

RESEARCH ARTICLE

**CORRELATION BETWEEN PHYSICAL ACTIVITY AND COGNITIVE FUNCTION
AMONG THE ELDERLY AT PADANG KANDIS PUBLIC HEALTH CENTER
(KORELASI AKTIVITAS FISIK DAN FUNGSI KOGNITIF LANSIA DI PUSKESMAS
PADANG KANDIS)**

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ABSTRACT

The increasing global elderly population has been accompanied by a rise in age-related health problems, particularly degenerative conditions such as cognitive decline. Physical activity is considered a modifiable factor that may play a protective role in maintaining cognitive health, as regular exercise is believed to delay cognitive deterioration in older adults. This study aimed to investigate the correlation between physical activity and cognitive function among elderly individuals living within the service area of Padang Kandis Public Health Center, located in Lima Puluh Kota Regency. This study employed an analytic observational design with a cross-sectional approach. Participants were selected using a consecutive sampling technique, resulting in 52 elderly individuals residing in the study area. Physical activity levels were assessed using the Global Physical Activity Questionnaire (GPAQ), while cognitive performance was evaluated using the Indonesian version of the Montreal Cognitive Assessment (MoCA-Ina). Bivariate analysis was performed using the chi-square test. The results showed that 23 respondents (44.23%) engaged in a moderate level of physical activity, and 27 respondents (51.92%) demonstrated normal cognitive function. Statistical analysis indicated a significant relationship between physical activity and cognitive function, with a p-value of 0.001 ($p < 0.05$). In conclusion, this study demonstrated a significant association between physical activity levels and cognitive performance in the elderly population served by the Padang Kandis Public Health Center.

Keywords: cognitive function, elderly, GPAQ, MoCA-Ina, physical activity

ABSTRAK

Peningkatan jumlah lansia secara global turut disertai oleh bertambahnya permasalahan kesehatan yang berkaitan dengan proses penuaan, salah satunya adalah penurunan fungsi kognitif akibat penyakit degeneratif. Aktivitas fisik merupakan salah satu faktor yang dapat dimodifikasi dan berperan penting dalam mempertahankan fungsi kognitif, di mana

pelaksanaan aktivitas fisik secara rutin diyakini mampu memperlambat penurunan tersebut pada kelompok lansia. Penelitian ini bertujuan untuk mengevaluasi hubungan antara aktivitas fisik dan fungsi kognitif pada lansia yang berdomisili di wilayah kerja Puskesmas Padang Kandis, Kabupaten Lima Puluh Kota. Penelitian ini menggunakan metode analitik observasional dengan desain studi potong lintang (cross-sectional). Pengambilan sampel dilakukan secara consecutive sampling, sehingga diperoleh 52 orang lansia yang memenuhi kriteria. Tingkat aktivitas fisik dinilai menggunakan kuesioner Global Physical Activity Questionnaire (GPAQ), sedangkan fungsi kognitif diukur dengan instrumen Montreal Cognitive Assessment versi Indonesia (MoCA-Indo). Analisis bivariat dilakukan menggunakan uji Chi-square. Hasil menunjukkan bahwa 23 responden (44,23%) memiliki tingkat aktivitas fisik sedang, dan 27 responden (51,92%) memiliki fungsi kognitif yang tergolong normal. Uji statistik menunjukkan adanya hubungan yang signifikan antara aktivitas fisik dan fungsi kognitif pada lansia dengan nilai p sebesar 0,001 ($p < 0,05$). Kesimpulannya, penelitian ini menemukan adanya hubungan yang bermakna antara tingkat aktivitas fisik dengan fungsi kognitif pada lansia di wilayah kerja Puskesmas Padang Kandis, Kabupaten Lima Puluh Kota.

Kata kunci: aktivitas fisik, fungsi kognitif, GPAQ lansia, MoCA-Indo

INTRODUCTION

The elderly represent a demographic group that has entered the final stage of the human life span. According to the 2013 guidelines issued by Indonesia's Ministry of Health, individuals aged 55 years and older are classified as elderly.¹ In recent decades, the global population of older adults over 60 years has increased substantially, primarily due to advancements in healthcare and improvements in life expectancy. Data from the United Nations Department of Economic and Social Affairs estimates that the global population aged 60 years and above has reached approximately 962 million individuals.^{1,2}

Indonesia has also experienced a significant demographic transition. Between 1971 and 2020, the proportion of elderly individuals in the country rose

significantly, reaching 9.92% of the total population, equivalent to approximately 26 million people. In 2020, six provinces were identified as having an aging population structure, where the elderly comprised at least 10% of the total population. DI Yogyakarta had the highest proportion at 14.71%, followed by Central Java (13.81%), East Java (13.38%), Bali (11.58%), North Sulawesi (11.51%), and West Sumatra (10.07%).^{1,3,4}

As the elderly population grows, various age-related challenges become more prevalent, particularly degenerative conditions such as cognitive decline. Cognitive deterioration is characterized by changes in perception, impaired communication, memory deficits, reduced concentration, and difficulties in performing daily activities. Among the

many factors that impact cognitive performance, physical activity plays a particularly important role. Engaging in physical movement helps stimulate the nervous system and may slow down the progression of cognitive decline in older adults.² Kirk-Sanchez and McGough highlighted that physical activity not only enhances brain function but also boosts the production of Brain-Derived Neurotrophic Factor (BDNF), a protein essential for maintaining neuronal integrity and function.⁵ Certain types of physical activities, particularly those requiring rapid responses, such as tennis and basketball, are especially effective in supporting cognitive engagement and development.⁶

Rinaningsih's study revealed that cognitive function in older adults is influenced by multiple factors, including level of education, history of degenerative illnesses, and physical activity.⁷ Elderly individuals with normal cognitive abilities were generally those with higher educational attainment, regular engagement in physical activity, and no history of degenerative diseases. In Lima Pulu Kota Regency, the coverage of elderly health screenings in 2019 was 54.2% of the total elderly population, which was considerably lower than the coverage rate in Padang City at 74.9%.^{8,9} Preliminary observations within the Padang Kandis Health Center service area indicate that a considerable

number of elderly individuals engage in low levels of daily physical activity. Based on this context, the present study aims to investigate the relationship between physical activity and cognitive function among elderly individuals residing in the Padang Kandis Health Center service area, Lima Pulu Kota Regency.

MATERIALS AND METHODS

This study employed an analytical observational design with a cross-sectional approach. A total of 52 elderly participants residing within the service area of the Padang Kandis Health Center, Lima Pulu Kota Regency, were included in the sample. Participants were selected using non-probability sampling through a consecutive sampling technique, based on umbrella research data that met the predetermined inclusion and exclusion criteria. Inclusion criteria were defined as the characteristics that must be met by members of the population to be eligible as study participants. The inclusion criteria for this study were elderly individuals registered within the Padang Kandis Health Center service area in Guguak District, Lima Pulu Kota Regency. aged 55 years or older, and willing to participate as respondents. Exclusion criteria were defined as characteristics that disqualified members of the population from participation. Individuals were excluded if they had

mental disorders, visual impairment (blindness), hearing impairment, speech impairment (aphasia), or physical disabilities. The research was conducted over a period from September 2021 to July 2023.

Data collection began with administrative preparation, including obtaining research permits and preparing research instruments. Data were subsequently collected from all eligible participants through guided interviews conducted by the researchers to complete the study questionnaires. Cognitive function, as the dependent variable, was assessed using the Indonesian version of the Montreal Cognitive Assessment (MoCA-Ina). Scores ranging from 0 to 25 indicated decreased cognitive function, while scores

of 26 or higher indicated normal cognitive function.¹⁰ Physical activity, as the independent variable, was measured using the Global Physical Activity Questionnaire (GPAQ). Physical activity levels were categorized as heavy (> 3000), moderate (601-3000), and light (≤600).¹¹

All collected data were processed and analyzed. Univariate analysis was performed to describe the frequency distribution of both dependent and independent variables. Bivariate analysis was conducted using the chi-square test to determine the relationship between physical activity and cognitive function.

RESULTS AND DISCUSSION

A. Characteristics of Research Subjects

Table 1 Characteristics of research subjects

Characteristics	F	%
Gender		
Male	7	13,46
Female	45	86,54
Age		
45-54	0	0
55-64	11	21,15
65-69	28	53,85
>70	13	25
Education Level		
Elementary school	7	13,46
Junior high school	17	32,69
Senior high school	13	25
College	15	28,85
Employment Status		
Employed	11	21,15
Not Working	41	78,85

Source: Primary data, 2023

This study involved 52 elderly respondents characterized by gender, age, disease history, education level, and employment status. As shown in Table 1, the majority of respondents in the Padang Kandis Health Center service area of Lima Puluh Kota Regency were female (45 individuals; 86.54%). The most frequent age range was 65-69 years (28 individuals, 53.85%), and the highest education level attained by the largest group was college (15 individuals, 28.85%). Additionally, the majority of respondents were no longer working (41 individuals, 78.85%).

The predominance of female respondents (86.54%, n=45) compared to males (13.46%, n=7) aligns with 2019 demographic data, which indicates a higher population of elderly women than men in Lima Puluh Kota Regency (28,946 vs 22,836 individuals).

Regarding age distribution, most respondents were within the 65-69 year age group (28 individuals, 53.85%), followed by those aged over 70 years (25%) and those aged 55-64 years (21.15%). No respondents were in the 45-54-year-old age

category. The age group 60-70 years is most susceptible to impaired cognitive function, a condition linked to the aging process and central nervous system changes that affect intelligence, memory, and psychological health.⁶

In terms of medical history, respondents presented with various health conditions. Hypertension was the most frequently reported condition (26.92%), followed by gout (17.31%), dyslipidemia (13.46%), acid reflux (11.54%), and diabetes mellitus (5.77%). Asthma, osteoarthritis, and hernia were each reported by one respondent (1.92%). Sixteen respondents (30.77%) reported no known medical history or were unaware of any diagnosed conditions. Regarding education attainment, the majority of respondents had completed junior high school (32.69%), followed by college (28.85%), senior high school (25%), and elementary school (13.46%). Based on employment status, most elderly participants were not working (78.85%), while 21.15% remained employed.

B. Physical Activity Overview

Table 2 Physical activity overview

Physical Activity	F	%
Light	9	17,31
Moderate	23	44,23
Heavy	20	38,46
Total	52	100

Source: Primary data, 2023

Based on table 2, the results indicate that the majority of elderly individuals within the service area of the Padang Kandis Health Center engaged in moderate physical activity (44.23%) and heavy physical activity (38.46%). Only 17.31% of respondents were categorized as having light physical activity. These findings suggest that most elderly individuals in the study area remain physically active. These results are in line with the research of Izzah (2014, which also reported a predominance of moderate to heavy physical activity among older adults. In contrast, Sauliyusta and Rekawati (2016) found a more balanced distribution of physical activity levels among the elderly, while Polan et al. (2018) reported generally low levels of physical activity.^{10,11}

The differences across studies may be due to variations in sample

characteristics. Although the majority of elderly participants in Padang Kandis were no longer working, they remained active in daily activities such as performing household chores, farming, walking, and participating in weekly elderly exercise sessions, all of which contribute to higher physical activity levels.

Physical activity consists of four main dimensions: type, frequency, duration, and intensity. According to Kerr et al., elderly individuals are advised to engage in physical activity at least three times a week for a duration of 30 minutes per session. Routine physical activity can improve cognitive function by up to 20%, particularly in executive functions such as planning, memory, and task coordination.¹²

C. Overview of Cognitive function

Table 3 Overview of cognitive function

Cognitive Function	f	%
Normal	27	51,92
Declining	25	48,08
Total	52	100

Source: Primary data, 2023

Based on table 3, the majority of respondents demonstrated normal cognitive function, totaling 27 individuals (51.92%), while 25 respondents (48.08%) experienced cognitive decline. Cognitive function was assessed using the Indonesian version of the

Montreal Cognitive Assessment (MoCA-Inda). These findings indicate that most elderly individuals within the Padang Kandis Health Center service area maintain adequate cognitive function.¹³

These results are consistent with the findings of Sauliyusta and Rekawati (2016), which reported that the majority of elderly individuals had normal cognitive function. However, they differ from the findings of Polan et al. (2018), which indicated a higher prevalence of cognitive decline among older adults. Cognitive decline tends to progress with age due to structural changes in brain neurons, such as reduced dendrites, demyelination, and the loss of synaptic processes.^{14,15}

The natural aging process also leads to decreased physiological function, including cognitive capacity. In addition to age, medical history is a significant factor affecting cognitive health.¹⁶ Among the elderly individuals with moderate physical

activity in this study, 17 out of 23 experienced cognitive decline, many of whom had a history of conditions such as hypertension and diabetes mellitus. Individuals with hypertension have a 2.8-fold higher risk of cognitive decline compared to those without hypertension.¹⁷

According to Setiati et al., the elderly often experience reductions in intellectual ability, nerve transmission efficiency, and information processing speed. They also tend to recall past events more easily than recent experiences.¹⁴

D. Relationship Between Physical Activity and Cognitive Function

Table 4 Association between physical activity and cognitive function

Physical Activity	Cognitive Function				Total		p-value
	Declining		Normal		f	%	
	f	%	f	%			
Light	7	77,78	2	22,22	9	100	0,000
Moderate	17	73,91	6	26,09	23	100	
Heavy	1	5	19	95	20	100	

Source: Primary data, 2024

Chi-square analysis, as shown in Table 4, revealed a p-value of 0.000, indicating a statistically significant association between physical activity and cognitive function in older adults. These results align with previous studies by Polan et al. (2018), Sauliyusta et al. (2016), and Aqidatul (2014), all of which reported

significant correlations between physical activity and cognitive performance with similar p-values of 0.000. Supporting evidence from Clouston et al. (2013) also demonstrated a correlation between physical activity levels and cognitive function in older adults. Similarly, Auyeung et al. highlighted that individuals with reduced physical activity and diminished

muscle strength are more likely to experience cognitive decline.^{14,18,19}

According to Muzamil et al., individuals who maintain high and consistent levels of physical activity generally demonstrate superior cognitive function scores. Conversely, those with low-to-moderate activity levels are more susceptible to cognitive decline, especially in domains such as memory and language abilities. Similarly, Bus et al. found that physical activity has a positive impact on various aspects of cognition, including executive functioning, attention span, processing speed, and working memory, as well as both short- and long-term memory.^{20,21}

Poland et al. (2018) further reported that many respondents experiencing cognitive decline were no longer employed. Employment often necessitates physical movement, which positively affects cognitive function. This issue could be addressed through elderly community health posts (Posyandu Lansia), which are expected to implement structured programs aimed at improving physical fitness in older adults, including regular exercise activities.¹⁹ These exercise routines could help increase physical activity levels. Additionally, elderly health posts are expected to conduct regular screenings, the results of which could be used to detect

early signs of cognitive decline in the elderly.^{22,23}

Physical activity has been identified as a factor contributing to cognitive function. Numerous studies have shown that older adults with limited mobility or sedentary lifestyles tend to exhibit lower cognitive performance. Engaging in regular physical activity not only supports cognitive health in later life but also acts as a protective factor against cognitive decline and dementia. Evidence suggests that physical activity may help prevent or postpone the onset of cognitive impairment or dementia.^{6,24}

Physical activity also facilitates neurotransmitter metabolism (where neurotransmitters are derived from amino acids, one of the brain's most essential nutrients that help increase alertness, reduce errors, and boost mental agility), promotes the production of trophic factors that stimulate neurogenesis (growth of new neurons), and enhances molecular and cellular activity in the brain, thereby supporting and maintaining brain plasticity (the brain's ability to reorganize through new neural interconnections). These processes are crucial in preventing brain tissue hypertrophy, which may cause neuronal degeneration impacting cognition. Sufficient physical activity increases oxygen flow to the brain, helping preserve memory function.^{16,25}

CONCLUSIONS

The results of this study indicate that the majority of participants were female, aged 65-69 years, educated to a junior high school level, and predominantly unemployed. Most elderly individuals in the study area demonstrated moderate levels of physical activity and maintained normal cognitive function. Additionally, a statistically significant relationship was identified between physical activity and cognitive performance, indicating that older adults who engage in higher levels of physical activity tend to exhibit better cognitive function compared to those with lower levels of activity.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest related to this scientific publication.

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