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Comparison of Cognitive Function and Depressive Symptoms in Older Adults Engaged and Not Engaged in Exercise: Analysis Using the AMT and GDS

Wahyana Mujari Wahid

Sports Science Study Program, Faculty of Sport and Health Sciences,

Universitas Negeri Makassar, Indonesia

*Corresponding Author: Wahyana Mujari Wahid, e-mail: wahyana.mujari@unm.ac.id

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Abstract

Studi purpose. The elderly are an age group that is prone to decreased cognitive function and depressive symptoms along with the aging process. These impairments can have an impact on the quality of life and independence of the elderly. Regular physical activity, such as calisthenics, has been widely studied to have a positive influence on mental and cognitive health. However, evidence is still needed regarding the effectiveness of low-frequency exercise that is commonly practiced in the community. This study aims to analyze differences in cognitive function and depressive symptoms in elderly people who are active and inactive in gymnastics activities, using the Abbreviated Mental Test (AMT) and Geriatric Depression Scale (GDS) instruments.

Materials and methods. This study uses a quantitative approach with a comparative research design, which aims to analyze differences in cognitive function and depressive symptoms between elderly people who are active and inactive in gymnastics. The sample amounted to 40 elderly (≥60 years), consisting of 20 elderly active in gymnastics (once a week) and 20 inactive elderly. The sampling technique used purposive sampling with the following criteria: age ≥60 years, no severe physical impairment, and willing to be a respondent.

Result. Measurement of cognitive function was carried out using the Abbreviated Mental Test (AMT) instrument, while depressive symptoms were measured using the Geriatric Depression Scale (GDS). Both instruments were administered through direct interviews by researchers to all participants to ensure understanding and accuracy of answers. AMT scores ranged from 0-10 (≥8 = normal), while GDS 0-30 (0-9 = normal, 10-19 = mild depression, ≥20 = severe depression). Analysis was conducted using independent samples t-test with the help of SPSS version 25, and the significance level was set at $p < 0.05$.

Conclusions. This finding shows that exercise performed only once a week is not enough to have a significant impact on the cognitive and psychological health of the elderly. The implication of this study is the need to develop a more structured, intensive and sustainable physical activity program for the elderly, in accordance with WHO recommendations. These results can also serve as a basis

for health practitioners, elderly program managers, and policy makers in designing effective exercise interventions to maintain the mental and emotional functions of the elderly.

Keywords: Elderly, AMT, GDS, Physical Activity.
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Introduction

Mental and cognitive health in the elderly is a very important aspect in supporting the quality of life of elderly independence. As they age, the brain, as a complex organ, the center of body system regulation and cognitive center, is one of the body's organs that is very vulnerable to the aging or degenerative process (Noor & Merijanti, 2020; Zhang et al., 2019). Many older adults face declining cognitive function and increasing symptoms of depression, which can adversely affect their physical and emotional well-being. Decreased cognitive function, such as memory impairment and difficulty in thinking, as well as depressive symptoms, can reduce the ability of the elderly to lead independent and meaningful lives. Elderly people who experience decreased cognitive function and depression are at higher risk of limitations in daily activities, decreased quality of life, and dependence. This condition is increasingly relevant considering that the elderly population continues to increase, including in Indonesia. Based on BPS data (2023), the number of elderly people in Indonesia reaches more than 10% of the total population, and is expected to continue to grow every year. Data from the Directorate General of Medical Services of the Ministry of Health of the Republic of Indonesia shows that the prevalence of cognitive dysfunction in the elderly in Indonesia reaches 32.4% (Prabowo & Chondro, 2021). In various elderly communities, especially in urban and semi-urban areas, there are many elderly who have limited physical activity and do not receive adequate mental health intervention programs. Therefore, maintaining the physical and mental balance of the elderly is crucial to improving their quality of life in old age.

Initial research in several elderly gymnastics groups showed that gymnastics activities were only conducted once a week and focused more on social interaction than fitness achievement. On the other hand, complaints about memory loss, anxiety, and sadness are still common, but have not been followed up in a structured way. This suggests a gap between the physical activities available and their impact on the mental health of older adults. Therefore, it is important to assess the effectiveness of common exercise activities for older adults in relation to cognitive function and depressive symptoms.

One approach that has been proven effective in maintaining the physical and mental health of the elderly is physical activity. Various studies have shown that regular exercise has significant benefits on physical health, such as improved muscle strength, balance and mobility, as well as mental health, including reduced symptoms of depression and improved cognitive function (Ramli & Suhermi, 2020). Research shows that regular physical activity can help slow the decline in cognitive function and reduce symptoms of depression (Santos-Lozano et al., 2016). Physical activities such as gymnastics, which can be done with controlled intensity, are one option that can be done by the elderly. Gymnastics provides not only physical, but also psychological benefits, such as improved mood and reduced anxiety.

However, the benefits of physical activity depend on several factors, such as the frequency, intensity and duration of the activity. WHO (2020) recommends that older adults engage in moderate-intensity physical activity for at least 150–300 minutes per week to achieve optimal benefits for both physical and mental health. Sporadic or unstructured exercise may not have an optimal impact on the health of the elderly. More in-depth research into the type and mode of exercise is essential to understand how physical activity can be adapted to meet the

specific needs of older people. Research by (Cunningham et al., 2020) showed that inadequate physical activity, even if done regularly, did not have a significant impact on cognitive function or mental health in the elderly.

This study reinforces previous findings showing that physical activity has potential benefits on cognitive function and psychological state in the elderly, as reported by (Zhang et al., 2024) and (Tang et al., 2024). However, the results in this study suggest that the low frequency of exercise (one time per week) is not enough to provide significant changes. This confirms the importance of designing physical activity programs in accordance with scientific guidance from the WHO and previous research on optimal exercise dose and intensity.

The main contribution of this study lies in the empirical evaluation of common community-based elderly exercise practices, which have not been quantitatively studied in terms of their impact on cognitive function and depression. The findings provide a basis for elderly program managers and health workers to consider intensifying the frequency and structure of physical exercise for the elderly. There is also scope for further studies to evaluate the effectiveness of more tailored physical activity interventions, including multimodal approaches that combine physical exercise and cognitive stimulation.

Materials and methods

Study participants

The study involved 40 elderly participants (≥60 years old), divided into two groups: 20 older adults who actively participated in exercise (once per week group exercise) and 20 older adults who were not engaged in exercise activities. Participants were selected using purposive sampling based on inclusion criteria: age ≥60 years, absence of severe physical impairments, and willingness to participate in the study. Purposive sampling was chosen because it is effective for selecting subjects with specific characteristics relevant to health research (Notoatmodjo, 2012).

Study organization

This study used a **comparative design,** which is suitable for analyzing differences between groups based on specific variables (Sugiyono, 2010). Cognitive function was assessed using the Abbreviated Mental Test (AMT), a 10-item questionnaire covering memory, time orientation, and basic cognitive abilities, with a total score ranging from 0 to 10. The AMT score interpretation was: 8–10 = normal, 4–7 = moderate impairment, 0–3 = severe impairment (Hodkinson, 1972).

Depressive symptoms were assessed using the Geriatric Depression Scale (GDS), a 30-item questionnaire designed to identify depression symptoms in older adults, with a score range of 0–30. The GDS score interpretation was: 0–9 = normal, 10–19 = mild depression, 20–30 = severe depression (Yesavage et al., 1982).

Data collection was conducted through face-to-face interviews, where participants completed the AMT and GDS questionnaires. **Recording and processing data from the scores obtained by each participant**. This procedure was carried out following recommended practices in nursing and health research to ensure data validity (Polit & Beck, 2017).

Instrumen AMT memiliki validitas yang telah terbukti dalam berbagai penelitian internasional dan telah digunakan secara luas untuk skrining cepat gangguan kognitif pada lansia (Hodkinson, 1972).

GDS dikembangkan oleh (Yesavage et al., 1982) dan telah divalidasi secara luas dalam berbagai populasi lansia, dengan reliabilitas tinggi (nilai Cronbach's Alpha antara 0,80–0,94). Dalam konteks Indonesia, GDS juga telah digunakan dan divalidasi dalam beberapa penelitian lokal.

Statistical analysis

The data were analyzed using independent samples t-test to compare the mean AMT and GDS scores between the exercise and non-exercise groups. The statistical analysis was performed using IBM SPSS Statistics software, version 25.0. The analysis included descriptive statistics to summarize participant characteristics and inferential statistics to test the differences between groups, with a significance level set at $p < 0.05$ (Field, 2024).

Results

Descriptive Analysis

Table 1. Descriptive Statistics of AMT and GDS Scores in the Elderly.

Variable	Group	N	Mean	SD	Category
AMT	Inactive	20	8,85	2,23	Normal
AMT	Active	20	9,70	0,73	Normal
GDS	Inactive	20	9,15	6,94	Normal
GDS	Active	20	10,00	5,52	Mild Depression (lower limit)

Based on the results of the descriptive analysis, the following picture is obtained:

AMT score:

1. Elderly inactive gymnastics obtained an average AMT score of 8.85 (SD = 2.23), which is included in the normal category.
2. Elderly active gymnastics obtained an average AMT score of 9.70 (SD = 0.73), which is included in the normal category.

GDS score:

1. Elderly inactive gymnastics obtained an average GDS score of 9.15 (SD = 6.94), which is included in the normal category.
2. Elderly active gymnastics obtained a mean GDS score of 10.00 (SD = 5.52), which is included in the mild depression category (lower limit).

Hypothesis Analysis

Tabel 2. Results of Independent Samples t-Test of AMT and GDS Score.

Variable	Group 1	Group 2	p-value (Sig. 2-tailed)	Description
AMT	Inactive	Active	0,114	Not significant
GDS	Inactive	Active	0,670	Not significant

Based on the results of the independent samples t-test test above, the results were obtained: At the level of cognitive mental function (AMT) there is no significant difference between the elderly active gymnastics and not active gymnastics with a value ($p = 0.114$; $p > 0.05$) and at the level of depression (GDS) there is no significant difference between the elderly active gymnastics and not active gymnastics ($p = 0.670$; $p > 0.05$).

Discussion

The results showed that the average score of cognitive function (AMT) in elderly who were active in gymnastics was 9.70, while inactive elderly was 8.85. Although both are included

in the normal category, the score of active elderly is higher, although the difference is not statistically significant (p = 0.114). This shows that physical activity in the form of gymnastics once a week is not enough to have a real impact on improving the cognitive function of the elderly.

These findings are in line with research by Iso-(Iso-Markku et al., 2024), which showed that physical activity ha**d** a weak but significant relationship with cognitive decline, especially in the domains of episodic memory and verbal fluency. However, no clear dose-response relationship was found between the amount of physical activity and overall cognitive function.

In the context of cognitive function, (Zhang et al., 2024) through their meta-analysis showed that physical exercise, particularly aerobic and resistance training, has positive effects on brain white matter integrity and cognitive function in the elderly. (Kirk-Sanchez & McGough, 2014) also said physical exercise contributes to improving executive brain function in the elderly. However, the effects were more significant in interventions with adequate duration and intensity. They emphasized the importance of a structured and sustainable exercise program for optimal cognitive benefits. Moderate-intensity aerobic exercise has been associated with improvements in executive function, memory, and neuroplasticity, especially in older adults (Da Silveira et al., 2021). Aerobic exercise has been shown to increase hippocampus volume and memory (Erickson et al., 2011).

Various types of physical exercise, such as brisk walking, yoga, and strength training, were shown to be effective in reducing depressive symptoms in the elderly. Effectiveness of physical exercise depends on the type of exercise, intensity, and consistency of exercise performed regularly, with a frequency of at least three times per week over a sufficiently long period (Noetel et al., 2024), (Maulana & Bawono, 2021). High-intensity exercise tends to give more significant results (Sofi et al., 2011). In addition, types of exercise such as yoga and strength training had a better tolerance rate among elderly participants, indicating that the exercises were well accepted by this group.

Interestingly, research by (Zhang et al., 2024) also showed that physical exercise interventions can improve cognitive flexibility in the elderly, especially when combined with cognitive stimulation. This suggests that a multimodal approach, which combines physical and cognitive exercise, may provide greater benefits in maintaining and improving cognitive function in the elderly. Recent studies have shown that the combination of physical exercise and cognitive stimulation can provide significant benefits in improving cognitive function in the elderly. (Blomstrand et al., 2023) in their systematic review found that combined exercises, such as yoga and tai chi, were more effective in improving cognitive function compared to aerobic or resistance training alone. This multimodal approach was shown to have a greater impact on improving attention, memory and information processing speed in healthy older adults. In line with this, (Xu et al., 2023) in their meta-analysis also revealed that physical exercise, both aerobic and resistance, significantly improved cognitive abilities in the elderly. This study reinforces the idea that physical exercise is not only beneficial for physical health, but can also contribute to improved cognition, especially in older adults.

Furthermore, a study by (Faraziani & Eken, 2024; Nugroho & Setiawan, 2020). emphasized that physical activity positively affects cognitive decline and quality of life in the elderly through improving cardiovascular health, neuroplasticity, and neurogenesis. Regular physical activity, especially aerobic and resistance training, is associated with better cognitive function and slower cognitive decline.

In the aspect of depressive symptoms measured using the GDS, the average score of elderly active gymnastics is 10.00 (mild depression category, lower limit), while the elderly not active gymnastics scored 9.15 (normal category). This difference was also not statistically significant (p = 0.670). Interestingly, the active elderly group showed a slightly higher depression symptom score, although it was not statistically significant.

This phenomenon can be explained by several factors. One of them is the low frequency of physical activity (only once a week), which is considered insufficient to have a significant psychological impact. (Laird et al., 2023) n their study involving 4,016 older adults aged ≥50 years for 10 years and found that physical activity with a frequency of at least three times a week can reduce the risk of depressive symptoms by 16% and major depression by 43%. This study supports the importance of exercise frequency in reducing depressive symptoms in the elderly. Physical activity doses lower than those recommended in overall health guidelines (i.e., ≥600 MET-minutes/week) may protect against depressive symptoms and major depression in older adults. However, higher doses of physical activity are associated with greater risk reduction. This study is also in line with findings from a study by (Chin et al., 2022), this study examined the effects of frequency and intensity of walking exercise on the elderly with insomnia and depressive symptoms. The results showed that only the group that did walking exercise three times a week, either at moderate or high intensity, for 12 weeks experienced a significant reduction in depressive symptoms. The group that practiced only once a week showed no significant improvement. This suggests that a higher frequency of exercise is needed to benefit depressive symptoms.

Meta-analysis by (Tang et al., 2024), which comprehensively evaluated the relationship between exercise and depression in the elderly, by analyzing 47 randomized controlled trials involving 2,895 participants. The results showed that various types of exercise, including walking, aerobic exercise, yoga, qigong, strength (resistance) training, and tai chi, significantly reduced depressive symptoms in the elderly compared to the non-exercising group. Of all these types of exercise, walking provided the most favorable effect, with moderate to high effect sizes. In addition, the study found a U-shaped relationship between exercise dose and improvement in depressive symptoms. This means that there is an optimal dose range of between 350-1,000 METs-minutes per week, with the most ideal dose being around 800 METs-minutes per week (or clinically effective in the 600-970 METs-minutes per week range). Doses that are too low or too high are less likely to provide optimal benefits.

The findings in this study, although not showing significant differences, reinforce previous findings that the intensity and frequency of physical activity play an important role in providing psychological and cognitive benefits for the elderly. Research by (Laird et al., 2023; Chin et al., 2022; Quigley et al., 2020; Wen et al., 2024). Suggest that a frequency of at least three times a week is required to have a protective effect against depressive symptoms and cognitive decline. Lack of physical activity increases the prevalence of depression in the elderly (Nieman & Wentz, 2019).

In this context, the results of this study provide an update that an exercise program conducted only once a week - as is common in many elderly communities - does not reach this threshold of effectiveness. That is, the non-significant results in this study were not due to the absence of an association between physical activity and mental health, but rather an insufficient frequency of activity to produce noticeable changes. Therefore, this study supports previous literature and highlights the need for evaluation of current physical activity programs to align them with evidence-based recommendations.

Overall, these studies highlight the importance of a multimodal approach to improving cognitive function in older adults. The combination of physical exercise and cognitive stimulation offers greater benefits compared to a single approach. This approach not only improves the physical and cognitive aspects of the elderly, but can also slow down the cognitive decline associated with aging, providing long-term benefits to the quality of life of the elderly.

Based on the findings in this study and referring to previous studies, older adults are advised to engage in physical activity at a frequency of at least three times per week, with a duration of 30-60 minutes per session, to obtain optimal benefits for mental and cognitive health. Types of physical activity that are effective for older adults in preventing cognitive

function decline and depressive symptoms include: (1)Light to moderate aerobic exercise, such as brisk walking, senior exercises, and stationary cycling. (2) Strength training (resistance training) using body weight or simple tools to maintain muscle mass and brain function. (3) Balance and flexibility exercises, such as yoga or tai chi, which can also reduce anxiety and improve focus. (4) A combination of physical activity and cognitive stimulation, such as rhythmic gymnastics with counting or following visual/auditory instructions, has been shown to be effective in improving cognitive flexibility.

Conclusions

This study found that there was no significant difference in cognitive function scores and depressive symptoms between the elderly who actively participated in gymnastics once a week and the elderly who did not participate in gymnastics. Both groups generally remained within the normal category for cognitive function and mild depressive symptoms.

The main contribution of this study is that it provides insight that the frequency of exercise commonly practiced in elderly communities (i.e., once a week) is not effective enough to have a significant impact on cognitive and psychological health. This finding reinforces the importance of the frequency and structure of physical activity in accordance with scientific recommendations for optimal benefits.

The practical implication of this study is the need for evaluation and improvement in the planning of elderly exercise programs, so that they are carried out with a minimum frequency of three times per week, and involve aerobic elements, strength training, and cognitive stimulation in a balanced manner.

This study has several limitations, including a relatively small sample size and the use of a cross-sectional design, which cannot infer direct causal relationships. In addition, the frequency and quality of physical activity performed were not measured in more depth.

Future researchers are advised to conduct long-term intervention studies with varying exercise frequency, and consider additional measurements such as physical fitness level, sleep quality, and more complex cognitive parameters. In addition, it would be beneficial to combine physical activity and cognitive interventions to see the combined effect on the mental health of the elderly.

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Conflict of interest

There is none.

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Information about the authors:

Wahyana Mujari Wahid, S. Or., M. Or: wahyana.mujari@unm.ac.id, https://orcid.org/0000-0003-3865-0511, Department of Sports Science, Faculty of Sport and Health Sciences, Universitas Negeri Makassar, Indonesia

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