THE RELATIONSHIP BETWEEN PHYSICAL ACTIVITIES AND COGNITIVE FUNCTION IN THE ELDERLY

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ABSTRACT

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The elderly will experience an aging process that is characterized by physical changes, intellectual changes, and a decrease in various body functions. Deterioration of intellectual function including cognitive function is one of the functions that will decrease in the elderly. Physical activity is a factor that can inhibit cognitive decrease in the elderly. One of the preventive actions that can be done by the elderly in slowing down the decrease of cognitive function is to increase physical activity. Physical activity is thought to stimulate nerve growth which might inhibit cognitive decrease in the elderly. When doing physical activity, the brain will be stimulated by talamus so that it will increase the Brain Derived Neurotropic Factor which plays a role in keeping nerve cells fit and healthy. The purpose of this study was to identify the relationship between physical activity and cognitive function in the elderly. This study was a quantitative study with a categorical correlative analytic method. The study used cross sectional study design. The chi-square test and ordinal logistic regression test were used for data analysis. The results of this study stated that the overall physical activities which were exercise, mild activity, heavy activity, use of stairs and participate in social activities showed a significant relationship to cognitive function. Participating in social activities and mild activity were the most significant physical activities that showed relationship to cognitive function, with p-value = 0.001 < 0.05. In conclusion, the findings highlight that the choice of appropriate physical activity can help to maintain cognitive function in the elderly.

BACKGROUND

The elderly will experience an aging process that is characterized by physical changes and a decrease in various body functions. The decrease in body function is a normal condition that occurs as the age increase, but it can also appear as problems related to the symptoms of aging in daily life (Muzamil, Afriwadi, & Martini, 2014). Deterioration of intellectual function including cognitive function is one of the functions that will decrease in the elderly. This decrease in cognitive function is closely related to memory disorders, changes in perception, problems in communication, decreasing focus and attention, and difficulty in carrying out daily tasks (Lestari, Riqqah, & Romus, 2017).

Indonesia is currently ranked fourth with the composition of the largest elderly population in the world after China, India and USA. Based on the population projection data, it is predicted that the number of elderly people will be increasing to 27.08 million in 2020, 33.69 million in 2025, 40.95 million in 2030 and 48.19 million in 2035. The large number of elderly population makes Indonesia at the stage of "Aged Society". It means that the proportion of population at the age of 60 and over is more than 10% of the total population (Pusdatin, 2017). The data of the elderly characteristics in Kasin sub district, the working area of Bareng Primary Health Care, showed that 78.2% of the elderly are still able to do doing daily activities, 82.4% are still able to do mild activities, 69.7% never do any house repairs, 62.7% are able to manage their finance, and 61.3% of them are still able to complete outdoor activities.

Many factors that contribute to the decreasing cognitive function in the elderly include individual factors, disease, and the environment. Age, genetic, and educational level are the individual factors that can contribute to the decreasing cognitive function in the elderly. While, hypertension, diabetes mellitus, and high cholesterol are the factors that increase the chances of cognitive decrease. Environmental factors that increase one's chances of experiencing cognitive decrease include social engagement and activity (Wreksoatmodjo, 2014). Poor cognitive function can be used as a marker of general health status in the elderly and as a predictor of death. Decreasing cognitive function is the biggest cause of inability to carry out daily activities in the elderly and the most common cause of dependence on others in self-care (Reusser, Willekens, & Bonneux, 2011).

Physical activity is a factor that can inhibit cognitive decrease in the elderly. Physical activity is thought to stimulate nerve growth that might inhibit cognitive decrease in the elderly (Sauliyusta & Rekawati, 2016). When doing physical activity, the brain will be stimulated by talamus so that it will increase the Brain Derived Neurotropic Factor that plays a role in keeping nerve cells fit and healthy (Sanchez & Gough, 2013). Previous studies indicate that there is a tendency for the elderly to limit their activities due to a decreasing health.

METHODS

The type of study was a quantitative study with a categorical correlative analytic method. The study used cross sectional study design. The study was conducted in January 2020 in sub-district of Kasin, the working area of the Bareng Primary Health Center in Malang. The study population was all the elderly who came to the Integrated Healthcare Center in Kasin, the working area of the Bareng Primary Health Center in Malang. The elderly who became the respondents were those who aged 60 and over, domiciled at least 1 year in their place, and were willing to become respondents. Respondents were obtained using random sampling technique. The total respondents were 51 people. The Ambbreviated Mental Test (AMT), the physical activity questionnaire, and the demographic data questionnaire were used to get study data. The data used in this study was primary data obtained directly from the elderly during the Integrated Healthcare Center visitation. Based on the study design that was used, the study examined all the variables at the same time. Each respondent would be examined for cognitive functions and daily physical activities. Data analysis was performed the chi-square test and ordinal logistic regression test.

RESULTS

Respondents' Characteristics

Based on table 1, the data showed that most of respondents' ages were between 66-70 years old (27.5%), 36 respondents (70.6%) were female, 35 respondents (68.6%) were elementary school graduates, 35 respondents (68.6%) suffered from illness, 44 respondents (86.3%) did not use walking devices, 46 respondents (90.2%) lived in the same house with other family members, 43 respondents (84.3 %) did not work, and 25 respondents (49.0%) did physical activity with a frequency of once a week.

Characteristics of Daily Physical Activity in the Elderly

Table 2 showed that 35 elderly people (68,6%) did exercise, 38 elderly people (74,5%) did mild work, 28 elderly people (54,9%) did heavy work, 38 elderly people (74,5%) used the stairs, and 38 elderly people (74,5%) did not take part in social activities.

Characteristics of Elderly Cognitive Function

Based on table 3, it was obtained that 39 elderly people (76.5%) had normal cognitive function.

Relationship between Physical Activity and Cognitive Function in Elderly

Table 4 showed that the exercise variable was 0.290 with p-value 0.003 (< 0.05), the mild activity variable was 0.327 with p-value 0.001 (< 0.05), the heavy activity variable was 0.490 with p-value 0.002 (< 0.05), the usage stairs variabel was 3.285 with p-value 0.003 (< 0.05), and the participation in social activities was 0,000 with p-value 0.001 (<0.05). This results mean that the overall physical activities which were exercise, mild activity, heavy activity, use of stairs and participate in social activities significantly influence cognitive function as measured by the Ambbreviated Mental Test (AMT) instrument.

DISCUSSION

Relationship between Exercise and Cognitive Function

Significance value showed the result of 0.003 ($p <0.05$), which showed that there was a significant relationship between exercise and cognitive function. Physical activity is understood as any body move-

Table 1. Respondents' Characteristics

No.	Characteristics	Frequency (F)	Percentage (%)
1.	Age:		
	a. 60-65 years old	10	19,6
	b. 66-70 years old	14	27,5
	c. 71-75 years old	12	23,5
	d. 76-80 years old	12	23,5
	e. 81-85 years old	2	3,9
	f. 86-90 years old	1	2,0
2.	Sex:		
	a. Male	15	29,4
	b. Female	36	70,6
3.	Education:		
	a. No	3	5,9
	b. Elementary school graduates	35	68,6
	c. Junior high school graduate	8	15,7
	d. Senior high school graduates	4	7,8
	e. Vocational graduates	1	2,0
4.	Suffering from illness:		
	a. Yes	35	68,6
	b. No	16	31,4
5.	Using walking devices:		
	a. Yes	7	13,7
	b. No	44	86,3
6.	Living in the same house with other family members:	46	90,2
	a. Yes	5	9,8
	b. No		
7.	Job / work:		
	a. Yes	8	15,7
	b. No	43	84,3
8.	Physical activity frequency:		
	a. Once a week	25	49,0
	b. 1 to 3 times in a week	1	2,0
	c. More than 3 times in a week	6	11,8
	d. Never	19	37,3

ment that requires expenditure of energy such as cycling and doing gymnastics (Polan, Asrifuddin, & Kalesaran, 2018). In the elderly, increasing age has an impact on daily physical activity. The choice of exercise should be adjusted to the physical ability of elderly to maintain the intensity and duration of the exercise. In the elderly, a decrease in the intensity and duration of exercise can accelerate to cognitive decrease. The results of this study are supported by previous study which says that the frequency of exercise with a minimum of three times a week for the elderly can improve overall body fitness (Muzamil et al., 2014). The elderly who exercise have cognitive abilities 2.47 times better than the other elderly who do not exercise. Other studies by Dayamaes (2013), found that there was a relationship between exercise and cognitive function in 55-91 years old men and women. Individuals of this age who are diligent in exercising have better reasoning, memory, and reaction time abilities than individuals who lack or never exercise.

Relationship between Mild and Heavy Activity and Cognitive Function

Significance value showed the number 0.001 (p < 0.05) which indicated that there was a significant relationship between doing mild activity and cognitive function. For the heavy activity, the significance value shown was 0.002 (p < 0.05) which stated if there was a significant relationship between doing heavy activity and cognitive function. The results of this study are supported by previous study which shows if there is a correlation between physical activity and cognitive function in the elderly. The higher

Table 2. Characteristics of Physical Activity in the Elderly

No.	Physical activity characteristics	Frequency (F)	Percentage (%)
1.	Exercise		
	a. Yes	8	15,7
	b. No	35	68,6
	c. Sometimes	8	15,7
2.	Mild activity		
	a. Yes	38	74,5
	b. No	13	25,5
3.	Heavy activity		
	a. Yes	28	54,9
	b. No	23	45,1
4.	Using stairs		
	a. Yes	38	74,5
	b. No	13	25,5
5.	Participating in social activity		
	a. Yes	13	25,5
	b. No	38	74,5

Table 3. Characteristics of Elderly Cognitive Functions

No.	Elderly cognitive functions	Frequency (F)	Persentase (%)
1.	Cognitive functions		
	a. Normal	39	76,5
	b. Mild impairment	12	23,5

Table 4. Analysis of Physical Activity and Cognitive Function in the Elderly

Variables	Wald	df	Sig
Ambrreviated Mental Test (AMT)	461.274	1	0.000
Exercise	0.290	1 0	0.003
Mild activity	0.327	1 0	0.001
Heavy activity	0.490	1 0	0.002
Using stairs	3.285	1 0	0.003
Participating in social activity	0.000	1	0.001

the physical activity, both heavy and mild activity, the higher the cognitive function score (Izzah, 2014).

In household activities, heavy physical activities can be interpreted as washing clothes, mopping, lifting weights, and repairing house. These activities result in calorie expenditure of 7.5 to 12 kcal per minute (Leitzmann et al., 2015).Meanwhile, mild activity category at home are such as cleaning the room, shopping, and sweeping the house. Mild and heavy activities are forms of physical activities that can facilitate the process of neurotransmitter metabolism. The basic ingredients of neurotransmitters are amino acids which are one of the nutrients for the brain and have an important function in alertness increase, errors reduction, and thinking stimulation. The process of neurotransmitters will stimulate the process of neurogenesis and maintain brain plasticity which is the brain's ability to make new interconnections of nerves. This process plays an important role in inhibiting brain tissue hypertrophy which can cause

neural degeneration which has an impact on cognitive functions (Muzamil et al., 2014).

Relationship between Using Stair and Cognitive Functions

The significance value indicated the result of 0.003 (p < 0.05) which stated that there was a significant relationship between the use of stairs and cognitive function. There are 3 types of physical activity to maintain physical health, which are endurance, flexibility, and strength. Endurance is defined as activities such as walking, jogging, swimming, gymnastics, tennis, and gardening. Flexibility are activities such as tai chi gymnastics, yoga, washing clothes, and mopping the floor. Meanwhile, strength is a variety of activities such as push-ups, using stairs, lifting weights, and carrying groceries. One of the assumptions between physical activity and cognitive abilities is that using stairs, as one of the physical activities, is able to improve cognitive function through increasing cardiovascular function. The increase of cardiovascular function can increase the speed of brain processing, memory, mental flexibility and cognitive function (Nisa, 2015).

The use of stairs in the elderly is classified as moderate physical activity with calorie expenditure of 5 to 7 kcal per minute (WHO, 2010). Cognitive function in the elderly with active use of stairs is significantly better than the elderly who do not actively do it. The use of stairs can improve cognitive performance through increasing levels of neurotrophin, increasing body fitness, reducing depression, maintaining blood flow to the brain and increasing brain nutrition. The risk of neurodegenerative disorders such as Alzheimer's and dementia can also be reduced through physical activity.

Relationship between Participating Social Activities and Cognitive Functions

The significance value shown was 0,000 (p < 0.05) which stated that there was a significant relationship between participating in social activities and cognitive function. The elderly who participate in social activities fulfill their social engagement functions. The elderly who participate in social activities have the opportunity to interact with their environment (Wreksoatmodjo, 2014). Participating in social activities and interactions with other people in elderly can help to stimulate cognitive function and slowing senility (Yuliati, Baroya, & Ririanty, 2014). Social participation can influence neural synaptogenesis, so that it can stimulate nerve branching in the hippocampus which can reduce cognitive impairment.

CONCLUSION

Social activities and mild activity are physical activities that show the most significant relationship to cognitive function. Increasing age can reduce a person's ability to do physical activity. The choice of appropriate physical activity can help to maintain cognitive function in the elderly.

REFERENCES

Dayamaes, R. 2013. A description of the cognitive function of elderly clients in Posbindu Rosella Legoso, working area of the Ciputat Timur Health Center, South Tangerang. Universitas Islam Negeri Syarif Hidayatullah, Jakarta.

Izzah, A. 2014. The relationship between physical activity and cognitive function in the elderly aged 60-69 years in Purwantoro, Blimbing District, Malang City. Saintika Medika, 10(2), 88-93.

Leitzmann, M., Powers, H., Anderson, A. S, Scoccianti, C., Berrino, F., Boutron-Ruuault, M. C, & Romieu, I. 2015. European code against cancser 4th edition: Physical activity and cancer. Cancer Epidemiology, 1-10.

Lestari, Riqqah, & Romus. 2017. The relationship between cognitive impairment and hypertension using the Indonesian version of Montreal Cognitive Assessment (Mocca-Ina). JIK, 11(1), 12-18.

Muzamil, Afriwadi, & Martini. 2014. The relationship between the level of physical activity and cognitive function in the elderly in Jati, East Padang District. Jurnal Kesehatan Andalas, 2(3).

Nisa, O. S. 2015. The relationship between the level of physical activity and cognitive function in the elderly in Pucangan, Kartasura District. Universitas Muhammadiyah Surakarta, Surakarta.

Polan, T. V. S, Asrifuddin, A., & Kalesaran, A. F. C. 2018. The relationship between physical activity and cognitive function in the elderly at Wori Health Center, Wori, North Minahasa Jurnal KESMAS, 7(2).

Pusdatin. 2017. Elderly data.

Reusser, Willekens, & Bonneux. 2011. Higher educatio delays and shortens cognitive: A multistate life table analysis of the US health and retirement study. Eur J Epidemiol, 26, 395-403.

Sanchez, & Gough, Mc. 2013. Physical exercise and

cognitive performance in the elderly: Current perspectives. Clinical Intervention Aging Journal, 9.

Sauliyusta, & Rekawati. 2016. Physical activity affects the cognitive function of the elderly. Jurnal Keperawatan Indonesia, 19(2), 71-77.

WHO. 2010. Global recommendations on physical activity for health. Geneva.

Wreksoatmodjo, B. R. 2014. The influence of social engagement on cognitive function in the elderly in Jakarta. CDK, 3(41).

Yuliati, A., Baroya, N., & Ririanty, M. 2014. The different of quality of life among the elderly who living at community and social services. 87-94.