



Systematic Review

A systematic review of the impact of physical activity on elderly mental health

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Abstract

Objectives: The purpose of this study was to conduct a systematic assessment of the available data about the benefits of physical activity and the appropriate forms of exercise for older adults' mental health.

Methods: LILACS, PubMed, SciELO, CINAHL, Scopus, Google Scholar, ProQuest, and ScienceDirect were all searched. Based on PRISMA, the reviewing guideline was selected. The Quality Assessment Tool (QAT) for Quantitative Studies was used to evaluate the methodological quality of each included study. We only included studies with moderate to strong quality.

Results: Fourteen studies were eligible for inclusion (six randomized controlled trials and eight pretest-posttest studies). A variety of exercises, including aquatic, aerobic, yoga, and muscle-strengthening ones, have been shown to improve elderly people's physical and mental health. According to QAT, five studies with Cohen's Kappa values of at least 0.80 and 11 high-quality studies with $p < 0.05$ had a significant impact on the mental health of the elderly.

Conclusion: This comprehensive study demonstrated how an exercise program benefits elderly people who are both usually healthy and have suffered a variety of symptoms.

Keywords: Elderly; mental health; physical activity; physical exercise; systematic review.

According to statistics from Basic Health Research, the aging process in the elderly frequently results in an increase in morbidity and mortality, which affects the elderly's mental health in this scenario and lowers their quality of life.^[1] The mental health of the elderly declines, particularly in those who are no longer employed^[2] and have trouble doing daily tasks.^[3] Degenerative illness, which makes it easy for the elderly to feel tired during activities,^[4] and the inability of the family to care for them, who subsequently ended up in a nursing home, are two factors in the transition from being active to passive.^[5,6] As a result, they become disinterested, believe they are unworthy, and suffer from insomnia, anxiety, and even melancholy.^[7] To ensure the well-being of the elderly, mental health issues must be avoided. Engaging in physical activity is one way to do

this. Repetitive body movements are used in physical training in a planned and controlled way to enhance physical fitness, particularly in elderly people with declining bodily function.^[8,9] In the meantime, sedentary lifestyles or infrequent exercise can increase the risk of several age-related health issues, including psychological issues, high blood pressure, senile dementia, and joint and muscle discomfort.^[10,11] Exercise is one of the alternative therapies that seniors can use because it reduces cortisol or epinephrine and increases norepinephrine, which acts as an antidepressant associated with a decrease in sympathetic nerve and hypothalamic-pituitary-adrenal activity, according to the Australian Physical Activity and Sedentary Behaviour Guidelines.^[12,13] Therefore, adding physical activity to an elderly person's routine is crucial for enhancing

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both their physical and mental health by lowering stress levels, anxiety, and even depression while also improving their quality of life.

Regular physical activity can aid the elderly in becoming healthier, fitter, and more energized.^[11] According to numerous studies, physical activity for seniors can range from easy to difficult, including walking, cycling, dancing, sports, swimming, and fitness activities.^[14-16] However, every physical activity must be modified for the elderly person's abilities to prevent bodily harm, and it is best to perform them frequently and repeatedly to receive the best results.^[17] Unfortunately, the majority of senior people believe that workouts such as weightlifting, walking, and posture maintenance only help them with everyday tasks and preserve their independence. In the meantime, the effects of exercise also serve to eradicate unconsciously held mental health illnesses and interventions in health services, which act as counselors and educators in assisting the elderly in understanding the advantages of physical activity for their mental health.

The issue is that while numerous studies have assessed the advantages of physical activity for the elderly, no one has yet demonstrated how the appropriate kind of physical activity might influence the elderly's mental health. For instance, a review on the topic of how physical activity can lessen anxiety in the elderly discovered a drop in anxiety scores following an exercise intervention.^[8,11,17,18] A review of a study where the sort of physical activity employed and the evaluation of the elderly's mental health did not demonstrate the elderly's sleeping quality after physical activity.^[19] Given that getting older adults to exercise regularly and monitor their mental health is crucial to their overall health and well-being. Therefore, the objective of this study was to thoroughly review the available data on the impact of various forms of physical activity on senior people's mental health.

Research Questions

- What impact does exercise have on elderly people's mental health?
- What kind of physical activity is suitable for and advises seniors to preserve their mental health?

Materials and Method

This systematic review was carried out according to the guidelines of the systematic review and meta-analysis (PRISMA) chosen in reviewing the strategy of article search, eligibility criteria, study selection, quality assessment, and synthesis data.

Search Strategy

The data were collected through searching articles indexed in the database and library that refer to Latin American and Caribbean Literature in Health Sciences (LILACS), the National Library of Medicine (PubMed), the Cochrane Library, the Scientific Electronic Library Online (SciELO), the Cumulative Index

What is presently known on this subject?

- The mental health of the elderly decreases, especially for those who are no longer working and have difficulty doing daily activities, which causes them to lose enthusiasm, feel worthless, and have insomnia, anxiety, and even depression.

What does this article add to the existing knowledge?

- This study provides new data on the effectiveness of physical exercise on the mental health of the elderly, consisting of the frequency, duration, and time of exercise.
- It was found that there are appropriate types of physical exercise for the elderly to maintain their mental health.

What are the implications for practice?

- Physical exercise, as recommended, can improve the health of the elderly both physically and mentally, and this is one of the elderly programs to build "healthy and productive aging".

to Nursing and Allied Health Literature (CINAHL), Elsevier (Scopus), Google Scholar, ProQuest, and ScienceDirect. Published international journals in full, indexed in English, publications made between 2010 and 2019 (10 years before the era of the coronavirus COVID-19 pandemic), identified by a Boolean descriptor and term in the title or abstract. The keywords used to search for resources were selected from the Medical Subject Headings (MeSH) database with controlled descriptors and selected Boolean operators (AND/OR) to broaden the search, including keywords in Indonesian: physical exercise, mental health, and the elderly, while keywords in English: "Physical Exercise" AND "Mental Health" AND "Elderly," OR "Physical Activity" AND "Mental Health" AND "Elderly."

Eligibility Requirements

Studies that investigated the impact of a physical activity program, or more precisely, an exercise program, on the mental health of older persons over the age of 60 were eligible for inclusion. The following requirements must be met for a study to be considered for this review: (1) Population: seniors over 60 who reside in a community or nursing home. In this study, the elderly were free of chronic illnesses, particularly if they had previously occurred, such as cancer, cardiovascular disease, or mental or psychiatric disorders; (2) Intervention: The program or intervention included sports or other forms of exercise. Studies that suggested a connection between general levels of physical activity and mental health or that physical activity or exercise had an immediate effect after just one session were omitted; (3) Finding: Elderly people's mental health benefits from physical activity; (4) Design: We included studies that investigated the connection between physical activity and senior people's mental health, including intervention studies, RCTs, full-text articles, and studies. Reviews, meta-analyses, qualitative cross-sectional studies, and guidelines were not included.

Study Selection

Three researchers separately conducted the search and selection process, and they were SMA, YS, and AS. Duplicate notes were eliminated in Endnote (Version X8.1) after loading all

notes from various databases. Based on title screening, unrelated articles were eliminated. After the remaining publications had their abstracts reviewed, the complete texts were retrieved, and two researchers independently determined whether or not they were eligible. To find additional studies that may be relevant, the article references that were found through the base data search were analyzed. The research selection process for the systematic review is given in the PRISMA flow diagram in Figure 1.

Quality Assessment

Utilizing the common technique of the Quality Assessment Tool (QAT) for quantitative studies, the study's quality was evaluated. The Cochrane Collaboration suggested that. Eight different topics were covered by this instrument, including data bias, research design, confounders, blinding, data collection method, withdrawal and dropout, intervention integrity, and analysis.^[19] Each item was given one of three ratings: "strong," "moderate," or "weak." If the study failed to provide a precise and straightforward description, the item was deemed "poor."^[20,21] Two researchers independently calculated the quality rank. Two assessors had a discussion to settle their differences.

Synthesis Data

The elderly's physical activity routine and mental health are described in detail (Table 1). The majority of mental health

evaluations were based on tests of mental ability or the presence of symptoms such as anxiety, sleeplessness, and sadness that are common in the elderly. For all trials reporting pertinent data, the effect measurement was calculated (Table 2). If the data needed to measure the effect were left out of the study, we got in touch to provide more information. A Cohen's *d* value of 0.80 or above was deemed to represent a significant effect assessment, and a $p < 0.05$ suggested a substantial impact of the intervention.

Results

Study Sample and Characteristic

An electronic database search turned up a total of 7.052 potential studies. 3.202 duplicate articles were eliminated, leaving 3.850 articles, of which 3.398 were disqualified based on the titles. The majority of publications were disqualified during this stage because the population or research design did not adhere to the requirements. 395 of the 452 remaining papers were disregarded after the abstract screening. The following were the most typical grounds for exclusion at this stage: inclusion criteria were not met by the population ($n=286$), the research design ($n=74$), the mental health findings ($n=24$), the manuscripts ($n=6$) that were not in English, the population ($n=286$), the research design ($n=74$), the remaining duplicates ($n=5$), or any of the other factors. 29 studies met the inclusion

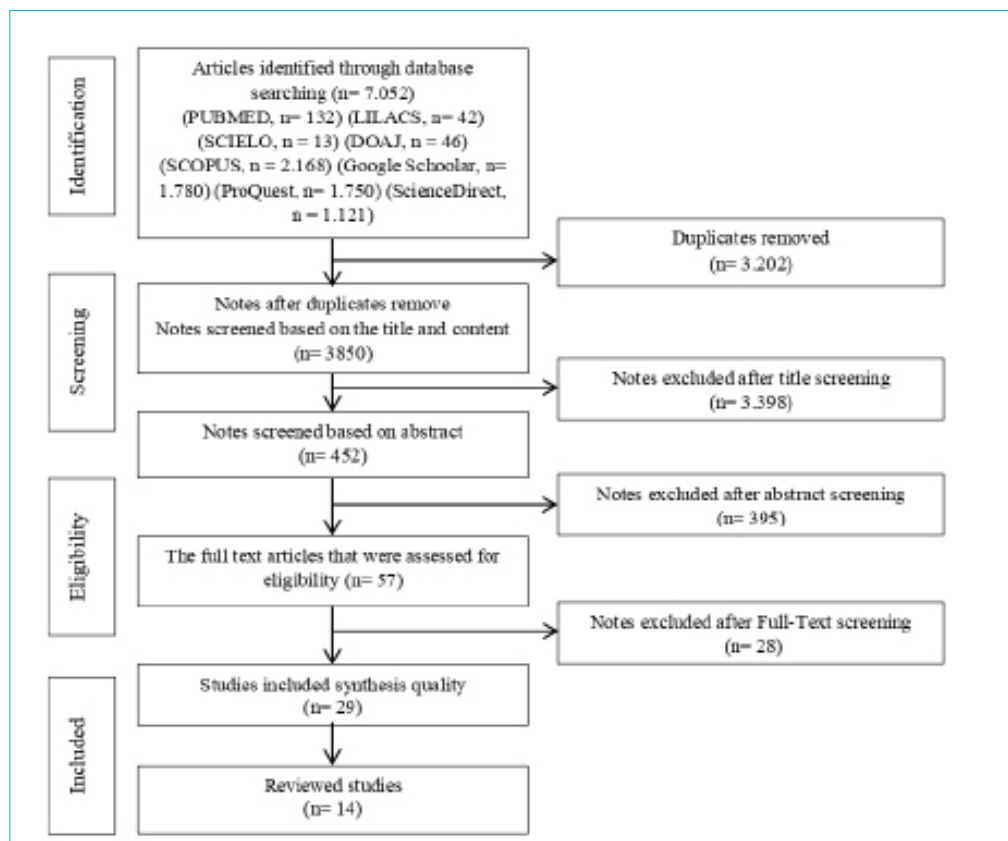


Figure 1. Search and selection process (Prisma Flow Diagram).

Table 2. Analysis physical exercise effect assessment and study quality

Author	Exercise Type	Frequency/Intensity/Time	Mean±SD		p-Value	Effect	Select bias	Component Ratings						Result
			Before	After				QAT	Study Design	Confounders	Blinding	Data Collect	Withdrawals & Dropout	
Battaglia G, et al. ^[6] (2016)	ROM exercise	2x/week Moderate/70 min	75.59±10.44	83.82±23.29	0.001	0.79	✓	✓	✓	✓	✓	✓	✓	Strong
da Silva LA, et al. ^[10] (2019)	Aquatic training	2x/week Moderate/45 min	73±12	101±10	0.001	0.90	✓	✓	✓	✓	✓	✓	✓	Strong
Black SV, et al. ^[5] (2015)	Aerobic exercise, step test	1x/week Moderate/25+ min	51.6±8.3	68.8±10.6	0.001	n	✓	✓	✓	✓	✓	✓	✓	Strong
Gothe NP, et al. ^[15] (2019)	Aerobic exercise, walking exercise	2x/week Moderate/20 min	82.18±10	84.72±13	0.000	0.78	✓	✓	✓	✓	✓	✓	✓	Strong
Byeon H. ^[6] (2019)	Physical activity aerobic	1x/week Strong/75 min	159±611.1*	95±355.08*	0.002	0.86	✓	✓	✓	✓	✓	✓	✓	Strong
de Oliveira LDS ^{SCB} , et al. ^[12] (2019)	Sport	1x/week Moderate/25-30 min	15.81±5.48*	5.81±2.31*	0.001	0.77	weak	✓	✓	✓	✓	✓	✓	Moderate
Rugbeer N, et al. ^[32] (2017)	Sport	3x/week Strong/60 min	82.43±26.75	96.28±11.36	0.001	0.56	✓	✓	✓	✓	✓	weak	✓	Moderate
Makizako H, et al. ^[24] (2019)	Aerobic exercise, muscle strength	2x/week Strong/30 min	29.41±7.64	41.79±9.5	0.000	1.0	✓	✓	✓	✓	✓	✓	✓	Strong
Ebrahim Z, et al. ^[13] (2019)	Yoga exercise	3x/week Strong/90 min	6.0±10.3*	2.07±0.7*	0.000	0.86	✓	✓	✓	✓	✓	✓	✓	Strong
Walker JG, et al. ^[92] (2010)	Aerobic exercise	2x/week Moderate/30 min	17.31±5.23*	5.57±4.42*	0.002	0.32	✓	✓	✓	✓	✓	✓	✓	Strong
Gschwind YJ, et al. ^[17] (2013)	Muscle strength exercise	2x/week Strong/45 min	38.9±8.15	46.48±10.97	0.001	0.96	✓	✓	✓	✓	✓	✓	✓	Strong
Okamoto R. ^[28] (2018)	Aerobic exercise, face muscle exercise	2x/week Moderate/30 min	28.2 ± 2.0	28.5 ± 2.8	0.004	0.76	✓	✓	✓	✓	✓	✓	✓	Strong
Tew GA, et al. ^[39] (2017)	Yoga exercise	2x/week Moderate/90 min	49±12	56±9	0.001	0.44	✓	✓	✓	✓	✓	✓	✓	Strong
Mortazavi SS, et al. ^[37] (2017)	Aerobic exercise	3x/week Strong/30 min	98±0.5*	45±0.3*	0.001	n	✓	✓	✓	✓	✓	weak	✓	Moderate

*The measuring instrument using PHQ-9 and GHQ-28 is a mental health questionnaire in the form of symptoms indicating anxiety, social dysfunction and depression. Effect measurement Cohen's d>80 = substantial, n=data to calculate effect measurement not available. Effect measurement is based on the main result reported on the study and is shown in bold in the table. Quality Assessment Tool (QAT), (✓) strong information.

criteria after reading the full texts of the remaining 57 articles, and 28 additional studies were excluded for the following reasons: (1) it was not included in the population of interest ($n=9$); (2) cross-sectional studies ($n=2$); (3) there were no articles reviewed by colleagues ($n=2$); (4) there were no results related to mental health ($n=9$); (5) it was not written in English ($n=1$); and (6) there were no physical activity programs ($n=5$). Eight studies were omitted because they had poor quality. Pretest-posttest studies ($n=8$) and random controlled trials ($n=6$) are included in the research design. Because the COVID-19 coronavirus pandemic has not yet occurred, the study was conducted from 2010 to 2019 to prevent bias in the mental health data of the elderly. Asia had three studies, North America had one, South America had five, Europe had three, and the Middle East had two. The sample measurement range was 30–909 participants. The mean age of the study sample range was 60–80 years old (mean 62.8 ± 1.2 – 81.98 ± 8.3). The elderly are those who live in nursing homes, elderly communities, and some in housing (Table 1).^[22,23]

Analysis of Physical Exercise Assessment and Study Quality

Fourteen studies in total were eventually included in this study (Fig. 1). Three of the study's participants had "moderate" quality, while 11 had "high" quality (Table 2).^[24] Five of the 14 studies that looked at the effects of the suggested exercise regimen—including aquatic, aerobic, yoga, and muscle strength training—found that the improvement in senior people's mental health was 100% significant.^[22-26] In six RCTs, the length of the program interventions varied from 1 week to 22 months.^[22-24,26-28] 8 weeks to 12 months in eight pretest-posttest investigations.^[18,25,29] The length of each session varied from 20 to 90 minutes, and there were one to three sessions per week. The majority of the intervention ($n=10$) was overseen by trained instructors. The control group in the study included individuals who continued with their regular activities, attended educational classes ($n=1$), received dietary counseling ($n=1$), or participated in low-intensity exercise programs ($n=2$) (Table 1). Various forms of physical activity with variables in frequency, intensity, and duration were also recorded. The average before 28.2–82.43 and after 46.48–96.28 using the MCS, WEMWBS, and MMSE questionnaires showed an increase in mental function, and a range before 6.0–159 and after 2.07–95 on the PHQ and GHQ questionnaires showed a decrease in symptoms of mental disorders.^[30,31] There was a significant difference before and after exercising, or there was a relationship between exercising and the mental health of the elderly (Table 2).

Components of Mental Health Results

There were recorded fifteen different mental health digests. No substantial negative effects were reported (Table 3). Three mental health outcomes (depression, sleep quality, pleasant emotion, optimism, and positive thought) were completely different and had a very beneficial impact. The elderly's mental health was then reported to be positively impacted by emotional (75%) and physical function, which was followed

by general health and physical function (80%). Up to 50% of favorable significant impacts were identified for the other four components (somatic symptom, sleep disturbance, cognition, and life quality). In addition, <50% of studies with statistically significant positive impacts were focused on social functioning. Energy sufficiency results were presented, but no substantial effects were seen. It was discovered that the MMSE revealed a 100% incidence of a substantial beneficial effect on the mental health measurement scores in the study. In addition, significant beneficial effects were observed by WEMWBS (75%), MCS (50%), and PHQ (50%) users. A significant improvement in the mental health of the elderly was noted by GHQ 50% of the time. In Table 2, the major outcome of the mental health of the elderly reported by 10 studies was given an effective assessment. The study's impact was measured between 0.32 and 1.0. Five out of ten studies^[32-33] with a Cohen's $d > 0.80$ reported the main component effect of mental health, with 100% reporting a significant beneficial influence on the mental health of the elderly (Table 3).

Discussion

The purpose of this study was to conduct a thorough literature analysis on the impact of physical exercise regimens on the mental health of seniors over 60. This systematic review comprised 14 papers, including 6 RCTs and 8 pretest-posttest investigations. The results of the exercise program were detailed in 14 trials, 11 of which were strong and 3 of intermediate quality. There were reported sixteen distinct sleeping outcomes. The studies that examined each of these results found substantial positive benefits for four of the results in more than 50% of the cases. Ten out of fourteen studies had estimated effect sizes, and five of those studies had results that were significant enough to be regarded as significant. Previous studies' clinical study populations revealed that exercise lowered anxiety and increased sleep quality, especially in the elderly.^[34] This review discovered that physical activity had a 100% significant favorable impact on the elderly's mental health and helped them sleep better. In addition, this analysis discovered that 66% of elderly people who exercised reported a considerable reduction in anxiety.

Two systematic reviews investigated the impact of physical activity on seniors' mental health.^[35,36] This review revealed that sports like yoga and aerobics had a favorable impact on depression, physical function, and GHQ scores. This was corroborated by the study review results, where more than 50% revealed a significant relationship between physical activity and older adults levels of depression, physical function, and anxiety as measured by the MMSE, WEMWBS, and PHQ. To understand the impacts of physical activity and difficulties that frequently affect the elderly, mental health issues were the ones that were most frequently reported.^[37] Studies with a good design were more likely to yield strong results, according to the literature.^[36,37] However, despite having a more robust methodological design than the eight pretest-posttest

studies, the six RCTs in this review did not differ significantly in terms of reported mental health outcomes or important effects.

A differing research outcome may also be attributed to the quality of the study.^[38] According to this evaluation, there was a greater correlation between the benefits of physical activity in the eleven high-quality studies compared to the three moderate-quality studies. This was demonstrated by the fact that 50% or fewer of all high-quality research reported relevant outcomes. The scores of the strong physical exercise effect on the mental health of the elderly were reported by five of the eleven studies with strong quality, whereas no study with moderate quality revealed an effect measurement greater than Cohen's *d* of 0.80. As a result, the study with a superior methodology was more likely to disclose an impact that was more significant and measured more effectively. The instrument/measurement score in the quantitative study helped determine if each intervention had a good impact, and the standard of the research was high.^[39,40] By demonstrating beneficial improvements in the mental health of the elderly after exercise, it was discovered in this study that 50% of the mental health score (MMSE, WEMWBS, MCS, PHQ, and GHQ) was the main result presented meaningfully in the strong quality study. Hence that, the higher study's quality, the better the measurement outcome.

Physical activity performed regularly by seniors helps alleviate mental health disorders and cognitive disorders, according to several earlier studies.^[38-40] Regarding exercise frequency, some research highlighted the value of "regular" exercise, but the term was not further explored. The majority of the programs in our review-eight of the fourteen studies-offered exercise twice a week, and it was reported that more than 50% of these programs improved elderly participants' mental health by increasing physical function, lowering depression and anxiety, and significantly improving MMSE and WEMWBS scores. Based on these results, exercise programs with a frequency of twice weekly were found to have a bigger or more significant impact on senior participants' mental health than programs with the highest (thrice weekly) and lowest (once weekly) frequency.

According to Paluska and Thomas (2012), senior people may choose moderate-intensity exercise due to improved adherence, a lower chance of injury, and long-term sustainability.^[40] According to the review's findings, eight moderate-intensity exercise programs reported a percentage of more than 50% of a significant result in mental health, or in this situation, the result was more significant than with a demanding exercise program. Even though our review only included one trial that examined the effects of a high-frequency, high-intensity exercise program (three times per week), it was concluded that there were no appreciable positive effects.^[32] This result demonstrated that an exercise regimen of low intensity was best for the elderly's mental health. However, as evidenced by the MCS score, one article found that concomitant high-inten-

sity exercise had a significant impact on the mental health of the elderly. In addition, three of eight moderate-intensity exercises combined demonstrated a 50% reported meaningful improvement in senior people's mental health. These results were in line with other research showing that moderate exercise, either alone or in combination, had favorable effects and a significant impact on physical and mental health-related factors in the elderly.^[41]

According to the findings of this study, five studies with program durations ranging from 12 weeks to 5 months showed the highest proportion of results from the physical exercise effect on senior people's mental health. Three studies using 12-week programs demonstrated a higher percentage of significant results in the overall MMSE and WEMWBS scores. In addition, two studies with programs lasting 3–5 months demonstrated higher meaningful results in GHQ and MCS overall scores, as well as in physical function, anxiety, sleep quality, and cognitive functions that have a favorable impact on senior people's mental health.^[41] In addition, the length of the exercise sessions also had an impact on how well the elderly's mental health fared. For example, two studies^[25,28] found that 90 min of exercise had a significant favorable impact on the elderly's anxiety, sleep quality, social functioning, and emotional state. This is consistent with several earlier studies that found that the longer the exercise session, the greater the impact on the elderly's mental health.^[42]

To improve mental health and combat distractions such as depression, sleeplessness, stress, anxiety, and other bodily problems, the State of Mental Health and Aging in America recommends exercising every day for at least 150 min a week.^[41,43] In addition, yoga exercise is specifically advised when people are worried, even melancholy, which can disrupt their sleep quality and general health. Regular aerobic exercise also enhanced their quality of life, with some elderly reporting that they felt pleased after exercising.^[40,19] Combining diverse sports seemed to be the most efficient way to simultaneously improve mental health.^[42] Only four of the studies included in our study combined different types of physical activity. These four studies showed a large percentage-more than 50%-of negative effects on mental health. This is consistent with the earlier discovery that combining different forms of exercise is more efficient at enhancing the many aspects of elderly people's mental health.^[43]

In addition, studies on certain forms of exercise, such as ROM, aerobics, yoga, and aquatics, revealed a 100% success rate for improving mental health. The ROM program and muscle strength have been shown to improve physical function and have a significant impact on senior people's quality of life, general health, and social functioning.^[40,43] Aquatic exercise is a different type of exercise program that is rarely used in Indonesia, but this review found that it has a positive impact on the mental health of the elderly by reducing depression and anxiety with a 100% effectiveness rate. There were also no negative effects noted in the study. To improve the men-

tal health of the elderly, which is done by lowering levels of anxiety and depression and enhancing physical function, it is advised that they engage in aquatic exercise, aerobic exercise, yoga, and muscle strengthening.

Limitations

We have conducted a systematic literature search, but there were only 14 articles from several countries suitable and relevant for our analysis. The majority of the articles showed the effects of physical exercise on the mental disorders of the elderly, while we wanted to review mental health in general. This article only discussed the effect of physical exercise on the mental health of the elderly and did not discuss the effect on their physical function.

Conclusion

This systematic review showed that exercise programs positively affect the mental health of the elderly, both those who are generally healthy and those who have experienced various symptoms. Based on this review result, a moderate-intensity exercise program with a frequency of twice a week and program duration of 12 weeks to 5 months reported the highest number of significant effects on elderly mental health. In addition, interventions that offer a single type of exercises, such as ROM, aquatic, aerobic, yoga, or exercise combination, showed the highest proportion of effectiveness and the result was reported in the mental health of the elderly.

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Table 1. Study sample and characteristic

Citation	Sample Measurement	Age (Range and Mean)	Residence Place	Exercise Duration	Data Collection	Intervention Group	Control Group	Instrument
Battaglia G, et al. ^[4] (2016)	n=30 (Intervention group n=17, Control group n=13)	Intervention group (age: 68.35±6.04 years old) Control group (age: 69.69±7.94 years old)	Society at the senior center in Palermo (Sicily)	8 weeks	Week 0-week 8	ROM exercise	No organized physical activity during the trial period.	MCS
da Silva LA, et al. ^[10] (2019)	n=92 (Intervention group= 56, Control group n= 36)	Age 62-75 years old (Mean age 63.5±8.8 years old)	House or apartment complex	12 weeks	Week 0, 6, 12	Aquatic training	Low intensity workout lasted for 15 minutes	WEMWBS
Black SV, et al. ^[5] (2015)	n=1.976	Age above 63 years old (Mean age 62,8 (SD=1.2) years old)	Settlement in the middle of England	12 months	Month 0-Month 12	Aerobic Exercise	Free living activities	WEMWBS
Gothe NP, et al. ^[15] (2019)	n=247	Age 65–75 years old (mean age 65.4±4.6)	City center society	6 months	Month 0-Month 6	Aerobic exercise and walking exercise	Low-intensity exercise, i.e. stretching, strengthening and stability	WEMWBS
Byeon H. ^[6] (2019)	n=256	Age 65–74 years old	Houses in City	12 weeks	Week 1-Week 12	Aerobic physical activity	Daily activities as usual	PHQ
de Oliveira LDSSCB, et al. ^[12] (2019)	n=200 (Intervention group =100, Control group= 100)	Age >60 years old Intervention group (69.75±4.36 years old) Control group (72.56±5.68 years)	Padre Firmo Social Home	6 months	Month 0-month 6	Sport	Daily activities as usual	GHQ
Rugbeer N, et al. (2017)	n= 100	Age >60 years old (Mean age SD 7,57)	Nursing home	12 months	0,3,6,9,12 month	Sport	Daily activities as usual	MCS
Makizako H, et al. ^[24] (2019)	n=90 (Intervention group n=60, Control group n=30)	Age 65 years old	Community center	20 weeks	Week 0, 5, 10, 15, 20	Aerobic exercise and Muscle strength	90-min education class	MMSE
Ebrahimi Z, et al. ^[13] (2019)	n=175 (Intervention group n=120, Control group n=55)	Age 60 years old (Mean age 81.98±8.3)	Masyhad Nursing home	3 months	Month 0-Month 3	Yoga exercise	Daily activities as usual	GHQ
Walker JG, et al. ^[42] (2010)	n=909 (Intervention group n=457, control group 452)	Age 60–74 years old (mean age of intervention group 65,68 (4,04), control group 66,10 (4,30))	Urban community	22 months	Month 8, 13, 18 and 22	Aerobic exercise	Providing nutrition in the form of vitamins	PHQ
Gschwind YJ, et al. ^[17] (2013)	n=54 (Intervention group 1 n=18, intervensi 2 n=18, control group n=18)	Age 65–80 years old	Geriatric community	12 weeks	Week 0,3,6,9,12	Muscle strength exercise	Daily activities as usual	MMSE
Okamoto R. ^[28] (2018)	n=53 (Intervention group n=25, control group n=28)	Age 65–80 years old (mean age of intervention group ± 5.3, control group 76.3±5.9)	Geriatric community environment	12 weeks	Week 0-Week 12	Aerobic exercise, facial muscle exercise	Daily activities as usual	MMSE
Tew GA, et al. ^[39] (2017)	n=57 (Intervention group n=25, control group n=27)	Age >60 years old (mean age of intervention group 73,8 (6,5), control group 75,7 (7,9))	Geriatric community	3 months	Month 0-Month 3	Yoga exercise	Daily activities as usual	WEMWBS
Mortazavi SS, et al. ^[27] (2017)	n=372 (Intervention group n=233, control group n=139)	Age above 60 years old	Nursing home	2 months	Month 0-Month 2	Aerobic exercise	Daily activities as usual	GHQ

MCS: Mental component summary; WEMWBS: Warwick-Edinburgh Mental Well-being Scale; PHQ: Patient health questionnaire; GHQ: General health questionnaire; MMSE: Mini-mental state examination score.

Table 3. Result report (mental health assessment)

Variabel	Battaglia G, et al. ^[4] (2016)	da Silva LA, et al. ^[10] (2019)	Black SV, et al. ^[9] (2015)	Gothé NP, et al. ^[15] (2019)	Byeon H. ^[6] (2019)	De Oliveira LDSSCB, et al. ^[12] (2019)	Rugbeer et al. ^[35] (2017)	Makizako H, et al. ^[24] (2019)	Ebrahimi Z, et al. ^[13] (2019)	Walker JG, et al. ^[42] (2010)	Gschwind YJ, et al. ^[17] (2013)	Okamoto R. ^[28] (2018)	Tew GA, et al. ^[39] (2017)	Mortazavi SS, et al. ^[27] (2017)	Result
Depression		R*			R*	R*				R*				x*	5*/5 (100%)
Physical Function		R*	R	R*	R*	R*	R*	R*			R*	R*	R		8*/10 (80%)
Somatic symptom				R						R*					1*/2 (50%)
Anxiety		R*				R*			R*	R		R		R*	4*/6 (66%)
Sleep disturbance										R*				R	1*/2 (50%)
Sleep quality				R*					R*						2*/2 (100%)
Social function	R			R*		R	R			R	R*		R*		3*/7 (42%)
Emotional						R					R*		R*	R*	3*/4 (75%)
Happiness			R*												1*/1 (100%)
Energy sufficiency							R						R		0*/2 (0%)
Optimism						R*									1*/1 (100%)
Positive thought													R*		1*/1 (100%)
General health	R*	R*	R*	R		R*									4*/5 (80%)
Cognitive								R*						R	1*/2 (50%)
Life quality	R*						R			R*		R			2*/4 (50%)
MCS Score	R							R*							1*/2 (50%)
WEMWBS Score		R*	R	R*									R*		3*/4 (75%)
MMSE Score											R*	R*			2*/2 (100%)
PHQ Score					R*					R					1*/2 (50%)
GHQ Score						R			R*					R	1*/3 (33%)
Outcome	2*/4 (50%)	5*/5 (100%)	2*/4 (50%)	4*/6 (66%)	3*/3 (100%)	4*/8 (50%)	1*/4 (25%)	3*/3 (100%)	3*/3 (100%)	4*/7 (57%)	4*/4 (100%)	2*/4 (50%)	4*/6 (66%)	3*/6 (50%)	

Mental Health measurement R = Result reported, R* = there was a significant positive change; no negative result was reported.