in the same session, may be more beneficial in preventing cognitive decline in older persons with mild cognitive impairment (MCI). Moreover, studies that include biomarkers in addition to cognitive outcomes are limited.

Condition being studied The type of exercise that may prevent cognitive decline by increasing neuroprotective markers and decreasing neuroinflammation in MCI still remains unclear. The exercise effects on cognition were studied with different methodologies. many research showed contradictory results. Our study may contribute to the field by examining the effects of different exercise types on cognitive outcomes, including neuroprotective and inflammatory blood markers into the analysis.

METHODS

Search strategy The search strategy was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses

(PRISMA) guidelines and using the keywords and inclusion criteria defined by the authors. The following keywords were used in the study ((" Mild cognitive impairment" OR "MCI") AND ("aerobic exercise" OR "resistance exercise " OR " strength exercise " OR "cardiorespiratory fitness" OR "cardiorespiratory exercise" OR "muscular endurance" OR "physical exercise" OR "physical activity" OR "running" OR “strength” OR “Hypertrophy” OR “Concurrent”)) AND ("BDNF" OR "IGF-1" OR "IL-6" OR "TNF-α" OR "VEGF" OR ”irisin” OR “Cognition” OR "blood brain barrier" OR "Cataphsin-B" OR “lactate”)) AND ("Mental health" OR "Cognitive assessment” OR “ Memory ” OR “ neurogenesis ” O R “neuroplasticity” OR "brain health" OR "cognition" OR "mental health"), searched in US National Library of Medicine National Institutes of Health (PubMED), Web of Science, SPORTDiscus, Scopus and PsycInfo bibliographic databases. The last search was conducted in May 2024.

Participant or population Old persons with MCI will be included. There are no restrictions concerning gender. There are no restrictions concerning gender. However, we will exclude supplement usage, neurological conditions, Parkinson's' disease andMultiple sclerosis (MS) and obesity disease population.

Intervention We will review studies developed in the context of aerobic, resistance, and multimodal exercise. Those exercises have no competition. However, exercise intensities could differ with varying ranges from the intensity of maximal aerobic capacity, Heart Rate, power output, or 1 repetition of maximum (1RM).

Comparator The control group usually refers to stretching activities or non active population.

Study designs to be included Randomized controlled trials.

Eligibility criteria The inclusion criteria used to select studies for this SRMA were: (a) human population with MCI or amnestic MCI; (b) measuring chronic exercise effects on cognition; (c) cognition measured with clear and cognitive assessment (e.g. using cognitive tests such as MoCA, MMSE, TMT, etc.), and blood markers related with neuroinflammation and neuroprotection; (d) study design with control trials; (e) reports published from 2012; (f) reports published in English language; (g) only MCI and amnestic MCI populations with exercise and control groups from the studies with different interventions. In addition, were excluded from the present SRMA studies that; (a) did not include a no-exercise condition; (b) were cross-sectional studies; (c) studies without any cognitive assessment; (d) acute design studies; and (e) that had poor quality assessment score according to Downs and Black modified checklist; (g) only included healthy control groups.

Information sources US National Library of Medicine National Institutes of Health (PubMED), Web of Science, SPORTDiscus, Scopus and PsycInfo.

Main outcome(s) Our outcome is the global effects of different types of exercise on the cognitive performance and on neuroprotective and neuroinflammatory blood markers of older persons with MCI. Thus, multiple outcomes of studies were computed and combined according to literature and were presented as one effect size. Effect size and all additional computations were carried out using Comprehensive Meta-Analysis (CMA) software (Biostat, Englewood, NJ, USA, version 4.0) selecting the standard difference in means metric. The calculation of effect size was conducted with the data of sample size (N), pre-post intervention and control group size, means (m), standard deviations (sd), effect direction, pre-post correlation and standardized by score sd changes. A random-effect model that combines sampling error and between study variance was used to estimate effect size. The effect size classified as trivial ($d \leq 20$), small ($0.21 < d < 0.50$), moderate ($0.51 < d < 0.79$) and large ($d \geq 0.80$) respectively.

Data management Comprehensive MetaAnalysis 4.0; EndNote 20.2; Word.

Quality assessment / Risk of bias analysis Methodological quality assessment of studies was performed using the modified Downs and Black checklist for randomized and non-randomized designs of health care interventions. The checklist includes twenty-seven items with a score range from 0 to 28 points. The corresponding score range for the modified Downs and Black checklist are: poor quality (≤14 points); fair quality (15-19 points); good quality (20-25 points); and excellent quality (26-28 points).

Strategy of data synthesis Data obtained from the search were imported into EndNote 20.2 program. The imported references were screened to determine whether the articles from the initial search were relevant for the study: (a) all duplicates were removed; (b) articles whose title and abstract did not provide enough information on the topic

were removed; (c) articles whose full texts did not meet the inclusion criteria were removed; (d) methodologic quality assessment from each study was checked using the modified Downs and Black checklist. The data extraction and screening was performed according to the PRISMA statement. In the present SRMA, we utilized PICOs (Population, Intervention, Comparison, Outcome and study design) approach.

Subgroup analysis Subgroup analyses were conducted to evaluate exercise types.

Sensitivity analysis We did not perform Sensitivity Analysis.

Language restriction Only articles in the English language are included.

Country(ies) involved Portugal.

Keywords Cognition; Mild Cognitive Impairment; Exercise; Older Adults; Neurodegeneration.

Contributions of each author

Author 1 - Kaan Akalp - Conceptualization; Methodology, Software; Formal Analysis; Writing.
Email: dakalp@hotmail.com
Author 2 - Jose Ferreira - Conceptualization, Methodology, Formal Analysis, Writing – Review & Editing, Visualization, Supervision.
Email: jpferreira@fcdef.uc.pt
Author 3 - Carlos Soares - Writing – Review &Editing, Visualization.
Email: solrach2o@gmail.com
Author 4 - Maria Ribeiro - Writing – Review & Editing, Visualization, Supervision.
Email: mjribeiro@fmed.uc.pt
Author 5 - Ana Teixeira - Methodology, Writing – Review & Editing; Visualization; Supervision.
Email: ateixeira@fcdef.uc.pt