What do we know about the effects of physical exercise on dementia, without Alzheimer's? systematic review of international clinical trials

¿Qué sabemos sobre los efectos del ejercicio físico en la demencia, excluyendo el Alzheimer? una revisión sistemática de ensayos clínicos internacionales

Lidia Nunes de Souza, Guilherme Torres Vilarino, Alexandre Andrade
Santa Catarina State University (Brasil)

Abstract. Dementia is characterized by a progressive decline in cognitive and physical functions beyond that expected in normal aging affecting the quality of life and that of those close to them. Except for Alzheimer's, few studies have summarized exercise results in dementia. Thus, the aim of the study was to analyze the effects of physical exercise (PE) on dementia in older adults, not including Alzheimer's. This systematic review of the literature followed the recommendations of PRISMA and was conducted in September 2022 in the databases: Scopus, Web of Science, PubMed, and EBSCO. The search was performed without restriction regarding the date of publication. Experimental studies that analyzed people with dementia submitted to PE were included. In total, 17 studies met the inclusion criteria, with eight of them from the Asian continent. The studies showed that PE, especially aerobic exercise, benefits physical and cognitive aspects of older people with dementia. However, better results were seen when PE was associated with cognitive therapies. Most of the studies evaluated older people who were at different stages of the disease. Aerobic exercise was present in 70.58% of studies. The intervention periods ranged from four to 65 weeks, with combined exercises three times a week in five studies, and the intensities varied according to the type of PE. The benefits showed improvements in the performance of daily activities and cognitive functions. However, some studies have low methodological quality, which could interfere with the results. Further research is required on PE and dementia in older adults.

Keywords: Dementia, Exercise, Elderly, Cognition, Systematic Review.

Resumen. La demencia se caracteriza por un deterioro progresivo de las funciones cognitivas y físicas más allá de lo esperado en el envejecimiento normal, lo que afecta la calidad de vida tanto de los afectados como de quienes les rodean. Excepto por el Alzheimer, pocos estudios han resumido los resultados del ejercicio en la demencia. Por lo tanto, el objetivo del estudio fue analizar los efectos del ejercicio físico (EF) en los adultos mayores con demencia, excluyendo el Alzheimer. Esta revisión sistemática de la literatura siguió las recomendaciones de PRISMA y se llevó a cabo en septiembre de 2022 en las bases de datos: Scopus, Web of Science, PubMed y EBSCO. La búsqueda se realizó sin restricciones en cuanto a la fecha de publicación. Se incluyeron estudios experimentales que analizaron a personas con demencia sometidas a EF. En total, 17 estudios cumplieron con los criterios de inclusión, de los cuales ocho eran del continente asiático. Los estudios mostraron que el EF, especialmente el ejercicio aeróbico, beneficia los aspectos físicos y cognitivos de las personas mayores con demencia. Sin embargo, se obtuvieron mejores resultados cuando el EF se combinó con terapias cognitivas. La mayoría de los estudios evaluaron a personas mayores en diferentes etapas de la enfermedad. El ejercicio aeróbico estuvo presente en el 70,58% de los estudios. Los periodos de intervención variaron de cuatro a 65 semanas, con ejercicios combinados tres veces a la semana en cinco estudios, y las intensidades variaron según el tipo de EF. Los beneficios mostraron mejoras en el desempeño de las actividades diarias y las funciones cognitivas. Sin embargo, algunos estudios presentaron baja calidad metodológica, lo que podría interferir en los resultados. Se requiere investigación adicional sobre el EF y la demencia en adultos mayores.

Palabras clave: Demencia, Ejercicio, Personas mayores, Cognición, Revisión sistemática.

Introduction

Population aging is a phenomenon that is observed all over the world (UN, 2017), and as a result, the number of disorders and diseases inherent to aging, such as dementia, is growing. Dementia is characterized by a progressive decline in cognitive and physical functions beyond what is expected in normal aging, affecting attention, learning, memory, language, and motor function (American Psychiatric Association, 2013; Liu et al., 2020; Logiudice & Warson, 2014). This makes simple daily tasks, such as remembering names, important dates, or how to perform everyday activities, a constant challenge. This loss of cognitive ability affects independence and self-esteem, contributing to a decrease in the quality of life (Aggarwal; Chaware; Aggarwal, 2022; Swinnen et al., 2021). Furthermore, dementia often leads to behavioral and emotional changes. Elderly individuals with dementia may experience agitation, apathy, depression, anxiety, and aggression, among other symptoms (Aggarwal; Chaware; Aggarwal, 2022; Lamb et al., 2018). These alterations can be perplexing and distressing for both them and their caregivers, further impacting their quality of life.

Due to the complications caused by the disease, in 2012 the World Health Organization (WHO) declared that the treatment of dementia should be a priority in public health, as it generates great economic, family, and social impacts (WHO, 2019). It is estimated that the world annual economic cost of treating dementia is approximately $818 billion, equivalent to 1.1% of global gross domestic product. In addition, the more severe the progression of symptoms, the greater the incapacity of the older adult, generating loss of autonomy and independence, thus, identity is impaired, as these individuals are unable to exercise their family and social role (Kolanowski et al., 2017; Okamura et al.,...
In this way, dementia directly affects the family structure and especially the caregiver, because, in addition to changes in the daily routine, there are physical, emotional, and financial overloads (Kolanowski et al., 2017).

It has been observed that dementia is more common among women, due to their longer life expectancy (Liu et al., 2020) and in the coming years, it is estimated that the number of individuals with dementia will increase considerably, from 50 million in 2017 to approximately 152 million by 2050 (WHO, 2019). Currently, approximately 5 to 8% of the population aged 60 years and over have dementia and in individuals between 85 and 90 years, the outlook increases to almost 50% (Alzheimer’s Disease International, 2019).

As Alzheimer’s is the most prevalent and the most widely studied dementia among older adults (Alzheimer’s Disease International, 2019), the other forms of dementia that affect both mental and physical health and socialization end up being underestimated, which demonstrates the need for specific studies, analyzing possible treatment strategies and minimizing symptoms. Among the other forms of dementia, we can mention vascular dementia, dementia with Lewy bodies, and frontotemporal dementia (Fymat, 2021; Alzheimer’s Disease International, 2019; Ienca et al. 2018).

Although there is no cure, several studies have developed actions to alleviate and even delay the symptoms of dementia, such as pharmacological treatments, cognitive therapies, and physical exercise (PE) (Lamb et al., 2018; Okamura et al., 2018). Drug treatment, despite being commonly used, is not efficient in improving all health conditions. In addition to being an expensive treatment, interactions between drugs for dementia and other comorbidities can occur, causing serious side effects (Sonnerstam et al., 2019). Cognitive therapy, on the other hand, has been widely used in older people with dementia because it helps to stabilize the condition or results in small improvements in cognitive and functional declines, in addition to being an easy-to-apply method with low financial cost (Careion et al., 2018; Tay et al., 2016). Like cognitive therapy, PE is a treatment that has no side effects, is easy to implement, and benefits many aspects of health. PE is already being used as a treatment in several populations such as patients with fibromyalgia (Andrade, Sieczkowska, & Villarino, 2019; Andrade, Steffens, et al., 2020; Sieczkowska et al., 2020; Sieczkowska et al., 2019; Parkinson’s (Rawson et al., 2019), and multiple sclerosis (Rooney, Albalawi, & Paul, 2020); demonstrating effectiveness in improving symptoms of depression (Andrade et al., 2017), mood states (Andrade et al., 2017; Curi et al., 2018; Andrade; Villarino et al., 2020), Obesity (Ceballos-Gurrola et al. 2020; Berelleza et al. 2021) and strength and functionality (Dittus et al., 2019).

However, the scientific literature still does not present a consensus regarding the benefits of PE practice on dementia in older adults. Studies show that aerobic exercise can increase the volume of the hippocampus and promote cerebral angiogenesis, increasing memory performance (Bossers et al., 2015; Groot et al., 2016; Karssemeijer et al., 2017) and improving brain vitality, in addition to reducing the risk of developing dementia in healthy older adults (Karssemeijer et al., 2017; Norton, et al., 2014). However, the systematic review carried out by Forbes et al. (2015) found that PE alone is not able to improve the clinical framework of patients with dementia. This result differs in parts from that presented by Lamb et al. (2018), where aerobic exercise and resistance exercise improved physical health but were not able to reduce the cognitive deficit in older people with mild and moderate dementia. Thus, there are gaps in the literature on the effects of PE in older people with dementia that need further investigation.

Although the current evidence on the isolated practice of PE does not show positive results in terms of dementia in older adults, the differences between PE modalities and the protocols used have not been investigated. In this way, systematic review studies can help to better understand the use of PE as an aid in the treatment of dementia, identifying the main benefits, best modality, which protocol should be used (intensity, volume, and frequency), and the effects in relation to the stages of dementia. Thus, the aim of this study is to analyze the effects of physical exercise on dementia in older adults, not including Alzheimer’s.

**Methods**

This systematic review was performed following the guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (Moher et al., 2015). It was registered in the International Prospective Register of Systematic Reviews (PROSPERO) under number CRD42020197554.

**Search Strategy**

The literature search was carried out in September 2022 in the electronic databases: Scopus, Web of Science, PubMed, and EBSCO. The search terms used by the researchers were obtained after consulting the Medical Subject Headings (Table 1).
Study selection

Two researchers (LNNS and GTV) independently selected the studies, and in the case of disagreement, a third researcher was consulted (AA). After excluding duplicate articles, the titles were read, then the abstracts were analyzed, and finally, the full texts of the studies that met the eligibility criteria were read.

Eligibility criteria

Eligibility for the study selection was determined according to the PICOS criteria (Moher et al., 2015), and is detailed in table 2.

Table 2.
Criteria for inclusion and exclusion of studies selected for review.

<table>
<thead>
<tr>
<th>Inclusion Criteria</th>
<th>Exclusion Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>P Participate</td>
<td>Elderly with dementia</td>
</tr>
<tr>
<td>I Intervention</td>
<td>Physical exercise</td>
</tr>
<tr>
<td>C Comparison</td>
<td>Elderly without dementia, sedentary control, healthy subjects</td>
</tr>
<tr>
<td>O Outcomes</td>
<td>Effects of physical exercise on dementia</td>
</tr>
<tr>
<td>S Study</td>
<td>Randomized Control Trial, Non Randomized Clinical Trial and pilot studies</td>
</tr>
<tr>
<td></td>
<td>Systematic review, case report and cross-sectional studies, book chapters or editorials</td>
</tr>
</tbody>
</table>

Data extraction

Data extraction was performed by two independent researchers (LNNS and GTV), and discrepancies were resolved by a third evaluator (AA). For the analysis and discussion of the results, the following data were extracted: author and study design, sample characteristics (age, sex, level of dementia), type of exercise, duration of intervention, intensity, and results on dementia.

Quality appraisal

This systematic review evaluated the quality of the included studies and the risk of bias using the Cochrane Collaboration Risk of Bias tool (Higgins et al., 2011), which includes criteria to identify bias in the selected studies that could interfere with the interpretation and conclusion. The bias analysis is divided into seven categories: generation of random sequence, concealment of allocation, blinding of participants, blinding of evaluators, incomplete outcomes, selective outcome reporting, and other biases. Bias risk assessment was performed by two researchers (LNNS and GTV). The kappa concordance index (Cohen, 1960) between the reviewers for each of the criteria was determined, and differences were resolved by consulting a third reviewer (AA) for a final opinion.

Results

Identification and selection of studies

The first stage of the database search identified 2536 studies, of which 700 duplicated studies were excluded. One hundred and thirteen studies were selected after reading the titles. In the review of abstracts, 78 studies were excluded, of these 30 were protocols, 17 were chapters in books or editorials, 16 evaluated animals, and 15 did not evaluate dementia. In the fourth stage, 35 articles were read in full, 22 were excluded because they were not clinical trials, and five did not evaluate older adults. Thus, 11 studies were selected for analysis, as shown in figure 1.

Bibliometric analysis

The studies were carried out in 15 countries, with the majority being published in Asia and the European continent. There were no studies developed in the African continent or in central America (Figure 2).

From the analysis of keywords, the 15 most frequent in the studies were identified, with the term "Dementia" being the most cited, present in 16 studies, followed by "Exercise" in 14, "Elderly" in 11, and "Randomized..."
controlled trial in nine. The study by Lamb et al. (2018) does not provide information about the keywords. The other words are illustrated in Figure 3 through a word cloud.

**Characteristics of included studies**

Of the seventeen articles included in this review, the oldest was published in 2006 (Stevens e Killeen, 2006) and the most recent were published in 2021 (Swinnen et al., 2021; Tanaka, Yamagami, & Yamaguchi, 2021). The study with the lowest mean age was that by Styliadis, Kartsidis, Paraskevopoulos, Ioannides e Bamidis (2015) with 70.42 ± 6.63 years, while the study by Tanaka et al. (2021) had the highest mean age with 88.10 ± 8.10 years. The total sample consisted of 65.7% of women (n=1054) aged ≥60 years. Most of the studies evaluated older people who were at different stages of the disease: all stages (Tanaka et al., 2021; Henskens, Nauta, Van Eeckeren, & Scherder, 2018; Lamb et al., 2018; Okamura et al., 2018; Cancela, Ayán, Varela, & Seijo, 2016), mild to moderate phases (Swinnen et al., 2021; Trautwein et al., 2020), and moderate to severe phases (Higuti, Barbosa, Corrêa, Izzo, & Ansai, 2020; Karssemeijer et al., 2019), and seven studies evaluated a sample of older people at the same stage: early (Tay et al., 2016), mild (Ho et al., 2020; Lee, Joung, & Shin, 2019; Cheng et al., 2014; Burgener, Yang, Gilbert, & Marsh-Yant, 2008), and moderate (Liu et al. 2020; Styliadis et al., 2015; Stevens, & Killeen, 2006). These and other characteristics can be seen in table 3.

<table>
<thead>
<tr>
<th>Reference</th>
<th>Sample</th>
<th>Interventions</th>
<th>Analyzed variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Swinnen et al. (2021)</td>
<td>45 elderlies; Age: 85.75 ± 6.0 years (35 women and 10 men)</td>
<td>Exercise and Combination therapy</td>
<td>Gait speed, balance, strength of the lower limbs, step reaction time, cognitive function, depression, quality of life, ADL.</td>
</tr>
<tr>
<td>Tanaka, Yamagami, &amp; Yamaguchi (2021)</td>
<td>41 elderlies; Age: 88.12 ± 10.0 years (18 women and 11 men)</td>
<td>Exercise and Combination therapy</td>
<td>Strength, aerobic exercise and cognitive stimulation - training group</td>
</tr>
<tr>
<td>Higuti et al. (2020)</td>
<td>17 elderlies; Age: 85.66 ± 5.3 years (9 women and 8 men)</td>
<td>Mobility exercise - training group</td>
<td>Mobility exercise with music - training group</td>
</tr>
<tr>
<td>Ho et al. (2020)</td>
<td>166 elderlies; Age: 79.0 ± 8.0 years (134 women and 12 men)</td>
<td>Exercise</td>
<td>Dance movement therapy (DMT) - training group, Body movement - training group, Loneliness, depression, mood, ADL, cognitive function, and cortisol</td>
</tr>
<tr>
<td>Trautwein et al. (2020)</td>
<td>163 elderlies; Age: 83.62 ± 7.0 years (137 women and 26 men)</td>
<td>Exercise and Combination therapy</td>
<td>Exercise Program (strength, balance, endurance, flexibility) and cognitive stimulation - training group, Gait performance, Balance, mobility, strength, and function of lower limb, cognitive function</td>
</tr>
<tr>
<td>Liu et al. (2020)</td>
<td>61 elderlies; Age: 85.72 ± 6.9 years (11 women and 8 men)</td>
<td>Exercise</td>
<td>Strength exercise - training group, Cognitive function, Depression, BDNF, plasma MCP-1, and plasma IGF-1</td>
</tr>
<tr>
<td>Karssemeijer et al. (2019)</td>
<td>115 elderlies; Age: 79.23 ± 6.9 years (63 women and 52 men)</td>
<td>Exergaming - training group</td>
<td>Exergaming - training group, Cognitive function, Depression, Gait performance, Episodic memory and working memory</td>
</tr>
<tr>
<td>Lee, Joung &amp; Shin (2019)</td>
<td>45 elderlies; Age: 79.24 ± 6.9 years (22 women and 13 men)</td>
<td>Exercise</td>
<td>Exercise Program (Fumanet exercise) – training Group, Cognitive function, Depression, Gait performance</td>
</tr>
<tr>
<td>Henskens et al. (2018)</td>
<td>87 elderlies; Age: uninformed (67 women and 20 men)</td>
<td>Exercise and Combination therapy</td>
<td>Strength and walking-training group, Activities of daily living - training group, Cognitive function, Physical function (Physical Endurance, Functional Mobility, Balance and Muscle Strength) Mood, behavior, and ADL.</td>
</tr>
<tr>
<td>Lamb et al. (2018)</td>
<td>415 elderlies; Age: 77.5 ± 7.0 years (163 women and 252 men)</td>
<td>Exercise</td>
<td>Strength and stationary bicycle - training group, Cognitive function, Neuropsychiatric symptoms, ADL, Physical fitness, and quality of life</td>
</tr>
<tr>
<td>Okamura et al. (2018)</td>
<td>100 elderlies; Age: 82.42 ± 8.0 (70 women and 30 men)</td>
<td>Exercise and Combination therapy</td>
<td>Arm ergometer cycle and visual exercise stimulation - training group, Cognitive function, Selective and continuous attention function, ADL.</td>
</tr>
<tr>
<td>Cancela et al. (2016)</td>
<td>189 elderlies; Age: 80.63 ± 8.32 (126 women and 63 men)</td>
<td>Exercise</td>
<td>Stationary bicycle - training group, Cognitive function, Memory, Depression, Functional independence (functional mobility and ADL) and neuropsychiatric disturbances.</td>
</tr>
<tr>
<td>Tay et al. (2016)</td>
<td>39 elderlies; Age: 79.26 ± 6.3 years (17 women and 22 men)</td>
<td>Exercise and Combination therapy</td>
<td>Strength, walking and cognitive stimulation - training group, Cognitive function, ADL, iADL, walking speed</td>
</tr>
<tr>
<td>Styliadis et al. (2015)</td>
<td>70 elderlies; Age: 70.80 ± 5.67 years (45 women and 25 men)</td>
<td>Exercise and Combination therapy</td>
<td>Exergaming - training group, Auditory processing and working memory - training group, Status and Cognitive function.</td>
</tr>
<tr>
<td>Cheng et al. (2014)</td>
<td>110 elderlies; Age: uninformed (71 women and 39 men)</td>
<td>Exercise and Combination therapy</td>
<td>Tai Chi - training group, Mahjong - training group, Cognitive function, Depression, Immediate/delayed recall, categorical fluency, and digit span</td>
</tr>
</tbody>
</table>

![Figure. 3. Keywords used in the articles selected for analysis.](image-url)
Characteristics of interventions (Physical Exercises)

It is noteworthy that only seven studies used PE as a single intervention (Ho et al., 2020; Liu et al., 2020; Karssemeijer et al., 2019; Lee et al., 2019; Lamb et al., 2018; Cancela et al., 2016; Stevens, & Killeen, 2006), while another five studies combined PE and cognitive therapy (Swinnen et al., 2021; Tanaka et al., 2021; Okamura et al. 2018; Tay et al., 2016; Styliadis et al., 2015; Cheng et al., 2014; Burgener et al., 2008, Burgener, Yang, Gilbert, & Marsh-Yant, 2008). Higuti et al. (2020) associated PE practice with music and Henskens et al. (2018) used the combination of PE and activities of daily living. Regarding the types of PE, aerobic exercise, in walking, exergaming, and cycling modalities, in isolation or combined with resistance exercise was used in almost all studies, except in the studies by Cheng et al. (2014) and Burgener et al. (2008) which investigated Tai Chi (Table 3) and the studies by Higuti et al. (2020) and by Lee et al. (2019) which investigated mobility exercises.

When analyzing the intervention protocol, six studies submitted patients to intervention three times a week (Swinnen et al., 2021; Karssemeijer et al., 2019; HenskenS et al., 2018; Cheng et al., 2014; Burgener et al., 2008, Stevens, & Killeen, 2006), four studies to once a week (Higuti et al., 2020; Lee et al., 2019; Okamura et al., 2018; Tay et al., 2016), three studies to twice a week (Tanaka et al., 2021; Ho et al., 2020; Trautwein et al., 2020), two studies to five interventions a week (Liu et al., 2020; Styliadis et al., 2015), and one study to daily sessions (Cancela et al., 2016). Regarding the intervention time, the shortest study lasted four weeks (Liu et al., 2020), while the longest studies lasted 40 weeks (Burgener et al., 2008) (Table 4).
In three studies, the intensity used for aerobic exercise was mild (Tay et al., 2016; Cancela et al., 2016; Stevens & Killeen, 2006), another three studies used mild to moderate intensities (Swinnen et al., 2021; Tanaka et al., 2021; Ho et al., 2020) and two studies used moderate to high intensities (Karssemeijer et al., 2019; Henskens et al., 2018; Lamb et al., 2018). Four articles used the Rating of Perceived Exertion (RPE) as a unit of measurement (Swinnen et al., 2021; Tanaka et al., 2021; Liu et al., 2020; Lamb et al., 2018), and one study used the maximum heart rate (Karssemeijer et al., 2019). The other studies do not mention the unit of measurement of the intensity of aerobic exercise (Ho et al., 2020; Henskens et al., 2018; Tay et al., 2016; Cancela et al., 2016; Stevens, & Killeen, 2006).

Resistance training consisted of exercises with machines and free weights that worked the large and small muscle groups, but only the study by Liu et al. (2020) specified how they determined the training load. In that study, the authors chose to work with an intensity between 40-50% 1RM. Exercise intensity was not reported in seven studies (Tanaka et al., 2021; Henskens et al., 2018; Okamura et al., 2018; Tay et al., 2016; Styliadis et al., 2015; Cheng et al., 2014; Burgener et al., 2008).

Regarding mobility exercises, only the study by Ho et al. (2020) specified the intensity (light to moderate) but did not inform the measurement unit. The training protocols used in each study are described in table 4.

**Results on physical and cognitive aspects**

Regarding physical variables, the analysis of results revealed that PE alone or combined with cognitive therapy is effective in improving performance in activities of daily living (Ho et al., 2018; Cancela et al., 2016; Lamb et al., 2018; Liu et al., 2020; Stevens, & Killeen, 2006; Okamura et al., 2018; TAY et al., 2016; Burgener et al. 2008), physical fitness (Lamb et al. 2018), and mobility (Trautwein et al., 2020; Cancela et al., 2016) in all stages of dementia in older adults.

With regard to cognitive aspects, it appears that PE alone (Liu et al., 2020; Cancela et al., 2016; Stevens, & Killeen, 2006) or combined with cognitive therapies (Swinnen et al. 2021; Cheng et al., 2014; Okamura et al., 2018; Styliadis et al., 2015; Tay et al., 2016) or interventions in activities of daily living (Henskens et al., 2018) increase cognitive performance, reducing the progression of dementia symptoms.

Positive changes in the biochemical markers for dementia, MCP-1, and IGF-1 were verified with the practice of aerobic and resistance exercises, both with moderate intensities (Liu et al., 2020). Improvements occurred in depressive symptoms with PE and interventions with activities of daily living (Henskens et al., 2018), in exergaming (Swinnen et al. 2021) in Dance Therapy (HO et al. 2018), and in tai chi (Burgener et al. 2008). Cheng et al. (2014) did not find beneficial effects of tai chi on depressive symptoms, but did find effects on memory, especially short-term memory. A similar result was found by Cancela et al., 2016, who observed significant improvements in memory functioning. On the other hand, Karssemeijer et al. (2019) found that both episodic memory, working memory, and executive functioning were not benefited by aerobic exercises (exergaming and stationary bicycle). However, these interventions were able to improve psychomotor speed, which is one of the most
important factors in predicting functional decline. The combination of aerobic exercise and cognitive stimulation positively affects attention and concentration at all stages of dementia. (Okamura et al., 2018).

**Practical implications**

The analysis of the results of the studies demonstrates that the practice of PE alone or combined with another therapy has important physical, psychological, and cognitive benefits in the lives of patients (Swinnen et al., 2021; Tanaka et al., 2021; Ho et al., 2020; Liu et al., 2020; Karssenmeijer et al., 2019; Okamura et al., 2018; Tay et al., 2016; Cancela et al., 2016; Cheng et al., 2014; Burgener et al., 2008; Stevens, & Killeen, 2006). It should thus be recommended that patients perform aerobic and resistance exercises, as they have important practical implications such as improvement in clinical symptoms of the disease and performance improvement in daily tasks. The practical implications of each study analyzed are presented in table 5.

<table>
<thead>
<tr>
<th>Table 5. References and Practical implications of physical exercise interventions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference</td>
</tr>
<tr>
<td>Tanaka, Yamagami &amp; Yamaguchi (2021)</td>
</tr>
<tr>
<td>Higuit et al. (2020)</td>
</tr>
<tr>
<td>Ho et al. (2020)</td>
</tr>
<tr>
<td>Liu et al. (2020)</td>
</tr>
<tr>
<td>Karssenmeijer et al. (2019)</td>
</tr>
<tr>
<td>Henskens et al. (2018)</td>
</tr>
<tr>
<td>Lamb et al. (2018)</td>
</tr>
<tr>
<td>Okamura et al. (2018)</td>
</tr>
<tr>
<td>Cancela et al. (2016)</td>
</tr>
<tr>
<td>Tay et al. (2016)</td>
</tr>
<tr>
<td>Styliadis et al. (2015)</td>
</tr>
<tr>
<td>Cheng et al. (2014)</td>
</tr>
<tr>
<td>Burgener et al. (2008)</td>
</tr>
<tr>
<td>Stevens &amp; Killeen (2006)</td>
</tr>
</tbody>
</table>

**Quality of studies and Risk of Bias**

According to the Cochrane Collaboration Risk of bias (Higgins et al., 2011), the Kappa agreement index between reviewers (LLNS and GTV) should be analyzed to assess the risk of bias in the studies. The agreement rate was greater than 85% for all criteria in the 17 studies. All studies presented a high risk of bias in criteria for allocation concealment, binding of participants and professionals, and binding of evaluators (figure 4). Although binding of participants has been assessed with a high risk of bias, due to the nature of the interventions (EF), binding of participants is impossible in some studies, a fact that does not affect the quality of the results.

**Discussion**

After analyzing the 17 studies included in the review, it appears that PE alone or combined with cognitive therapies improves medical, psychological, and cognitive conditions in older people with dementia, with both aerobic, mobility, and resistance exercises being recommended.

Most of the studies were conducted in European and Asian countries, with only one study being conducted in South America and none in the African continent or Central America. The interest in studying diseases related to the aging process in these countries can be justified due to the large population of older people present in the European and Asian continents (Balachandran et al., 2020; WHO, 2017). Furthermore, the study samples were mostly composed of women (65.7%), who are the majority among older adults (He, Goodkind, & Kowal, 2016; WHO, 2017), and who, because they have a longer life expectancy due to greater health care, end up suffering more from aging-related diseases, such as dementia.

The gradual decline in cognitive function is the main symptom of dementia and is associated with loss of memory, attention, reasoning, and the ability to perform daily tasks, negatively affecting the autonomy and independence of individuals (Liu et al., 2019; WHO, 2019; Etien, Shih & Piepmeier, 2015). A review by Groot et al. (2016) found that interventions with AE are beneficial for cognitive and physical function at any stage of dementia, with AE being able to promote neurobiological alterations that increase angiogenesis, synaptogenesis, and neurotransmitter synthesis in different brain structures and functions involved in cognition (Paillard, 2015; Di Liegro et al., 2019; Firth et al., 2018). Thus, in order to achieve a healthy old age, PE has been encouraged as a strategy to
reduce the loss of physical and cognitive abilities associated with age, with both aerobic and resistance exercises being used for this purpose.

In relation to AE, it was found that when performed in isolation it improves performance in daily tasks (Ho et al., 2020; Liu et al., 2020; Cancela et al., 2016; Stevens & Killeen, 2006), cognitive function in general (Ho et al., 2020; Cancela et al., 2016; Karssemeijer et al., 2019; Liu et al., 2020; Stevens & Killeen, 2006), and cognitive aspects (Karssemeijer et al., 2019), in addition to reducing levels of MCP-1 and increasing BDNF (Liu et al., 2020). AE, when used in conjunction with cognitive therapies, promotes neuroplasticity (Styliadis et al., 2015), and improves cognitive function (Swinnen et al., 2021; Styliadis et al., 2015; Okamura et al., 2018; Karssemeijer et al., 2019), attention and concentration (Okamura et al., 2018), and performance of daily activities (Swinnen et al., 2021; Styliadis et al., 2015; Okamura et al., 2018).

It was observed that there is no specific AE protocol for individuals with dementia, with different types of exercise, intensities, durations, and frequencies of training being used in different studies, which can produce different benefits. The study by Liu et al. (2020) subjected older people with dementia to stationary bicycle training at moderate intensity for 30 minutes a day and found improvements in cognitive function, while the study by Cancela et al. (2016) submitted patients to 15 minutes daily and the study by Karssemeijer et al. (2019) presented an intervention of 30 to 50 minutes 3 times a week. Despite the differences between the durations of the sessions, these studies demonstrate that AE was effective in improving cognitive function, alleviating dementia symptoms. It is also noteworthy that the results obtained in the study by Liu et al. (2020) occurred after just four weeks. Other AE modalities used were outdoor walks (Henskens et al, 2018), arm ergometer (Okamura et al., 2018), dance therapy (Ho et al., 2020), and exergaming (Karssemeijer et al., 2019; Styliadis et al., 2015).

Although current recommendations for older adults include at least 150-300 minutes of moderate-intensity aerobic physical activity or 75-150 minutes of vigorous-intensity aerobic physical activity per week (WHO, 2010), some researchers believe this recommendation may not be appropriate for individuals with dementia, especially in the most severe stage (Forbes et al., 2015; Liu et al., 2020; Ho et al., 2020). This may justify the results of this study where the majority of studies opted for lower intensities (Ho et al., 2020; Cancela et al., 2016; Stevens & Killeen, 2006). However, when referring to the literature, it appears that there is no consensus on the best AE intervention protocol for individuals with dementia. This probably occurs due to the different types and etiologies of this disease, which produce different symptoms at different times (Forbes et al., 2015; Karssemeijer et al., 2017).

Few studies have been published evaluating the effects of RE on older people with dementia. The limited number of studies is believed to have occurred because AE tends to improve physical components more than cognitive functions in cases of dementia (Tyndall et al., 2018; Ten Brinke et al., 2015; Liu-Ambrose & Donaldson, 2009). Liu et al. (2009) found that RE does not significantly improve cognition among older people with dementia, but can prevent cognitive declines among healthy older adults. According to this study, RE can reduce morbidity, improve sarcopenia, and, consequently, fractures and falls. Other studies suggest that RE decreases frailty (Yoon, Lee, & Song, 2018), balance (Cadore et al., 2014; Yoon et al., 2018), strength (Brown et al., 2015; Cadore et al., 2014; Yoon et al., 2018), and performance of daily activities (Chen et al., 2020; Bossers et al., 2016; Lee & Don Kim, 2018). Although the physical benefits of RE are a consensus among researchers, some studies have shown that there may be benefits of this practice on cognitive function (Brown et al., 2015; Yoon et al., 2018).

Few studies have been published evaluating the effects of RE on older people with dementia.
significantly improve cognition among older people with dementia, but can prevent cognitive declines among healthy older adults. According to this study, RE can reduce morbidity, improve sarcopenia, and, consequently, fractures and falls. Other studies suggest that RE decreases frailty (Yoon, Lee, & Song, 2018), balance (Cadore et al., 2014; Yoon et al., 2018), strength (Brown et al., 2015; Cadore et al., 2014; Yoon et al., 2018), and performance of daily activities (Chen et al., 2020; Bosssers et al., 2016; Lee, & Don Kim, 2018). Although the physical benefits of RE are a consensus among researchers, some studies have shown that there may be benefits of this practice on cognitive function (Brown et al., 2015; Yoon et al., 2018).

Regarding RE, only one of the studies evaluated its effects in isolation, the study by Liu et al. (2020) compared RE with AE. The RE protocol consisted of exercises for the upper and lower limbs with 40-50% of 1RM. The results showed similar results on physical and cognitive variables between the two practices. Regarding sets and repetitions, the study by Liu et al. (2020) used 2 sets of 12, while Henskens et al. (2018) used 3 sets of 8 repetitions and Lamb et al. (2018) 3 sets of 20 repetitions, so it appears that there is no standardization in the number of sets, repetitions, and intensities.

In addition to the AE and RE, two articles used tai chi as an intervention (Cheng et al., 2014; Burgener et al., 2008) and three used mobility exercises (Higuti et al. 2020; Ho et al. 2020; Lee et al., 2019). Regarding tai chi, despite the interventions having the same weekly frequency (3 times a week) and different durations in the two studies (12 weeks versus 40 weeks, respectively), both found that this practice can alleviate the degenerative effects and symptoms in cases of moderate dementia. Similar studies suggest that in the early stages of the disease, tai chi can delay or slow cognitive degeneration (Anderson, et al., 2017; Lim et al., 2019; Nyman et al., 2019). Cheng et al. (2014) found that although tai chi improves memory components, the results do not differ from Mahjong practice. According to the authors, both practices preserve cognitive functioning and may delay declines from dementia, including depressive symptoms. Burgener et al. (2008) found 20 weeks of tai chi combined with cognitive training were sufficient to alleviate and delay the derogatory effects of dementia, reduce depression, and improve self-esteem, balance, and muscle strength. However, the authors found that from the twentieth week onwards there is stabilization of physical and cognitive symptoms. Even though it is not an expected result, stabilization can represent positive effects, as dementia is characterized by progressive declines in performance. The scientific literature still lacks a consensus on the best intervention protocol for older people with dementia to benefit from the practice of tai chi. In this review, it was found that short interventions can have good results, and tai chi, performed in the short or long term, has a positive impact on physical and cognitive health as well as on social life in patients at any stage of dementia (Yang et al., 2020; Liu et al., 2019).

With regard to mobility, although studies differ in the duration and frequency of the intervention, it was found that this modality, when performed alone, has little or no effect on physical and cognitive performance in older people with dementia. Ho et al. (2020) when comparing the effects of dance therapy and mobility exercises in older people with moderate dementia, observed that two sessions for 12 weeks were sufficient to improve loneliness, depression, mood, and performance of daily tasks in dance therapy practitioners. No positive effect on these variables was observed in the mobility exercises group. Higuti et al. (2020) found that interventions with mobility exercises alone or combined with music therapy, performed once a week for 12 weeks, did not improve cognitive function or functional capacity in patients with moderate and severe dementia. Although there were no gains, there was no loss of these functions during the intervention, suggesting some delay in the degeneration caused by the disease. In the study conducted by Lee et al. (2019), although the authors consider mobility exercises an effective intervention for locomotion and socialization, they did not benefit cognitive function or reduce depressive symptoms in mild cases of the disease.

Although PE, alone or in combination, provides physical and cognitive benefits in older people with dementia, some studies suggest that its practice is unable to prevent the progression of dementia (Trautwein et al., 2020; Henskens et al., 2018; Lamb et al., 2018). Henskens et al. (2018) and Lamb et al. (2018) found that the combination of resistance and aerobic exercises, performed at moderate to high intensities, is able to benefit physical fitness and handgrip strength only in mild and moderate cases of dementia. Neither study found any benefit from this intervention on other physical and cognitive functions, suggesting that this modality of PE does not reduce cognitive decline. Likewise, Trautwein et al. (2020) found that a combined PE program involving stretching, balance, flexibility, and resistance, performed for 16 weeks at moderate intensity, was not sufficient to promote motor or cognitive benefits in elderly people with dementia. Two reviews found results similar to these, verifying that the practice of physical exercise can have null effects on cognition, especially in the severe stage of the disease (Forbes et al., 2015; Groot et al., 2016).

Strengths and Limitations of the Study

Some limitations must be noted. The analysis of intervention protocols was limited due to the lack of data related to the intensity of the PE. In addition, due to the diversity of interventions and the low number of studies, it was not possible to conclude which type of exercise is most efficient for dementia in older adults.

However, this is one of the few studies to address dementia without focusing on Alzheimer’s, since most of the research produced analyzes Alzheimer’s disease and excludes other types of dementia. Investigating how physical exercise works in dementia in general can help health professionals and families to use physical exercise to
alleviate, delay, and even prevent negative events from this disease, in order to provide better quality of life for patients and their caregivers and close relatives.

**Conclusion**

The recommendation to incorporate PE as part of the treatment for elderly individuals with dementia is a highly valuable strategy that has been gaining increasing support from scientific evidence. Research in this field has shown promising results, pointing to significant improvements in daily functional capacity and cognitive skills in these patients. This underscores the importance of PE as an essential component of comprehensive care for individuals with dementia. It is crucial to understand that results may vary depending on the stage of the disease and the individual characteristics of each patient. Each person with dementia is unique, and therefore, it is important to tailor therapeutic approaches, including PE, to their specific needs. However, it is worth noting that some studies investigating the effects of PE on dementia patients have methodological limitations that may affect the reliability of their results. This highlights the pressing need for conducting more rigorous research in this area to fully understand how exercise can benefit elderly individuals with dementia and how these benefits can be optimized. Therefore, continuous research and the improvement of therapeutic strategies are essential to address this public health challenge more effectively.

**References**


of Medical Science, 189(1), 341-347. 

- 1013 - 
Retos, número 51, 2024 (1º trimestre)