



## The benefits of physical exercise on mental health and cognitive decline in aged people: An integrative review


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**Objective:** to analyze the scientific production about the impact of physical exercise on aged people's mental health. **Methodology:** this is an integrative literature review carried out in 2021 with the following guiding question: Which are the benefits of physical exercise on aged people's mental health? The search for productions was conducted in the Scientific Electronic Library Online, Web of Science and National Library of Medicine from the National Institutes of Health databases, using the following controlled descriptors; "aged", "physical exercise", "mental health" and "cognitive dysfunction". **Results:** after applying the inclusion and exclusion criteria, as well as reading the titles and abstracts and a subsequent full reading of the studies, 19 productions remained, whose level of evidence was analyzed. The results revealed the following benefits related to the practice of physical exercises: better scores in the Mini Mental State Examination (MMSE); better self-perception of mental health; prevention of cognitive decline and delay in its progression; decrease in depressive signs and symptoms; and development of effective and long-lasting social relationships. **Conclusion:** the articles revealed that practicing physical exercise has benefits for mental health; better self-perception of mental health; prevention of cognitive decline and delay in its progression; reduction of depressive signs and symptoms; and development of effective and long-lasting social relationships.

**Descriptors:** Aged; Physical Exercise; Mental Health; Cognitive Dysfunction.

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## Os benefícios do exercício físico na saúde mental e no declínio cognitivo do idoso: uma revisão integrativa

**Objetivo:** analisar a produção científica acerca dos efeitos positivos do exercício físico na saúde mental e no declínio cognitivo do idoso. **Metodologia:** trata-se de uma revisão integrativa da literatura, realizada em 2021, cuja pergunta norteadora foi: Quais são os benefícios do exercício físico na saúde mental dos idosos? A busca das produções foi realizada nas bases de dados *Scientific Electronic Library Online*, *Web of Science* e *National Library of Medicine/National Institutes of Health*, por meio da utilização dos descritores controlados “aged”, “physical exercise”, “mental health” e “disfunção cognitiva”. Os artigos foram analisados por 2 pesquisadores e, após extração dos resultados, outro pesquisador realizou a revisão dos dados. **Resultados:** após aplicação dos critérios de inclusão e exclusão, bem como leitura de título e resumo e posterior leitura completa dos estudos, restaram 19 produções cujo nível de evidência foi analisado. Os resultados revelaram os seguintes benefícios relacionados à prática de exercícios físicos: melhores pontuações no Mini Exame do Estado Mental (MEEM); melhor autopercepção da saúde mental; prevenção do declínio cognitivo e retardo em sua progressão; diminuição dos sinais e sintomas depressivos e desenvolvimento de relações sociais efetivas e duradouras. **Conclusão:** os artigos analisados mostraram que a prática de exercícios físicos pelos idosos pode auxiliar no controle dos prejuízos cognitivos e no surgimento de problemas de saúde mental, e proporcionar o desenvolvimento de relações sociais efetivas e duradouras, fatores relacionados à melhor qualidade de vida e bem-estar.

**Descritores:** Idoso; Exercício Físico; Saúde Mental; Disfunção Cognitiva.

## Los beneficios del ejercicio físico sobre la salud mental y el deterioro cognitivo en adultos mayores: una revisión integradora

**Objetivo:** analizar la producción científica sobre el impacto del ejercicio físico en la salud mental de las personas mayores. **Metodología:** se trata de una revisión integradora de la literatura, realizada en 2021, cuya pregunta orientadora fue: ¿Cuáles son los beneficios del ejercicio físico en la salud mental de las personas mayores? La búsqueda de producciones se realizó en las bases de datos *Scientific Electronic Library Online*, *Web of Science* y *National Library of Medicine del National Institutes of Health*, utilizando los descriptores controlados “anciano”, “ejercicio físico”, “salud mental” y “disfunción cognitiva”. **Resultados:** después de aplicar los criterios de inclusión y exclusión, así como de la lectura del título y resumen y posterior lectura completa de los estudios, quedaron 19 producciones, sobre las cuales se analizó el nivel de evidencia. Los resultados revelaron los siguientes beneficios relacionados con la práctica de ejercicios físicos: mejores puntajes en el Mini Examen del Estado Mental (MMSE); mejor autopercepción de la salud mental; prevención del deterioro cognitivo y retraso en su progresión; disminución de los signos y síntomas depresivos y desarrollo de relaciones sociales efectivas y duraderas. **Conclusión:** los artículos revelaron que la práctica de ejercicio físico por los adultos mayores puede ayudar a controlar el deterioro cognitivo y la aparición de problemas de salud mental, y propiciar el desarrollo de relaciones sociales efectivas y duraderas, factores relacionados con una mejor calidad de vida y bienestar.

**Descriptores:** Anciano; Ejercicio Físico; Salud Mental; Disfunción Cognitiva.

## Introduction

Population aging is a clear global reality and has been outlined accompanied by profound social, epidemiological and cultural transformations. Globally, it is estimated that, by 2050, the population will include nearly two billion people aged at least 60 years old, the majority living in developing countries<sup>(1)</sup>. In Brazil, according to data made available in 2011 by the IBGE, the numbers of aging account for 27.8 million people aged 60 years old or more, representing 13.7% of the Brazilian population; in the projections for 2050, this is estimated to reach 64 million, representing almost 30% of the population<sup>(2)</sup>.

Senescence is a physiological (normal) process that affects aged people's life during their aging process; however, when there is cognitive decline that can be accompanied by senility, pathological changes occur, which can signal the presence of dementia syndromes when they present themselves in a progressive and intensified way, causing a reduction in older adults' quality of life<sup>(3)</sup>. In the current epidemiological transition, characterized by population aging, there is an increase in the prevalence of chronic non-communicable diseases (CNCs), which usually cause significant cognitive decline. A study carried out in 2013 in southern Brazil revealed that the prevalence of cognitive dysfunction reached 34.1% of the older adults in a city from Rio Grande do Sul, with the most significant harms in women and in people with lower schooling levels and lower purchasing power<sup>(4)</sup>.

In the context of diseases that interfere with aged people's cognition, dementia is configured as the clinical expression of a series of pathologies, with Alzheimer's Disease (AD) as the most prevalent, representing nearly 70% of the dementia-related diseases. The worldwide incidence of AD has been growing exponentially in recent years, with an estimated 7.7 cases *per* 1,000 individuals/year in 2012<sup>(5)</sup>.

Once installed, the dementia syndrome imposes barriers to aged people's life, preventing them from carrying out their activities of daily living and rendering them increasingly dependent on care provided by third parties<sup>(6)</sup>. It is in this logic that actions to prevent and promote cognitive health are necessary, even if a person already has the syndrome, as there is the possibility of delaying its effects and seeking alternatives to adapt to the situations experienced with progression of the disease.

Among the health promotion actions to be developed with older adults, the practice of physical exercise (PE) stands out, as an active lifestyle is considered one of the primary factors for disease prevention and health improvements in all aspects<sup>(7)</sup>. In particular, the influence of PE on the mental health of

these individuals has been addressed as positive in the literature, mainly when it refers to their social inclusion after beginning such practice<sup>(8)</sup>.

This review is justified because it is a way of knowing the mental health benefits arising from the PE practice, thus enabling the results of this paper to be used by professionals from the health and related areas in order to improve aged people's mental health and, consequently, their quality of life. In addition to that, the knowledge synthesis arising from the results of this research may assist in the construction of diverse evidence to support guidelines for better practices to increase the quality of life of the aged population. The results of this study may enable the initiation of findings that, later on in future research studies, allow specifying the findings for particular exercises.

In view of the above, it can be observed that the practice of physical exercise by older adults is beneficial, mainly with regard to mental health promotion, exerting a positive influence on the quality of life of these individuals. Thus, the objective was to analyze the scientific production about the positive effects of physical exercise on mental health and cognitive decline in the aged population.

## Methodology

This is an integrative literature review developed from the six stages proposed by Mendes, Silveira and Galvão, namely: (1) Identification of the research topic and the guiding question; (2) Definition of inclusion/exclusion/sampling criteria; (3) Categorization of the studies selected; (4) Evaluation of the studies; (5) Interpretation of the results; and (6) Presentation of the review and knowledge synthesis<sup>(9)</sup>.

The research question was elaborated according to the PICO strategy, an acronym that means "Population, Intervention, Comparison and Outcomes", being an important strategy to formulate the guiding question for later search for evidence in the literature. Thus, P corresponded to Aged people, I was assigned to Practice of physical exercises, C does not apply and O identifies the Benefits for aged people's mental health arising from the practice of physical exercises; thus resulting in the following guiding question: Which is the impact of physical exercise on aged people's mental health?

The research was carried out in August and September 2021 in three virtual databases, namely: Scientific Electronic Library Online (SciELO), Web of Science and National Library of Medicine from the National Institutes of Health (PubMed).

To survey the articles, the keywords related to the controlled descriptors indexed both in the Health Sciences Descriptors (*Descritores de Ciências da Saúde*, DeCS) and in the Medical Subject Headings (MeSH) were

considered, namely: “*idoso*”, “aged”, “*exercício físico*”, “physical exercise”, “*saúde mental*”, “mental health” and “*disfunção cognitiva*”, “cognitive dysfunction”. It is noted that, for the *PubMed* and *Web of Science* databases, the descriptors written in English were used in the search and that, for the *SciELO* database, the descriptors in Portuguese were employed. The “AND” Boolean operator was used to group the descriptors. Thus, grouping of the descriptors was as follows: “aged AND physical exercise AND mental health AND cognitive decline” and “*idoso AND exercício físico AND saúde mental AND declínio cognitivo*”. The eligibility criteria for the articles were as follows: scientific productions in full, available free of charge and published in the last 10 years (from 2011 to September 2021) in Portuguese, English and Spanish. Editorials, letters to the editor, theses, dissertations, reports and articles that did not answer the guiding question of this review were excluded. The final sample consisted of 19 articles, described below.

With the *corpus* of articles defined, an in-depth reading and subsequent organization and analysis were performed, adopting an adaptation of the instrument already validated in the literature, which consists of a checklist divided into nine domains, intended to facilitate the description of the main data present in the articles<sup>(10)</sup>. It is noted that all the articles selected were reviewed by the research advisor to evaluate selection and extraction of the results from the articles in order to reduce possible measuring biases regarding the studies.

The articles were organized according to title, year of publication, journal, study objective, methodological design, conclusion and level of evidence<sup>(11)</sup> (Figure 1). The levels of evidence were evaluated based on the instrument used, where the value varied from 1 to 7<sup>(11)</sup>. The review content resulting from the critical analysis of the articles was prepared according to the similarity of thematic content addressed by the studies.

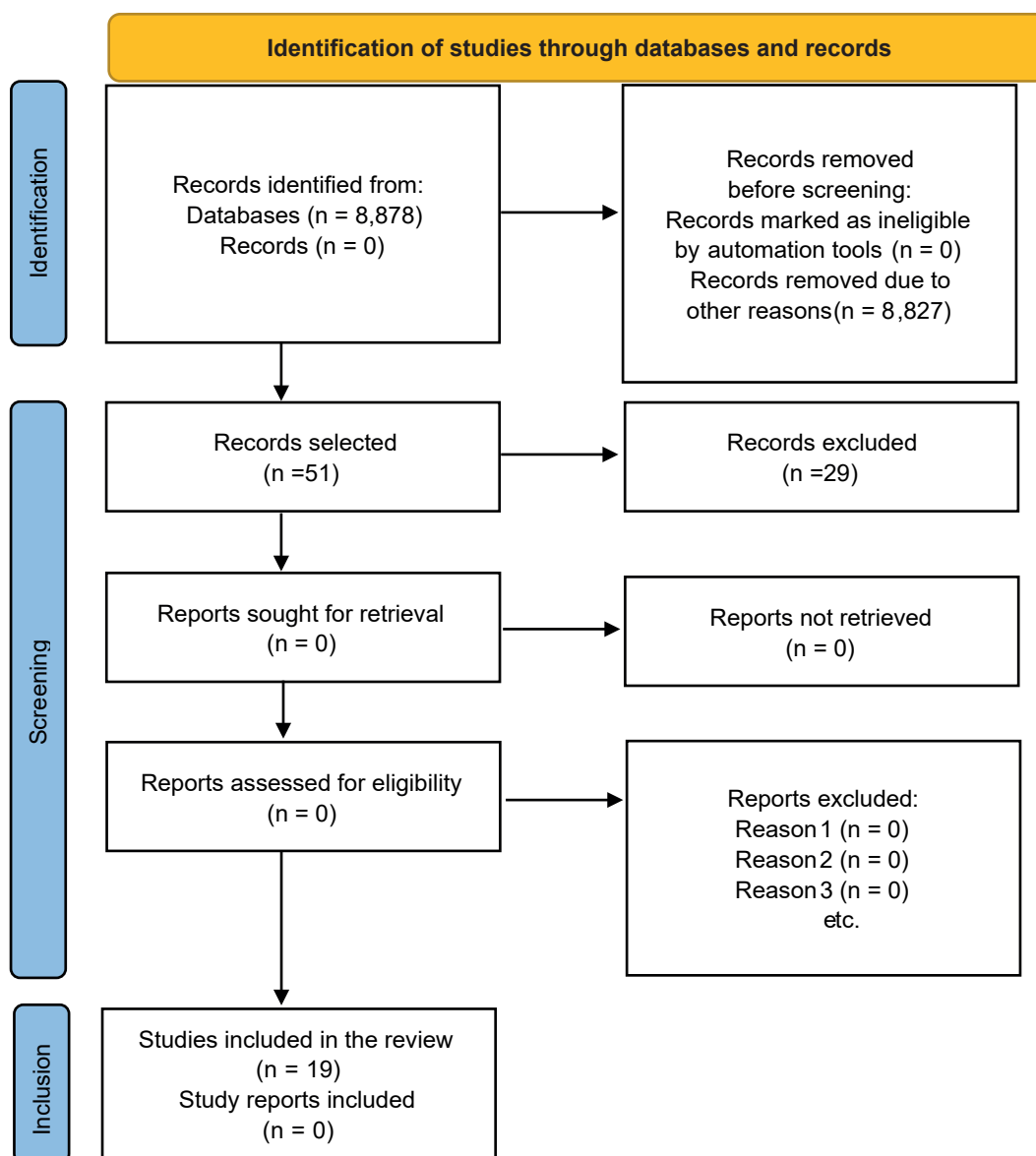
Type of evidence	Level of evidence	Description
Systematic review or meta-analysis	I	Evidence from a systematic review or meta-analysis of all randomized controlled trials or from guidelines based on systematic reviews of controlled trials.
Randomized controlled trial	II	Evidence obtained from at least one well-designed, randomized, controlled clinical trial.
Controlled trial without randomization	III	Evidence from a well-designed and controlled study without randomization.
Case-control or cohort study	IV	Evidence from a case-control or cohort study.
Systematic review of qualitative or descriptive studies	V	Evidence from a systematic review of qualitative and descriptive studies.
Qualitative or descriptive study	VI	Evidence from a single descriptive or qualitative study.
Opinion or consensus	VII	Evidence from the opinion of authorities and/or reports of experts' committees.

Figure 1 - Level of evidence by type of study. Redenção, CE, Brazil, 2021

With regard to the ethical aspects, as this is an integrative review involving data in the public domain, the opinion of a Committee of Ethics in Research involving human beings is waived. However, as they are universal access documents from original research studies, all copyrights were respected, duly referencing all the characteristics of the publications analyzed.

## Results

A total 6,074 scientific productions were found using the search strategies. Figure 2 below shows the flowchart consisting of the steps used to identify and select the articles for analysis, characterizing the data search.



Adapted from PRISMA, 2021

Figure 2 - PRISMA flowchart characterizing the search in the databases

Regarding the number of scientific productions identified and selected in each individual database, it is noted that 3,863 productions were found in *PubMed* and that, of these, 2,818 had been published in the last 10 years, 1,213 were articles, 1,119 were available in English, Spanish or Portuguese and 1,119 were available in full and free of charge. In the *SciELO* database, 11 papers were identified, of which seven were articles published in the last 10 years, available in English, Spanish or Portuguese, in full and free of charge. Finally, 2,200 papers were found on *Web of Science* and of these, 1,622 were published in the last 10 years, 1,508 were articles, 1,472 were available in English, Spanish or Portuguese and 693 were available in full and free of charge.

Thus, 1,119 productions from *PubMed*, seven from *SciELO* and 693 from *Web of Science* were pre-selected

for reading their titles and abstracts. Of these, the following did not answer the guiding question: 1,094 articles from *PubMed*, 7 from *SciELO* and 671 from *Web of Science*; with 51 articles remaining as pre-selection: 25 from *PubMed*, 4 from *SciELO* and 22 from *Web of Science*. Of all 51 articles, two duplicates and another 30 articles that did not answer the guiding question were excluded; therefore, this review was comprised by 19 articles.

Among the 19 articles, four were published in 2014 (n=4) and 2018 (n=4); three in 2015 (n=3) and 2017 (n=3); and one in 2014 (n=1), 2016 (n=1), 2013 (n=1), 2010 (n=1) and 2009 (n=1) each. As for the language, 16 articles (84.21%) were available in English and three (15.79%) in Portuguese. Regarding the databases, most of the articles were obtained from *Web of Science*

(n=13; 68.43%), followed by PubMed (n=4; 21.05%) and SciELO (n=2; 10.52%).

Most publications were from 2014 to 2018, with a higher number as of 2014. For the classification of the levels of evidence, levels I and II were considered as strong evidence; III and IV as moderate and, from V to VII as weak. As noted, there is predominance of descriptive studies that fall within level of evidence VI. The interest of several countries in producing knowledge on this theme is perceived, capable of generating diverse scientific evidence that supports the decision-making

practice for the multiprofessional team in the context of older adults, although the need to develop more studies with a methodological path of strong evidence such as Randomized Clinical Trials stands out. Thus, the need to develop more clinical trials directed to this theme is highlighted.

Figure 3 presents the characterization of all 19 scientific productions included in this review according to their numbering, titles and objectives of the studies, in addition to including the methods and levels of evidence of the study samples.

N	AUTHOR(S) / JOURNAL / YEAR	TITLE OF THE ARTICLE	OBJECTIVE	METHODS	CONCLUSION	LE*
01	Dias, et al. <i>Jornal Brasileiro de Psiquiatria</i> (2014)	<i>Diferenças nos aspectos cognitivos entre idosos praticantes e não praticantes de exercício físico.</i>	To compare the cognitive performance of aged people who practice and do not practice physical exercises.	A cross-sectional study was carried out with 104 older adults: 64 belonging to the Physical Exercise Practitioners Group (G1) and 40 belonging to the Non-Practitioners Group (G2), registered in a Health Center.	Aged individuals who practice physical exercises show better performance for simple reaction time, choice reaction time and assisted attention, when compared to aged individuals who do not do so.	VI
02	Bittar, et al. <i>Revista Brasileira de Geriatria e Gerontologia</i> (2013)	<i>Efeitos de um programa de jogos pré-desportivos nos aspectos psicobiológicos de idosas.</i>	To investigate the effect of a pre-sports game program ( <i>Jogos Pré-Desportivos</i> , JPD) on the psychobiological aspects of aged women.	A randomized clinical trial conducted with 53 aged women distributed into two groups: Active (n=27) - Subjected to a program consisting of adapted sports activities for six months, three times a week, for one hour; and Control (n=26) - Instructed not to modify their routine, not engaging in any systematized physical activity program.	The results suggest that a JPD program lasting six months produces a positive impact on the psychobiological aspects of aged women.	II
03	Antes, et al. <i>Revista Brasileira de Cineantropometria e Desempenho Humano</i> (2012)	Índice de aptidão funcional geral e sintomas depressivos em idosos.	To verify the association between the presence of depressive symptoms and the General Functional Fitness Index (GFFI) in aged individuals who practice physical exercises.	An analytical study carried out with a sample of 77 aged participants of the "Floripa Ativa Program" with a mean of 67.9 years old. The Yesavage Geriatric Depression Scale (GDS-15) was applied to verify the presence of depressive symptoms and the battery of physical tests from the AAHPERD (American Alliance for Health, Physical Education, Recreation and Dance), to obtain the General Functional Fitness Index (GFFI).	Considering that the GFFI value is obtained through physical tests, it is evident that, for the group under study, the practice of physical exercises may be corroborating the absence of depressive symptoms.	VI
04	Thogersen-Ntoumani, et al. <i>Journal of Aging and Physical Activity</i> (2018)	"Shall we dance?" Older adults' perspectives on the feasibility of a dance intervention for cognitive function.	To explore perceptions of social dance as a possible intervention to improve functioning in older adults with subjective memory complaints.	A descriptive and qualitative study conducted with 30 participants (mean age of 72.6 years old), who self-reported memory problems, and nine spouses who reported noticing such deficit in their partner.	In general, the participants were positive about the potential appeal of social dance to improve cognitive and social functioning and other health-related aspects.	VI
05	Fave, et al. <i>Frontiers in Psychology</i> (2018)	Promoting well-being in old age: the psychological benefits of two training programs of Adapted Physical Activity	To evaluate the mental well-being of 58 Italian older adults aged between 67 and 85 years old, participants of two training programs in Adapted Physical Activity (APA).	A longitudinal study conducted with 58 aged people, divided into two groups: 39 participants joined an adapted motor activity program, whereas 19 took part in a program specifically developed for people with osteoporosis. The well-being dimensions were assessed using the Mental Health Continuum form (short version), the Emotional Regulation Questionnaire and the Satisfaction with life scale. Physical functioning was assessed before and after the programs through the <i>Physical Performance Battery</i> (short version) and the Jamar Dynamometer Test.	The results suggest the potential of moderate physical activity in promoting mental health, emphasizing the additional role of training programs as cost-effective opportunities for older adults to socialize and improve emotional functioning.	IV

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N	AUTHOR(S) / JOURNAL / YEAR	TITLE OF THE ARTICLE	OBJECTIVE	METHODS	CONCLUSION	LE*
06	Anderson-Hanley, et al. <i>Frontiers in Aging Neuroscience</i> (2018)	The Aerobic and Cognitive Exercise Study (ACES) for community-dwelling older adults with or at-risk for Mild Cognitive Impairment (MCI): neuropsychological, neurobiological and neuroimaging outcomes of a randomized clinical trial.	To replicate and extend previous findings about cognitive benefits of using video games for physical exercises (exergame) among older adults with or at risk of Mild Cognitive Impairment (MCI).	A randomized clinical trial carried out with 14 aged individuals where the effects of virtual reality bicycle rides during six months were compared to those of pedaling through a video game to score points. The primary outcome was executive function, whereas the secondary ones included memory and everyday cognitive function.	Both stress conditions resulted in significant improvements in verbal memory. The effects appear to generalize to self-reported everyday cognitive function.	II
07	Leirós-Rodríguez, et al. <i>Hindawi Rehabilitation Research and Practice</i> (2018)	Comparisons of the health benefits of strength training, aqua-fitness, and aerobic exercise for the elderly.	To compare strength training, water aerobics and aerobic exercise programs to discern differences in the benefits gained by each of the activities in older adults.	A double-blind randomized trial carried out with 108 aged people divided into two groups: 54 women compared to 54 men of the same age (mean of 65.5 years old). Both groups underwent three exercise programs (water aerobics, aerobic exercise and strength training) for six months.	To maximize the benefits, the seniors in general may want to consider participating in the aerobic activity. In addition to that, older women would benefit greatly, both emotionally and physically, from exercise that includes strength training.	II
08	Tada T. <i>Clinical Interventions in Aging</i> (2018)	Psychological effects of exercise on community dwelling older adults.	To examine the effect of an exercise-based intervention to improve the mental health of community-dwelling older adults.	An analytical study carried out with community-dwelling aged people, participants of a health promotion program in Kakogawa, Japan. The participants in the Intervention Group integrated an exercise program developed for older adults using elastic bands (Thera-Band).	Simultaneous changes in sensations of fatigue and cortisol levels were observed among the subjects who underwent the regular exercise intervention.	VI
09	Boström, et al. <i>International Journal of Geriatric Psychiatry</i> (2016)	Effects of a high-intensity functional exercise program on depressive symptoms among people with dementia in residential care: a randomized controlled trial.	To evaluate the effect of a high-intensity functional exercise program on depressive symptoms among aged people with dementia living in care institutions.	A randomized clinical trial conducted with 186 aged individuals $\geq 65$ years old, diagnosed with dementia, who scored $\geq 10$ scores on the Mini Mental State Examination and were dependent on activities of daily living. The participants were randomized to either a high-intensity functional exercise program or to a control activity with no exercises (talking, singing, listening to music), performed for 45 minutes, every day of the week, for four months.	A 4-month high-intensity functional exercise program has no superior effect on depressive symptoms in relation to a control activity among aged people with dementia living in residential care facilities. Exercise and non-exercise group activities can reduce high levels of depressive symptoms.	II
10	Preto, et al. <i>American Journal of Preventive Medicine</i> (2015)	Physical activity and mental well-being in a cohort aged 60-64 years.	To investigate the associations of monitored total PA on free-living conditions, self-reported leisure-time physical activity (LTPA) and pleasure walking with mental well-being between 60 and 64 years of age.	A cohort study including data on 930 men and 1,046 women, aged 60-64 years old, from the United Kingdom Medical Research Council's National Health and Development Survey (2006–2011).	In adults aged 60-64 years old, participation in self-selected activities such as LTPA and walking is positively related to mental well-being, whereas the total free-living LTPA levels are not.	IV
11	Du, et al. <i>Neuropsychiatric Disease and Treatment</i> downloaded (2015)	Physical activity as a protective factor against depressive symptoms in older Chinese veterans in the community: result from a national cross-sectional study.	To conduct a national epidemiological survey to determine the relationship between physical activity and depressive symptoms in community-dwelling aged Chinese veterans, adjusting for potential confounders.	A cross-sectional study conducted with a sample of 9,676 community-dwelling Chinese veterans. The depressive symptoms were identified using the Depression Scale of the Center for Epidemiological Studies.	Seniors who remained active or increased activity over time had a reduced risk of cognitive decline. Involvement in physical activity at the end of life may have cognitive health benefits.	VI

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N	AUTHOR(S) / JOURNAL / YEAR	TITLE OF THE ARTICLE	OBJECTIVE	METHODS	CONCLUSION	LE*
12	Suzuki, et al. BMC Neurology (2012)	Effects of multicomponent exercise on cognitive function in older adults with amnesic mild cognitive impairment: a randomized controlled trial.	To examine the effects of a multicomponent exercise program on the cognitive function of older adults with amnesic Mild Cognitive Impairment (aMCI).	A 12-month randomized clinical trial conducted at a community center in Japan. The participants were 50 older adults aged between 65 and 93 years old (mean of 75), who were randomized to perform a multicomponent exercise (n=25) or to comprise an education control group (n=25).	This study found an inverse relationship between physical activity and depression symptoms in the oldest community-dwelling Chinese veterans. It was also indicated that the antidepressant effect of physical activity probably extended to the oldest ones, and light-intensity physical activity was likely available for the same protective effect.	II
13	Ku; Stevinson; Chen. Journal of Epidemiology (2012)	Prospective Associations Between Leisure-Time Physical Activity and Cognitive Performance Among Older Adults Across an 11-Year Period.	To examine prospective associations between changes in physical activity and cognitive performance in a population sample of Taiwanese aged people over an 11-year period.	A cohort study with data analysis of the survey entitled Health and Living Status of the Elderly Survey, conducted in Taiwan in 1996, 1999, 2003 and 2007. Data from a fixed cohort of 1,160 participants > 67 years old monitored over 11 years were included.	This study indicates that physical exercise at least partially improves or supports cognitive performance in older adults with MCI.	IV
14	Chen, et al. International Journal of Behavioral Nutrition and Physical Activity (2012)	Relationships of leisure-time and non-leisure-time physical activity with depressive symptoms: a population-based study of Taiwanese older adults.	To elucidate independent associations between leisure-time physical activity (LTPA), non-leisure-time physical activity (NLTPA) and specific physical activity parameters (frequency, duration and intensity) with depressive symptoms in older adults.	The study selected 2,727 individuals aged ≥ 65 years old, who participated in the 2005 Taiwan National Health Interview Survey to assess the impact of LTPA and NLTPA on depressive symptoms. The Depression Scale of the Center for Epidemiological Studies and diverse information on energy parameters were used to assess the effect of each type of activity during the last two weeks.	Physical activity at the end of life is associated with slower age-related cognitive decline.	VI
15	Middleton, et al. Journal of the American Geriatrics Society (2010)	Physical activity over the life course and its association with cognitive performance and impairment in old age.	To determine how physical activity at various ages and throughout life is associated with cognitive impairment at the end of life.	A cross-sectional study where the modified Mini Mental State Examination (mMMSE) was applied to 9,344 women ≥ 65 years old (mean of 71.6) who self-reported as physically active in adolescence, at 30 years old, at the age of 50 and at the end of life.	These findings imply that exercise recommendations for older adults should emphasize the importance of higher-intensity activities, rather than frequency or duration, to improve mental well-being.	VI
16	Lindelof, et al. PLOS One (2017)	Experiences of older people with dementia participating in a high-intensity functional exercise program in nursing homes: "While it's tough, it's useful".	To describe the points of view and participation experiences in a high-intensity functional exercise program among aged people with dementia living in a long-term care institution.	A qualitative study that interviewed 21 older adults aged between 74 and 96 years old and who scored between 10 and 23 scores on the Mini Mental State Examination at the beginning of the study. The participants were asked to perform activities of a high-intensity functional exercise program (individualized and monitored) for four months.	Women who reported being physically active at any time throughout their lives, and especially in adolescence, are less likely to have cognitive impairments later in life. Interventions should promote physical activity early in life and throughout the life cycle.	VI
17	Chang, et al. BMJ Open (2017)	Effects of different amounts of exercise on preventing depressive symptoms in community-dwelling older adults: a prospective cohort study in Taiwan.	To compare the effects of four different amounts of physical exercise on preventing depressive symptoms in community-dwelling older adults.	A comparative study conducted with 2,673 older adults > 65 years old selected from the research entitled "Taiwan Longitudinal Study on Aging (TLISA)" in the period from 1996 to 2007.	The results of the interviews reinforce the positive significance of intense exercise for aged people with moderate to severe dementia in nursing homes. The participants were able to safely adhere to and understand the need for exercise. Exercise providers should consider aspects valued by the participants, such as supervision, individualization, small groups and encouragement, and this exercise involved joy and rediscovery of body skills.	IV

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N	AUTHOR(S) / JOURNAL / YEAR	TITLE OF THE ARTICLE	OBJECTIVE	METHODS	CONCLUSION	LE*
18	Abdin, et al. BMC Psychiatry (2017)	The mediational role of physical activity, social contact and stroke on the association between age, education, employment and dementia in an Asian older adult population.	To investigate the paths by which sociodemographic factors, modifiable health risk factors and lifestyle influence each other and subsequently lead to dementia.	The data used were those from the Singapore Elderly Well-Being Study, a nationally representative survey of the aged population $\geq 60$ years old.	Consistent exercise for at least 15 minutes an hour, three times a week and of moderate intensity, is significantly associated with lower risks of depressive symptoms.	VI
19	Williamson, et al. Journal of Gerontology: Medical Sciences (2009)	Changes in cognitive function in a randomized trial of physical activity: results of the lifestyle interventions and independence for elders pilot study.	To report the results of a pilot study to provide estimates of the relative impact of physical activity on one-year changes in cognitive outcomes and to characterize the relationships between changes in mobility disability and cognition in older adults at increased risk for disability.	102 sedentary older adults aged between 70 and 89 years old, at an increased risk for disability, were randomized to perform moderate intensity physical activity or health education. The Digit Symbol Substitution (DSST), Rey Auditory Verbal Learning (RAVLT), modified Stroop, and modified Mini Mental State Examination tests were applied, comparing time zero with one year later.	Our results suggest that physical activity, social contact and stroke were potential mediators in the relationship between age, schooling, work and dementia. Intervention programs focusing on physical activity, such as physical exercise and social contact, may be useful in reducing the risk of dementia among older adults.	VI

\*LE = Level of Evidence

Figure 3 - Characterization of the articles selected for analysis. Redenção, CE, Brazil, 2021

## Discussion

### Knowledge synthesis

One of the benefits of physical exercise on mental health has been reported in the literature as an improvement in the Mini Mental State Examination (MMSE) score. In 2014, a comparative study carried out with aged people who practiced and did not practice physical exercises evidenced that the members of the group participating in PE presented a total MMSE score significantly higher than the one obtained by the non-participating group<sup>(12)</sup>. This finding is reinforced by another study, where the authors verified that physically active women in adolescence, at 30 years old, at the age of 50 or at the end of life, had higher MMSE scores when compared to those who were inactive at the same ages<sup>(13)</sup>. Therefore, it is confirmed that this benefit is directly related to the practice of physical exercises over time<sup>(14)</sup>.

Another aspect evidenced in the studies concerns the practice of physical exercises as a factor related to a better perception of mental health. In a study carried out in Spain, it was observed that aged people who practiced physical exercises, whether in water, aerobic or strength training, had a better self-perception of mental health as a direct benefit<sup>(15)</sup>. A similar result was reported in a previous study where it was verified that aged people who participated in leisure-time physical activities or walked had higher scores on the Warwick-Edinburgh Mental Wellbeing Scale when compared to those who stated not performing any type of exercise<sup>(16)</sup>.

In addition to that, it was reported that the practice of physical exercise and the improvement of physical

function contribute benefits to cognitive performance in older adults<sup>(17)</sup>, presenting a moderate effect on the Simple Reaction Time (SRT) and Sustained Attention (SA) variables and a high effect on the Choice Reaction Time (CRT), Short Term Memory (STM) and Working Memory (WM) variables; thus reinforcing their positive impacts on the cognitive scope<sup>(12)</sup>.

Exercise also produced significant improvements in immediate verbal memory and self-reported everyday cognitive function in older adults, as shown by a randomized clinical trial conducted in New York. In the study, the physical exercise amount was associated with an increase in the neurotrophic factor, derived from the brain and responsible for the maintenance, growth and differentiation of neurons, as well as causing increased gray matter volume in the prefrontal cortex (associated with improved memory) and anterior cingulate cortex<sup>(18)</sup>. Thus, it is observed that practicing physical exercises exerts positive effects not only on what is reported by the older adults, but also at the biological level.

The benefits of physical exercise on older adults' cognition were also reported by a study that examined the prospective associations between changes in physical activity and cognitive performance of this population segment in Taiwan. Higher initial levels of physical activity were significantly associated with better initial cognitive performance and slower decline in cognitive performance, when compared to lower levels of physical activity<sup>(19)</sup>.

Exercising in adolescence is also reported in the literature as a protective factor, as it has a strong association with lower chances of cognitive impairment

in later life. However, it is important to note that women who were physically inactive in adolescence and became active later in life had a lower risk of cognitive impairment than those who remained inactive<sup>(13)</sup>. This finding shows that the practice of physical activities has cognitive benefits in old age, whether initiated early in adolescence or in adulthood.

Practicing physical exercises is also beneficial for older adults with presence of cognitive deficit already installed. One study revealed that institutionalized aged people with moderate to severe dementia perceived the practice of physical activity as positive. The participants were able to safely adhere to and understand the need for physical exercise. In addition to that, they highlighted the appreciation given to aspects such as supervision, individualization, small groups to practice the activity and incentive; together, these factors aroused joy and rediscovery of body skills in the older adults<sup>(20)</sup>.

In addition to the positive repercussion in the cognitive context, older adults who perform some physical activity also have better psychobiological responses on mood, represented by lower scores on anxiety and depression levels, better quality of life, increased functional capacity and vitality and improved body image, when compared to inactive aged individuals, who presented increased scores on the fatigue dimension in the same type of analysis<sup>(21)</sup>.

The positive impact of physical exercise on depressive symptoms was also reported by other authors, where there was a negative and significant correlation between the General Functional Fitness Index (GFFI) and the score obtained on the Yesavage Geriatric Depression Scale (GDS), showing that the higher the GFFI value, the lower the GDS score. Therefore, physical activity proved to be a protective factor against depression<sup>(22)</sup>.

Participation in training programs also contributed significantly to the increase in adaptive emotion regulation strategies. In relation to this theme, a research study that evaluated the repercussion of training in adapted physical activity for older adults showed that the participants reported significantly higher levels of emotional and psychological well-being<sup>(23)</sup>.

In addition, a study conducted in Japan, which evaluated aged people's participation in physical exercise programs for six months, found that, although without statistical difference, the tension-anxiety, depression-deterioration and confusion scores decreased in those who participated in the exercise programs, revealing the benefits on the participants' mental health<sup>(24)</sup>.

As for exercise intensity, a research study that evaluated the effect of a high-intensity functional exercise program for four months on depressive symptoms among aged people with dementia who lived in care institutions is mentioned. It was observed that

such exercises had no superior effect on the depressive symptoms when compared to a control activity without exercise (talking, singing, listening to music, enjoying drawings)<sup>(25)</sup>. Analyzing the study, it can be inferred that, if combined with other activities, physical exercises can further reduce the levels of depressive symptoms.

On the other hand, a study conducted with older adults in Taiwan indicates that physical exercises for aged people should emphasize the importance of higher-intensity activities, rather than frequency or duration, to improve mental well-being. Such recommendation was validated by proving that there is a significant association between physical activity intensity and presence of depressive symptoms, which indicates that the fact of engaging in free physical activities of greater intensity is associated with a lower probability of developing depression<sup>(26)</sup>.

It is believed that these divergent findings may be related to socioeconomic situation, marital status, schooling, presence of comorbidities and different lifestyle habits among the samples under study. In addition, the researched populations themselves differed from each other since, in a study from the literature the participants had dementia, whereas in another one carried out in 2012, the participants were older adults aged at least 65 years old with or without comorbidities<sup>(25-26)</sup>.

Another study showed that aged people who practiced physical activity had a significantly lower probability of depressive symptoms (5.43% *versus* 18.83%). In addition to that, aged people who practiced 90 minutes or more of physical exercise per week had a 43% reduction in the risk of developing depressive symptoms when compared to those who were physically inactive; physical activity was inversely associated with depressive symptomatology and a single independent protective factor. In addition, it is noted that there was a significant difference in the Depression Scale score between the participants of the active physical activity and those who did not perform it<sup>(27)</sup>.

Other researchers corroborate the aforementioned, where it was shown that, even if very low (3 times/week, 15 minutes), practicing physical exercises exerts significant preventive effects on depressive symptoms<sup>(28)</sup>.

Regarding the social interaction promoted by the practice of physical exercises, it was observed that it can play an important role in this process. In one of the studies analyzed, which aimed at exploring the perceptions about dance as a possible intervention to improve cognitive functioning in aged people with subjective complaints of memory deficit, it was found that the participants were positive about the appeal of a dance class, as it can provide better social interaction, preserving physical/cognitive health and making them relive happy experiences of younger ages<sup>(29)</sup>.

In addition, there are studies that investigated the influence of modifiable risk factors, concluding that the practice of physical exercises play a significantly relevant role in the promotion of long-lasting and significant social relationships in older adults' lives, reflecting positively on their mental health, as these individuals are filled with vitality, hope and confidence in themselves and others<sup>(30)</sup>.

## Conclusion

This integrative review aimed at identifying the benefits arising from the practice of physical exercises on aged people's mental health. The analysis of the productions revealed that physical exercise exerts a positive impact on the cognitive aspects, including prevention of cognitive decline, as well as delay in its progression; self-perception of mental and cognitive health; prevention and/or reduction of anxiety and depression signs and symptoms; and development of effective and long-lasting social relationships, leading to improvements in mental health, reflected in higher confidence, vitality and hope levels.

Based on the premise that there are several physical exercise modalities, more in-depth studies are suggested regarding the specific contributions of each type of physical exercise on the various components of mental health in the aged population.

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