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THE RELATIONSHIP BETWEEN COGNITIVE FUNCTION AND LEVEL OF INDEPENDENCE IN DOING ACTIVITIES OF DAILY LIVING IN THE ELDERLY

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ABSTRACT

The elderly experience structural changes in the function of biological systems in their bodies due to the aging process they experience. One of the health changes caused by the aging process is cognitive decline. The decline in cognitive function in elderly is due to the gradual changes in the older brain, which may cause older adults to become dependent in performing daily activities. The aim of this study was to determine the relationship between cognitive function and level of independence in activities of daily living in the Banjar Ketapian Kelod elderly population in Denpasar City. This type of study is an analytic observational study with a cross-sectional design that used a consecutive sampling technique. The number of subjects obtained in this study was 62 elderly subjects who met predetermined inclusion criteria. Data were obtained through interviews that measured cognitive function using the MoCA-Ina questionnaire and interviews that measured daily activities using the Barthel Index questionnaire. Spearman rho non-parametric analysis test results from cognitive function with daily activities obtained p value = 0.000 ($p < 0.05$) and correlation coefficient r = 0.648. The conclusion of this study, that these two variables showed a strong, meaningful and proportional relationship between cognitive function and independence in carrying out activities of daily living among elderly in Banjar Ketapian Kelod, Denpasar City.

Keywords: ***activities of daily living; elderly; independence; cognitive function***

INTRODUCTION

Elderly is the last period of a person's life. According to Law (UU), Number 13 of 1998, the age of 60 years and over is the age that can be classified as elderly. In 2020, the number of elderly will increase to 27.08 million people or 10.11%[1]. This condition shows that Indonesia is undergoing a transition toward population aging because the elderly population is already above 10%. This makes Indonesia as a country with an old population structure or it can also be called an aging population[2] .Bali province has the fourth-largest proportion of the elderly population, reaching 11.3% in 2019, according to Susenas data[1]. An increase in the percentage towards elderly in Indonesia will cause the ratio of the dependence of the elderly to the productive age population to continue to increase. In 2019 it was found that the dependence of the elderly in Indonesia had a ratio of 15.01. This means that in 2019 every 100 people of the productive age population, have to bear as many as 15 elderly people and this definitely can increase in the following year[1].

The elderly experience structural changes and changes in the function of biological systems in their bodies due to the aging process they experience. The aging process can be interpreted as a change in the process of time that is continuous and progressive and detrimental. This will also affect all aspects of elderly's lives, including environmental, social, and especially health aspect[3]. One of the changes that arise

in the elderly is the ability of a cognitive function to decline. The decline in the ability of cognitive function in the elderly is caused by gradual changes in the elderly brain, which is also accompanied by changes experienced in other organs due to the aging process. This can result in changes in cerebral tissue and a decrease in circulating capacity and neurotransmitters[4].

Cognitive function is abilities for problem solving, mental abilities, attention, decision making, remembering, learning and reasoning. In this cognitive function, sensory input will be processed, corrected, and stored and after that, it will be used[5]. The elderly have a high risk of experiencing cognitive decline, which includes learning to receive and process information which has implications for various orientations[6].

Prevalence of the occurrence of decline in cognitive function is as much as 80% in the age group 80 years and over[7].

Changes in cognitive function abilities can have an impact on the lives of the elderly. Cognitive function has a significant relationship with an increase in depression and can affect quality of life in the elderly[8]. Elderly who have impaired cognitive abilities, can experience delays when carrying out activities of daily living due to decreased thinking skills, ability to remember things, and decision making in the elderly[6]. It affects the elderly when carrying out daily activities because in fulfilling the lives and needs ofthe elderly every day, good cognitive function is needed, so that the elderly can carry out daily activities optimally[9]. Daily activities are all basic activities performed on a daily basis, including self-sufficient activities such as, bathing, drinking and eating, changing places, dressing, going up and downstairs and toileting[9].

Elderly who have difficulty in carrying out daily activities can cause the elderly to become not independent in their daily lives, and become not independent on the people around them[10]. Elderly who carry out daily activities independently, can maintain a good quality of life until the end of life[11]. Several similar studies are in line with this study, which found that cognitive function has correlation between cognitive function and the level of independence in the elderly in fulfilling daily activities[7,12]. The study about the relationship between cognitive function and level of independence in doing activities of daily living in the elderly is still limited in Bali Province. Therefore, researchers are interested in exploring the relationship between cognitive function and the level of independence of elderly to carry out their daily activities in Banjar Ketapian Kelod, Sumerta Village, Denpasar, Bali. Prospect of this study is to provide a reference for further research on the relationship between cognitive function and independence of daily activities in the elderly. It is also hoped that this research can provide information to the elderly regarding the importance of maintaining cognitive function to remain independent in carrying out their daily activities.

METHODS

a. Methodology

Study design

This study used analytic observational research using a cross sectional approach. This study has ethical clearance number 1436/UN14.2.2.VII.14/LT/2021, which confirmed by the Faculty of Medicine, Udayana University. Before conducting this study, subjects were informed of the benefits and procedures of this research using the informed consent that had been previously determined.

Subjects recruitment

The research subjects were the elderly in Banjar Ketapian Kelod Denpasar City who met the inclusion criteria, and the total is 62 subjects with 23 subjects obtained when collecting the elderly in Banjar Ketapian Kelod, and 39 subjects obtained when doing door to door. Eligibility specification in this study were the elderly aged 60-74 years, able to write and read independently, and signed informed consent as a sign of willingness to be a subject in this study. In this study, exclusion criteria were subjects who had mental disorders, subjects who experienced bed rest, subjects who suffered fractures, and subjects who experienced visual impairment or were blind.

Sampling technique

Non-probability sampling is a sampling technique that used in this study with the consecutive sampling method. Consecutive sampling research method is a method by taking subjects with certain considerations and criteria in accordance with predetermined inclusion criteria, with a certain period of time until the number of research subjects is met. This research was conducted from December 2021 to January 2022 and took place in Banjar Ketapian Kelod, Denpasar City.

b. Material and procedure

Material

The measure of cognitive function is the Montreal Cognitive Assessment Questionnaire which used Indonesian language (MoCa-Ina). The interpretation of the assessment of the MoCa-Ina questionnaire is in the normal category in the range of values 26-30, the category of mild cognitive impairment in the range of values 20-25, and in the category of severe cognitive impairment with a score fewer than 20 points. Measurements for the assessment of daily activities are using the Barthel measuring instrument. Interpretation in the Barthel index measuring instrument, in the category of total dependent with a value range of 0-20, severe dependent with a value of 21-40, moderate dependent with a value of 41-60, mild dependent with a score of 61-90 and the independent category with a value of 91-100.

Procedures

The study began by making initial observations of Banjar Ketapian Kelod Denpasar City which is the place of research used, applying for research permission with related parties, and preparing informed consent to research subjects. This study was conducted at Balai Banjar Ketapian Kelod and also door to door in the Banjar Kerapian Kelod area. The procedure for carrying out the research is before taking measurements of research subjects, researchers prepare Personal Protective Equipment (PPE) such as always providing hand sanitizers, and always wearing masks when conducting research to avoid the transmission of the covid-19, then research subjects will be given education regarding the procedures and benefits of conducting this research, the research subjects signed informed consent, conducted interviews related to identity, cognitive function, and interviews regarding daily activities.

c. Assessment

Cognitive function can be measured using a measuring instrument, namely the Montreal Cognitive Assessment (MoCA), where the MoCA has been adapted into Indonesian called MoCA-Ina. The MoCA-Ina questionnaire consists of 30 points to be tested which assesses various cognitive domains such as executive function, visuospatial, language, delayed recall, attention, abstraction, and orientation, which later in these various cognitive domains, there are points to be tested. The measuring instrument that can be used to assess daily activities is the Barthel index. Barthel index is a measuring tool used to assess and measure a person's independence in the field of mobility and self-care. Barthel index has a scoring system that focuses on a person's level of independence in the ability to carry out daily activities which have 10 assessment items consisting of eating, bathing, self-care, dressing oneself, self-care, urinating, defecation, toileting, transfer, mobility, and the last one is going up and downstairs. After that, a score will be given to each question point posed to the research subject. Each point of the question asked, has a different minimum score and maximum score.

d. Data analysis

All data that has been collected were analyzed using SPSS 25.0 software. The analysis was carried out with univariate data analysis to analyze the general description of the frequency and percentage of age, gender, cognitive function ability, and level of independence during daily activities, and using spearman rho correlation test to determine the relationship between cognitive function and the level of independence in doing daily activities.

RESULTS

After taking the data, the results of the distribution of respondent characteristics are obtained as shown in the table below.

Table 1. Distribution of Respondent Characteristics

Variable	Frequency	Persentage (%)
Age		
60	11	17,7
61	3	4,8
62	6	9,7
63	2	3,2
64	7	11,3
65	3	4,8
66	2	3,2
67	5	8,1
68	3	4,8
69	1	1,6
70	5	8,1
72	5	8,1
73	3	4,8
74	6	9,7
Gender		
Male	26	41,9
Female	36	58,1

Analysis of the univariate data according table 1, the research subjects started from the age 60-74 years, according to the inclusion criteria that had been determined previously. Most of the subjects were 60 years old in this study, as many as 11 subjects (17.7%) and the average age of the research subjects is 66,08 years. Based on gender, it can be seen that there are 26 male subjects (41.9%) while the female research subject is 36 subjects (58.1%).

Table 2. Distribution of Cognitive Function Values

Variable	Frequency	Persentage (%)
Cognitive Function		
Normal Cognitive	23	37,1
Mild Cognitive Impairment	32	51,6
Severe Cognitive Impairment	7	11,3

Based on the classification of cognitive function values, it can be seen that there are 23 subjects (31.7%) who still have normal cognitive, 32 subjects (51.6%) have mild cognitive impairment and 7 subjects (11.3 %) had severe cognitive impairment.

Table 3. Distribution of Activities of Daily Living Values

Variable	Frequency	Persentage (%)
Activities of Daily Living		
Independent	57	91,9
Mild dependent	5	8,1

Based on the classification of the value of daily activities, it can be seen that 57 subjects (91.9%) were included in the independent category when carrying out their daily activities, while 5 other subjects (8.1%) had mild dependent when doing daily activities.

Table 4. Spearman-rho Correlation Test

Variable Correlation	Correlation	Significance
Cognitive Function Activities of Daily Living	0,648	0,000

Bivariate data analysis that used is spearman rho correlation test. This correlation test was found a significant correlation between cognitive function and daily activities, which the significance value or p value = 0.000 ($p < 0.05$) and the correlation coefficient value of 0,648 that was positive. This means that the two variables have a strong, meaningful, and directly proportional relationship. Directly proportional here means that if the value of cognitive function increases, the value of activities of daily living also increases, and vice versa.

DISCUSSION

This research took place in Banjar Ketapian Kelod, Sumerta Village, East Denpasar, Denpasar. Research data collection was carried out by collecting the elderly in Banjar Ketapian Kelod and by door to door. According to the spearman-rho test, this study has a strong, meaningful and directly proportional relationship between the two variables. Directly proportional here means that if the value of cognitive function increases, the value of activities of daily living also increases, and vice versa.

Several previous studies support the findings of this study, which found that cognitive function has a relationship with daily activities. Trihayati, et al. conducted a study involving 34 elderly people in Yogyakarta.[7] In this study, it had been found that there was a correlation between cognitive function and the level of independence of the elderly in carrying out daily activities, with a p value = 0.02. The next research is by Amy, et al., which obtained a result p = 0.0001 on the Spearman Rank test. This indicates that there's a major correlation between cognitive function and the level of independence when carrying out daily activities in the elderly[12].

The findings of this research also are supported by the analysis of Suspiyanti, et al. In this study, it was found that there was a significant correlation between cognitive function and the level of independence in fulfilling activities in the elderly (p = 0.003) and correlation coefficient value is 0.321[13]. This means that the two variables have a low level of relationship and have a positive correlation direction. Research from Marlina, et al also supports the results of this study, which the results obtained p value = 0.018. This research indicate there was a correlation between cognitive function and the level of independence when carrying out activities of daily living in the elderly[14].

The studies described above used the Mental Status Examination (MMSE) to measure cognitive function, while in this study to measure cognitive function is used the Montreal Cognitive Assessment Questionnaire which used Indonesian language (MoCa-Ina), which this measuring instrument is still rarely used to measure cognitive function in the elderly. The MoCA-Ina questionnaire has been tested for validity according to transcultural validation rules and is reliable to use properly[15].

As time goes on, the elderly can experience structural changes and changes in the function of biological systems in their bodies due to the aging process they experience. This will also affect all aspects of elderly's lives, including environmental, social, and especially health aspect[3]. As can see from the health side, the function of the elderly's organs can experience a decline, either due to natural factors or as a result of disease factors suffered by the elderly. The decline in the function of the elderly's organs is caused because the elderly experience a reduction in the number of anatomical cells, a lack of nutritional intake consumed by the elderly, and a reduction in physical activity which can cause the organs of the body in the elderly to experience structural changes and physiological changes[16]. One of the changes experienced by

the elderly as a result of changes in the structure and physiological function is a decreased cognitive function[16].

The decline in cognitive function in the elderly occurs due to gradual changes in the elderly brain, which is also accompanied by changes in other organs due to the aging process that occurs. This can affect changes in cerebral tissue and a decrease in circulating capacity and neurotransmitters[4]. The central nervous system in the elderly may experience impaired function, along with a decline in cognitive abilities experienced. Impaired functions that occur such as reduced cerebral blood flow and brain weight reduction, can lead to a proliferation of astrocytes that can cause changes in neurotransmitters[14]. Changes in neurotransmitters can cause the monoamine oxidase (MAO) enzyme to increase in activity. An increase in this enzyme can make a person's reaction time and also his central process can experience this event, resulting in a decrease in a person's social function, which can have an impact on the elderly during daily activities[14].

Changes in cognitive abilities in the elderly have a major correlation with their quality of life, because the elderly who have impaired cognitive function can experience a delay in carrying out daily activities. This change is caused by a decrease in the ability to think, intellectual ability, memory ability and the ability to make a decision[6]. It affects the elderly when carrying out daily activities because in fulfilling the lives and needs of the elderly every day, good cognitive function is needed, so that the elderly can carry out daily activities optimally[9]. By having the ability to hold out daily activities optimally, the old are expected to be ready to maintain a decent quality of life until the end of their lives[11].

The assessment regarding elderly's cognitive function in this study, most of the elderly who have mild and severe cognitive function disorders, experience limitations in the question of attention. This can be as a result of the elderly tend to expertise a decline in processing information quickly and experience a decrease in paying attention to an incoming stimulus, that this attention has the meaning of an ability not to pay attention to other stimulus that are not needed, but only pay attention to one specific stimulus and react to only one stimulus that is needed[17]. The elderly as a result of the aging process experienced, have limited energy to perform cognitive operations, such as when processing incoming information[17].

One of the method to maintain the cognitive function of the elderly is by doing physical activities which can be in the form of exercises given to the elderly to be able to maintain cognitive function and to increase their fitness. Elderly who regularly do physical exercise can have an impact on the growth and survival of cells in the brain and can also increase plasticity in the brain. Physiotherapists here can focus on providing exercises to the elderly, which aims to maintain elderly's cognitive function. If the elderly's cognitive function is good, then the elderly are expected to be able to carry out daily activities optimally[18]

The assessment regarding elderly's daily activities in this study, most of elderly subjects experienced limitations in the up and downstairs, which the elderly were in the category of mild dependence on their daily activities. This is due to the aging process in the elderly, one of the impacts that occur is changes in the joints, which the elasticity of connective tissues such as ligaments, fascia, and tendons undergoes aging. Other changes that occur are degeneration and erosion of the capsule and joint cartilage. These changes cause the joint to experience a decrease in flexibility that can cause the Range of Motion (ROM) of the joint to be limited. Decreased joint ROM can affect the elderly to experience joint stiffness, joint pain and affect on daily activities of the elderly, such as going up and downstairs[19].

Another cause that affects the elderly to experience limitations in activities up and downstairs is because the elderly experience a decrease in physiological functions in the body, such as changes in body posture and decreased muscle strength and flexibility[19]. If the muscles in the body such as postural muscles experience a decrease in function due to the aging process, it can result in decreased and unstable body balance. Postural muscles that work in synergy can form a good balance in the body, which is needed when going up and downstairs[20].

One of the efforts to improve the balance of the elderly can be done by doing 12 balance exercises. According to research conducted by Nugraha et al, 12 balance exercises can improve dynamic balance more than balance strategy exercises. The increase in body balance in this exercise is carried out with 12 movements, one of the movements is to increase muscle strength and optimize posture control so that the postural balance of an elderly person can be improved[21].

The implications of this study is to advice the elderly to maintain their optimal cognitive function by staying active in physical activity such as doing aerobic exercise. Types of physical activity that are suitable for the elderly include aerobic exercise, which can improve fitness in the elderly, and finally increase the independence of the elderly. Carrying out activities in daily living such as walking, gardening, doing housework and going up and down stairs can achieve the desired goal, and is recommended to do at least 30 minutes. The other way to maintain cognitive function in the elderly is staying active to socializing with the surrounding environment[22]. The limitations are this study does not examine other factors that can influence the value of cognitive functions such as the educational and occupational history of the research subjects. Therefore, more analysis is required on the factors that may have an affect the value of cognitive function in future studies.

CONCLUSION

Based on the results, cognitive function and activities of daily living in the elderly have a strong, meaningful and directly proportional correlation, which obtained p value = 0.000 ($p < 0.05$) and the correlation coefficient value was 0.648 which was positive. The elderly who experiences a decline in cognitive function will begin with forgetfulness, followed by Mild Cognitive Impairment (MCI) and the last stage is dementia. In this study, most subjects experienced mild cognitive impairment and for their daily activities, most of the elderly in Banjar Ketapian Kelod were included in the independent category when carrying out their daily activities. As time goes on, the decline in cognitive function will have an impact on daily activities in the elderly, therefore the elderly have to do physical activities, so that elderly will become independent in carrying out their daily activities. Further research is required to examine other factors that can affect cognitive function, such as educational factors, occupational factors, and medical history in the elderly.

CONFLICT OF INTEREST

The author state there is no conflict of interest.

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