Methods of physical exercise for older adults with Alzheimer's and the factors that hinder its practice: a systematic review

Abstract

Objective: To assess the impact of participation in physical exercise programs among older adults with Alzheimer's disease (AD) and the factors that compromise its practice. Method: This study constitutes a systematic review conducted across the databases of the United States National Library of Medicine (PubMed), Web of Science, Scopus, Scientific Electronic Library Online (SciELO), LILACS, and Embase, starting from 2014. The PRISMA – 2020 guidelines were employed, alongside bias risk analysis supported by the Cochrane (RoB2) tool. Results: Eleven studies were included for qualitative analysis. The impairment of episodic memory leads to a decline in AD and involves a complexity of cognitive processes encompassing multiple aspects of the neural system. Conclusion: Depression, anxiety, and difficulty in comprehension are the primary factors that compromise the participation of older adults with Alzheimer's in exercises aimed at physical stimulation, and they are the main predictors hindering perceptual-motor development. Protocols involving combined exercises appear to better promote executive function in patients with AD. Awareness of physical exercise is fundamental from the outset of treatments, with the suggestion to prioritize improvements in attention for older adults with AD. The particularities of the relationship between activities of daily living and the functional capacity of Alzheimer's patients still represent a gap to be explored, as well as the prescription of specific exercises that consider both the level of attention and the stage of the disease.

Keywords: Aging. Longevity. Physical Exercise. Alzheimer's Disease.
INTRODUCTION

Alzheimer's disease (AD) is the most common neurodegenerative pathology, accounting for 60-70% of all dementia cases. Researchers estimated that the number of people with dementia would increase from 57.4 million cases worldwide in 2019 to 152.8 million cases in 2050. They further declared AD as a significant health problem, with an urgent need for the identification of new therapeutic targets, given its increasing incidence and high social impact.

Pathologically, it is characterized by severe neuronal degeneration or loss, predominantly triggered by the overproduction of senile plaques containing β-amyloid (Aβ) proteins and the formation of neurofibrillary tangles resulting from tau protein hyperphosphorylation. The evolution of these traits is considered crucial for the development of cognitive impairments, defined in this context as the unique combination of attention, learning, memory, language, visuospatial skills, and executive functions.

Similarly, high levels of pollutants classified as fine particulate matter (PM2.5) cause oxidative stress, characterized by the production of chemically active substances that can damage Deoxyribonucleic acid (DNA) and cellular structures. The decline in memory in older adults with AD, in the continuous presence of PM2.5, has indicated a significant strength in this association.

Due to the limited impact outcomes with medication therapies, interventions through physical exercise are proposed and suggested to delay or prevent cognitive decline, as they offer fewer side effects and ensure better adherence of Alzheimer’s patients. Furthermore, there are assumptions in the literature that acute exercise-induced changes, as well as the type of exercise, intensity, and duration, are related to various moderators such as cognitive tasks. Regardless of the types of treatments already developed for these individuals, the results seem not to have significant effects on cognitive performance. Thus, the objective of this study was to verify the methods applied in physical exercise programs for older adults with AD and the factors that compromise their practice.

METHOD

A systematic literature review was conducted using a literature search through a flowchart based on the PRISMA-2020 checklist. A protocol was established, outlining an assessment report comprising various scientific studies. The protocol for this systematic review was registered with CRD 42024497905 (Centre for Reviews and Dissemination), an international prospective register of systematic reviews.

A protocol was developed with criteria to facilitate and establish consensus among the authors regarding the search strategy. The studies were organized into data, and for better interpretation, a table was prepared detailing the methodological characteristics of the studies, such as sample groups, treatment period, sample size, sex, and country where the research was conducted.

Inclusion criteria: Studies involving individuals aged 60 years or older diagnosed with AD were included. Randomized controlled trials (RCTs) published within the last 10 years were prioritized. The selected research should include at least one physical exercise protocol.

Exclusion criteria: Studies categorized as reviews and observational were not included in the qualitative analysis. Additionally, studies involving populations other than older individuals with AD or those evaluating mental health status instead of physical exercise protocols were excluded. Furthermore, other types of publications such as conference abstracts, editorials, personal opinions, newspapers, and studies with significant methodological flaws, as well as papers involving other populations, i.e., patients with other neurological pathologies and other neurological dysfunctions, were excluded.

The search was conducted using data from primary or secondary sources contained in RCTs. The search strategy was guided by the following research question: "What is the impact of Alzheimer’s patients participating in a physical exercise program and the factors hindering its practice?" This question was supported by the PICO strategy: (Population) Individuals with Alzheimer’s, (Intervention)
who participated in a physical exercise program, (Comparison) compared to the same population who did not engage in physical exercise, (Outcomes) and had different outcomes in functional, cognitive, and quality of life domains.

The selection of studies was conducted through the Rayyan selection platform developed by the QCRI (Qatar Computing Research Institute), and duplicates were removed. The stages were organized according to the PRISMA-2020 flow diagram. Consequently, a reference selection process was applied for systematic reviews following these steps: screening of titles and abstracts; eligibility of the population; methods, relevance of the project; data association regarding exercise strategies and outcomes in Alzheimer’s patients; studies evaluating factors influencing treatment difficulties; anthropometric parameters and patient functionality and manifestation; as well as the results and validity of the applied strategy. Consecutively, three themes were explored in the discussion of this systematic review, aiming to facilitate the relationships with the objectives of this research:

a) Main complications in Alzheimer’s disease
b) Factors hindering the practice of physical exercise in older adults with Alzheimer’s
c) Physical exercise protocols utilized and outcomes achieved in older adults with Alzheimer’s disease

The electronic databases searched included the United States National Library of Medicine (PubMed), Web of Science, Scopus, Scientific Electronic Library Online (SciELO), Latin America and the Caribbean Literature on Health Sciences (LILACS), and Embase. The literature search was conducted in September 2023, limiting studies from 2014 onwards in the languages of Portuguese, English, and Spanish. To obtain keywords, researchers consulted the Health Sciences Descriptors (DeCS) from Bireme, available at: https://decs.bvsalud.org/. The following descriptors were utilized: Aging, Longevity, physical exercise, Alzheimer Disease, along with the boolean operators "AND" and "OR".

Keyword searches were applied to all scientific databases according to Chart 1.

**Chart 1.** Search strategies in the databases. Florianópolis, SC, Brazil, 2023.

<table>
<thead>
<tr>
<th>DATABASE</th>
<th>SEARCH STRATEGY</th>
</tr>
</thead>
<tbody>
<tr>
<td>PubMed/MEDLINE</td>
<td>(((aging OR longevity) AND (physical exercise) AND (Alzheimer Disease))).</td>
</tr>
<tr>
<td>Web Of Science</td>
<td>( ((physical exercise) AND (Alzheimer Disease) AND (aging OR longevity)) ; ((Alzheimer Disease AND (aging OR longevity) OR (physical exercise)))).</td>
</tr>
<tr>
<td>Scopus</td>
<td>(((physical exercise) AND (Alzheimer Disease) AND (aging OR longevity))</td>
</tr>
<tr>
<td>SciELO</td>
<td>Alzheimer Disease AND aging OR longevity OR physical exercise</td>
</tr>
<tr>
<td>LILACS</td>
<td>Aging OR longevity OR physical exercise AND Alzheimer; Alzheimer Disease OR aging OR longevity AND physical exercise; physical exercise OR Alzheimer Disease OR aging AND longevity</td>
</tr>
<tr>
<td>Embase</td>
<td>(((aging OR longevity) AND (physical exercise) AND (Alzheimer Disease)) ; (((physical exercise) AND (Alzheimer Disease) AND (aging OR longevity)); (((Alzheimer Disease) AND (aging OR longevity)) OR (physical exercise))).</td>
</tr>
</tbody>
</table>

Source: The authors.
The selection process followed the recommendations of the PRISMA-2020 consensus. Two researchers independently conducted the search, and in case of any disagreement, priority was given to more recent papers with higher methodological rigor. It is worth noting that a protocol with pre-established criteria was developed, and although there was a limitation on the inclusion year, the protocol prioritized the most recent studies with stronger scientific evidence, emphasizing the internal validity of the research according to the guidelines of the pyramid.\(^\text{12}\)

Initially, duplicate papers were excluded, and subsequently, the adequacy of titles and abstracts was evaluated. The remaining papers were read in full and selected according to the pre-established eligibility criteria.

The full texts of potentially eligible papers were independently reviewed by two authors based on the inclusion and exclusion criteria. Discrepancies were resolved through discussion and consensus between the two reviewers (A.D.B.A. and F.C.I.), and in case of disagreement, a third reviewer (I.B.N.) was consulted for a final opinion. Information on authors, year, population (mean age, sex proportion, sample size, treatment period), study design, and the model of instrument used to measure exercise program evaluation was obtained.

From eligibility, four specific topics of the protocol were observed: a) Whether the method was clarified and if there was indeed a randomized sequence; b) Whether the population matched the purpose of this research; c) Whether the interventions involved physical exercises for older adults diagnosed with Alzheimer’s; d) Whether the evaluated outcome of the respective studies matched the purpose of investigation of the present research. It is worth noting that if any information was not well clarified due to lack of data or any other reason, the authors of the selected papers for qualitative synthesis would be contacted to clarify the inadequately elucidated data.

Five criteria were considered for the evaluation of RCTs using the RoB 2 tool: a revised Risk-of-Bias tool from Cochrane for randomized trials.\(^\text{13}\) In the first stage, two authors independently verified and analyzed the scoring (A.D.B.A. and F.C.I.). In the second stage, two other authors jointly reached a consensus on the developed scoring results (A.S.M. and A.Q.N.). In case of disagreement, a third author would verify (I.B.N.). The assessment was carried out by two independent evaluators who considered five criteria for evaluating RCTs contained in the tool: (1) Bias in randomization; (2) Bias due to deviations from intended interventions; (3) Risk of bias due to missing outcome data; (4) Bias due to outcome measurement; (5) Bias due to reported outcome selection and other sources of bias.

In the RoB 2 tool, the risk of bias in each domain is classified as: low risk of bias, high risk, and unclear risk. For this study, the scoring was adapted as follows: studies to be included should have a low risk of bias in three out of the five domains of RoB 2, meaning that studies with a minimum relative frequency of 60% of low risk of bias would be included. However, it is important to emphasize that within this percentage, low risk of bias in domains one, two, and four was indispensable. In case of disagreement, a third author would conduct a new verification.

**DATA AVAILABILITY**

The dataset is not publicly available due to the preservation of the entire organizational process, containing a sequence of specific strategies of the current research group. Another factor was the acquisition of some details from eligible researches to establish and organize inclusion and exclusion criteria, since some information was obtained through contact with authors who requested confidentiality. Thus, it is the responsibility of researchers of this current research to release data repositories only upon request.

**RESULTS**

In the databases, 5,718 papers were identified. After the removal of 2,739 duplicates, 2,779 papers remained for analysis. In the first stage of screening, there was a comprehensive analysis of titles and abstracts with the support of the PICO question, excluding 2,763, resulting in 16 scientific papers.
Subsequently, two studies were retrieved through manual search and grey literature search on Google Scholar. Eighteen eligible papers remained for full-text reading, with seven being excluded from the analysis due to the following factors: four studies lacked details in the methods section; in two studies, the results of physical exercise for AD were not well elucidated in terms of statistical data; and one study presented a different outcome than the purpose of the current research. Consequently, eleven scientific studies remained, as depicted in Figure 1.

Among the selected studies, 27.3% were from Brazil, 18.2% from Italy, 18.2% from Denmark, 9.1% from France, 9.1% from Portugal, and 9.1% from Finland, with further details provided in Table 1.

Regarding the scores of the scale using the RoB 2 tool, two experimental studies obtained low risk of bias in five domains, which was the most significant proportion of low risk of bias, four scientific researches achieved low risk of bias in four domains, and five with only three domains (Table 2).

Figure 1. Flowchart of the selection process for the literature search. Florianópolis, SC, Brazil, 2023.

Source: Checklist by Page et al.10 for systematic reviews.
Table 1. General characteristics of the selected randomized controlled experimental studies in the qualitative synthesis. Florianópolis, SC, Brazil, 2023.

<table>
<thead>
<tr>
<th>First Author/ Year/Country</th>
<th>Sample/Sex/Study Type</th>
<th>EG/CG</th>
<th>Treatment Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angiolillo et al. 2023 / Italy</td>
<td>Older adults (n = 22) M 8 / F 14 RCT</td>
<td>EG (n = 9); CG (n = 13)</td>
<td>60 Minutes, 2x per week, 24 weeks</td>
</tr>
<tr>
<td>Stein et al. 2023 / Brazil</td>
<td>Older adults (n = 34) M 15 / F 19 RCT</td>
<td>TG (n = 18); CG (n = 16)</td>
<td>3x per week, 12 weeks</td>
</tr>
<tr>
<td>Chortane et al. 2022 / Tunisia</td>
<td>Older adults (n = 20) M 6 / F 14 RCT</td>
<td>IG (n = 11); CG (n = 9)</td>
<td>60 Minutes per week, 2x per week, 3 months</td>
</tr>
<tr>
<td>Musaeus et al. 2022/ Denmark</td>
<td>Older adults (n = 45) M / F (Not reported) RCT</td>
<td>EG (n = 24); CG (n = 21)</td>
<td>60 Minutes, 3x per week, 16 weeks</td>
</tr>
<tr>
<td>Ayed et al. 2021 / Tunisia</td>
<td>Older adults (n = 78) M 27 / F 51 RCT</td>
<td>EG (n = 25); CEG (n = 27); CG (n = 26)</td>
<td>20 minutes of moderate-intensity cycling at 60% of HRmax</td>
</tr>
<tr>
<td>Cezar et al. 2021 / Brazil</td>
<td>Older adults (n = 40) M 17 / F 23 RCT</td>
<td>IG (n = 20); CG (n = 20)</td>
<td>60 minutes, 16 weeks</td>
</tr>
<tr>
<td>Enette et al. 2020 / France</td>
<td>Older adults (n = 52) M 19 / F 33 RCT</td>
<td>EG (n = 31); CG (n = 21)</td>
<td>18 sessions of cycling for 30 minutes 2x per week, 9 weeks</td>
</tr>
<tr>
<td>Pedrinolla et al. 2020 / Italy</td>
<td>Older adults (n = 39) M 13 / F 26 RCT</td>
<td>EG (n = 20); CG (n = 19)</td>
<td>72 sessions of 90 minutes, 3x per week, 6 months</td>
</tr>
<tr>
<td>Sampaio et al. 2019 / Portugal</td>
<td>Older adults (n = 36) M 9 / F 27 RCT</td>
<td>EG (n = 19); CG (n = 18)</td>
<td>45 to 55 minutes per session, 2x per week, 6 months</td>
</tr>
<tr>
<td>Pedroso et al. 2018 / Brazil</td>
<td>Older adults (n = 31) M 8 / F 23 RCT</td>
<td>FE (n = 14); SG (n = 17)</td>
<td>60 minutes, 3x per week, 12 weeks</td>
</tr>
<tr>
<td>Pertilla et al. 2018 / Finland</td>
<td>Older adults (n = 194) M 119 / F 75 RCT</td>
<td>EG (n = 129); CG (n = 65)</td>
<td>2x per week, 1 year</td>
</tr>
</tbody>
</table>

M: male; F: female; RCT: Randomized controlled trial; EG: experimental group; CG: control group; TG: training group; IG: intervention group; CEG: Combined Exercise Group; FE: Functional Exercise; SG: social group; HRmax: maximum heart rate. Source: The authors
DISCUSSION

The present systematic review identified that stimulating the attention of older adults is a relevant process to be explored within protocols, aiming to establish greater convergence and improvement in selective attention. Thus, the executive function, which requires brain organization and planning, emerged as a favorable predictor for enhancing the daily living activities of an older adult diagnosed with Alzheimer’s.

The earliest and most relevant aspect of Alzheimer’s disease (AD) is the impairment of episodic memory\(^1\). It comprises distinct cognitive processes, such as the encoding of target information (learning) and subsequent retrieval, each involving complex neural systems. In the preclinical phase, characteristic symptoms include declines in verbal episodic memory, such as the ability to remember details of daily and remote experiences with context. Prolonged exposure to PM2.5 has been shown to increase the similarity scores of AD patterns by 22.6% (95% CI: 1% to 68.9%) and 10.7% (95% CI: 1.0% to 30.3%) overall\(^7\).

<table>
<thead>
<tr>
<th>Authors</th>
<th>Low bias score according to Cochrane Handbook OS/MS</th>
<th>Relative Frequency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angiolillo et al. / 2023</td>
<td>4/5</td>
<td>80.0</td>
</tr>
<tr>
<td>Stein et al. / 2023</td>
<td>4/5</td>
<td>80.0</td>
</tr>
<tr>
<td>Chortane et al. / 2022</td>
<td>5/5</td>
<td>100.0</td>
</tr>
<tr>
<td>Musaeus et al. / 2022</td>
<td>3/5</td>
<td>60.0</td>
</tr>
<tr>
<td>Ayed et al. / 2021</td>
<td>4/5</td>
<td>80.0</td>
</tr>
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</tr>
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<td>Sampaio et al. / 2019</td>
<td>3/5</td>
<td>60.0</td>
</tr>
<tr>
<td>Pedroso et al. / 2018</td>
<td>5/5</td>
<td>100.0</td>
</tr>
<tr>
<td>Pertilla et al. / 2018</td>
<td>3/5</td>
<td>60.0</td>
</tr>
</tbody>
</table>

OS: obtained score; MS: maximum score. Source: The authors

At the onset of the disease, deficits in executive functions responsible for processing speed, language, and visuospatial skills can also be observed\(^1\). Executive function is a cognitive process that promotes the planning, coordination, and regulation of higher-order behavior. Deficits in executive functions are associated with a reduction in activities of daily living (bathing, eating, using the toilet), instrumental activities of daily living (managing finances, shopping, preparing meals), overall cognitive decline, and increased mortality\(^16,17\).
Thus, executive function appears to be a cognitive process that promotes the planning, coordination, and regulation of behavior in higher cortical areas.

The combination of exercises suggested a congruent possibility when the purpose is the development of executive functions. In a comparison between the exercise group (EG), combined exercise group (CEG) (physical exercise and cognitive games), and control group (CG), in the assessment of executive function, the CEG took less time to complete the task than the EG (71.62±1.73 versus 81.50±1.70, p<0.001), and when compared with the CG, 71.62±1.73 versus 94.83±1.71, respectively (p<0.001). In the analysis of the weighted score relative to the raw score of the forward order (Test Digit span forward), the CEG achieved a better score than the EG (3.52±0.03 versus 3.37±0.03, p=0.002), and when compared with the CG, (3.52±0.03 versus 3.15±0.03, respectively (p<0.001).

The neurobiological bases of behavioral changes in AD are not precisely known and/or fully elucidated. However, an association between lower executive function and the progression of behavioral disturbances has been described in AD. These behavioral changes result from dysfunctions in complex brain circuits influenced by neurotoxic proteins such as amyloid, tau, alpha-synuclein, and TDP-43 (Transactive DNA-binding protein 43). These abnormalities in circuits lead to behavioral syndromes, where genetic, neurobiological, and resilience factors contribute to the final behavior exhibited by the patient, which may include agitation, psychosis, apathy, and sleep disturbances.

The cognitive impairment in AD involves progressive degeneration, which can make it difficult for patients to understand and follow the instructions of an exercise program. This can lead to lack of adherence and understanding of the proposed activities. Another issue is advanced age, as it can result in physical frailty and motor limitations, which hinder participation in more intense physical exercises.

Another factor that hinders exercise practice in patients with AD is the presence of neuropsychiatric symptoms such as depression and anxiety, which are common in the disease. These symptoms can demotivate patients and make it more challenging to initiate and maintain a regular exercise program. Additionally, the need for proper supervision and guidance during exercise, especially in patients with moderate or severe Alzheimer’s, can be a hurdle as it requires additional resources from caregivers and healthcare professionals.

Finally, the lack of specific and adapted exercise programs for patients with Alzheimer’s can be a limiting factor. The mentioned studies suggest that the combination of exercises with cognitive games or multicomponent exercises can be beneficial, but often these programs are not widely available. Therefore, it is essential to raise awareness about the importance of exercise for patients with Alzheimer’s and develop supportive strategies that address these specific challenges in order to improve the quality of life and physical function of these patients.

Regarding physical exercise tests applied to older adults with AD, a significant portion of the research has applied protocols of 60 minutes over a period of more than two weeks. Other studies have utilized cycling as physical exercise, conducting 18 sessions of 30 minutes, twice a week, over nine weeks. In contrast to the previous study, research has shown that there was no significant improvement in cognitive function; however, there was improvement in aerobic conditioning and functional capacities. In a treadmill aerobic exercise protocol, at a speed of four kilometers per hour, three times a week for 12 weeks, no significant improvement in cognitive function was identified. However, the training group showed better performance in aerobic fitness after the exercise protocol compared to the control group and their own performance before the exercise intervention.

Another proposal involved the use of Nordic walking (NW) strategy, which consisted of one hour of exercise per week for 24 weeks without standardization of intensity level, with maximum effort under the guidance of a specialized coach. The session was divided into 10 minutes of warm-up, 40 minutes of stretching, and 10 minutes of cooldown. The results indicated that the NW protocol over 24 weeks could significantly improve cognitive function in patients with Alzheimer’s.
The Short Physical Performance Battery (SPPB) test was used to assess physical functioning and mobility by involving strength, balance, endurance, and multitasking\(^29\). The exercise intervention was conducted at the older person's residence for approximately one hour, twice a week, for one year, which significantly modified the risk of falls among individuals with Alzheimer's who were taking antihypertensive and psychotropic medications. The intervention group (IG) took antihypertensive medication, and the incidence rate was reduced by 0.5 falls per person-year (95% CI 0.4–0.6), while the CG increased by 1.5 falls per person-year (95% CI 1.2–1.8; \(p<0.001\))\(^29\).

A study conducted in Portugal, nevertheless, used the American College of Sports Medicine (ACSM) guidelines, incorporating aerobic exercises, muscle strengthening exercises, flexibility exercises, balance, and postural exercises with two sessions per week on non-consecutive days. It was found that a six-month exercise program can improve cognitive and physical functions in older individuals with mild to moderate Alzheimer's disease\(^19\). Similar results were observed in a proposed 12-week protocol, with increasing intensity each week using combined exercises in daily tasks containing aerobic endurance, flexibility, muscular endurance, and balance\(^9\).

Researchers utilized a protocol consisting of 72 exercise sessions, lasting 90 minutes each, three times a week for six months. The activities involved joint mobilization, where patients underwent a total of 45 minutes of resistance exercises divided into 15-minute cycling on a cycle ergometer, 15 minutes of treadmill walking, and 15 minutes of arm rotation on a specific ergometer. In flow-mediated dilation (FMD), exercise induced an increase in vascular function in patients with Alzheimer's disease (+3.725%, \(p<0.001\)), passive limb movement (PLM) peak delta (+99.056 ml/min, \(p=0.004\)), and in blood sample analysis, vascular endothelial growth factor (VEGF) increased (+8.825 pg/ml, \(p=0.004\))\(^20\).

Similarly, when functional exercises targeted aerobic endurance, strength, and balance, using a Home-based multimodal exercise program for older adults with Alzheimer's disease (AD-HOMEX) to address frailty, the results were positive and significant according to the Edmonton Frail Scale (EFS) (\(p<0.01\)). It was concluded that AD-HOMEX reduces frailty in older individuals with Alzheimer's, suggesting that home-based physical exercises be implemented as a treatment for these patients\(^28\).

A study in Denmark utilized the Tinetti Balance Subscale, which is a tool for assessing abnormalities in balance and gait in older individuals during various everyday situations, in addition to the Berg Balance Scale, which consists of an assessment tool for balance, the Timed Up and Go Test, which quantitatively evaluates mobility, static balance, and dynamic balance, and The Walking and Talking Test, which assesses the risk of falls. The older participants underwent the tests for one hour, twice a week, over a period of three months, resulting in improvement in walking, mobility, and posture in older adults with Alzheimer's disease\(^24\).

Lastly, the research Preserving Cognition, Quality of Life, Physical Health and Functional Ability in Alzheimer's Disease: the Effect of Physical Exercise (ADEX trial) conducted weekly 60-minute sessions of aerobic exercises, three times a week, for 16 weeks, at moderate to high intensity\(^27\). Unlike the other studies, the results indicated that the applied protocol did not alter functional connectivity in patients with AD. Such findings may be related to the level of the disease, which could be very advanced and suggests being a variable impacting the outcomes of protocols in patients with AD.

Therefore, the treatment period demonstrates relevance and the need for further investigations, as the results indicated that physical exercise, after a duration of three months, promotes improvement in neurophysiological and neuropsychological performance in older adults with AD.

This study had some limitations, such as the restricted sample size in some studies included in the qualitative analysis (Table 1). Although internal validity was ensured, it complicates the understanding of their future applicability and/or generalizability process.

Another limiting factor was the non-use of a validated instrument on the percentage of agreement.
between the authors, although the researchers used the established protocol with inclusion criteria to be advocated as support. We recommend that new studies be conducted and specified with further clarifications, such as sports experience, volume, and level of training, so that the effects of physical exercise practice in patients with Alzheimer's can be evaluated.

CONCLUSION

Depression, anxiety, and difficulty in comprehension are the main factors that compromise the participation of individuals with Alzheimer's in exercises aimed at physical stimulation and are the main predictors that hinder perceptual-motor development. Protocols with combined exercises seem to better favor executive function in older adults with Alzheimer's disease (AD). Awareness of physical exercise is crucial from the beginning of treatments, with the suggestion to prioritize improvements in attention in older adults with Alzheimer's. The peculiarities of the relationship between activities of daily living and functional capacity of patients with Alzheimer's still represent a gap to be explored, as well as the prescription of specific exercises that consider both the level of attention and the stage of the disease.

AUTHORSHIP

• Állef Diego Bonfim de Andrade - conception; data analysis and interpretation; manuscript writing; approval of the version to be published; responsible for all aspects of the work.
• Francisco Camolesi Ide - design; data interpretation; critical revision and approval of the version to be published.
• Ariella Sebastião Mangia - design; data interpretation; critical revision and approval of the version to be published.
• Alessandra Catarina Martins - data collection; conception and data analysis and interpretation; critical revision and approval of the version to be published.
• Ananda Quaresma Nascimento - data analysis and interpretation; manuscript writing; critical revision and approval of the version to be published.
• Iramar Baptistella do Nascimento - manuscript writing; responsible for all aspects of the work, ensuring accuracy or integrity of any part of the work and approval of the version to be published.

REFERENCES


