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Abstract

Background: Malnutrition is one of the factors that affect cognitive function in elderly. Currently nutritional disorders are common in the elderly. It may be caused by a decrease in taste and smell function, socioeconomic factors, decreased mobility, accompanying diseases and decreased oral and dental health in elderly.

Objectives: This study aimed to determine the association between nutritional status and cognitive function in the elderly.

Methods: This cross-sectional study involved subject with consecutive sampling techniques. Elderly people aged over 60 years who were in the district of Medan Helvetia and fulfilled the inclusion and exclusion criteria were included in this study from February until April 2020. Cognitive examination were assessed using Montreal Cognitive Assessment Indonesian Version (MoCA-INA) and Visual Cognitive Assessment Test (VCAT). Nutritional status was assessed using Mini Nutritional Assessment (MNA).

Results: This study was conducted on 71 samples consisting of 42 women and 29 men with a mean age of 68.68 ± 6.35 years. There were 32 subjects (45.1%) who were malnourished and at risk of malnutrition. The average MoCA INA score was 19.80 ± 4.07 and the VCAT score was 17.24 ± 5.17 . Subjects who were malnourished (32 subjects) had lower MoCA-INA score and there was a relationship between nutritional status and MoCA INA with $p = 0.002$ ($\alpha < 0.05$). Subjects who were malnourished had lower VCAT score and there was a relationship between nutritional status and VCAT score with $p = 0.004$ ($\alpha < 0.05$).

Conclusions: There is significant relationship between nutritional status and cognitive function in elderly.

Introduction

Cognitive functions play an important role in elderly to carry out daily life. Decreased cognitive function in the elderly will certainly reduce the function of life.¹ The incidence of cognitive impairment in patients aged 75-79 years is 22.5 per 1000 population.² Nutritional disorders or malnutrition are disorders that adversely affect the body from a functional or clinical perspective and often found in the elderly population.³ Nutritional disorders in geriatrics are one of the serious problems that becomes comorbid the emergence of disease. Decreased the amount of daily nutrients is associated with a decrease in the quality of metabolism in the body. The central nervous system is an organ that is very sensitive to a decrease in the body's nutritional intake so that a decrease in nutrition will cause brain function disorders, one of them is cognitive function.⁴

Nutritional factors can affect neurotransmitters, synaptic transmission, cellular fluid and signal transduction pathways. The brain is very vulnerable to oxidative damage due to its high metabolic burden, and "anti-oxidant diets" have a positive effect on nerve function. According to a study conducted by Zoghbi et al (2013), there was a relationship between nutritional status and cognitive function in elderly ($r = 0.208$ ($p = 0.028$)).⁵ Gazzoti et al (2000) mentioned that nutritional status in elderly can be measured using several tools, one of which was Mini Nutritional Assessment (MNA), that can assess the tendency to develop complications of controlling mechanisms of food intake and decreased sensitivity caused by malnutrition.⁶



Method

Study sample

This study sample was taken from subjects in Medan Helvetia District using consecutive sampling techniques. This research subject consisted of 71 elderly who aged ≥ 60 years, able to speak Indonesian, cooperative, able to read and write and willing to take part in the study by signing a research informed consent.

Study design

This study was a cross-sectional design without treatment. This study assessed cognitive function using MoCA-INA and VCAT. MoCA-INA, has been developed as a brief cognitive screening tool to detect mild-moderate cognitive impairment with normal score ≥ 26 . VCAT is a visual-based tool that may be more suitable for multicultural, multilingual societies around the world with normal score 23-30, mild cognitive impairment score was 18-22 and dementia score was less than 18. Nutritional status was assessed using MNA which consist of 6 items of screening and 12 items of assessment with normal score was ≥ 12 .

Statistical analysis

Data from the research was analyzed statistically using the SPSS computer program (Statistical Product and Science Service) to analyze the relationship between research variable. The relationship between nutritional status with MNA and cognitive function with MoCA INA and VCAT analyzed with Fisher exact test and Chi square.

Result

There were 71 subjects in the Medan Helvetia district from February to April 2020 participated in this study. There were 42 women (59.2%) and 29 men (40.8%) out of 71 subjects in this study. The average age of the subjects was 68.68 ± 6.35 years with the most age group were 60-64 years. The education level of the most subjects was Senior High School (SMA) with a total of 29 people (40.8%). The demographic Characteristic are show in the table 1.

*Table 1. Demographic Characteristic of Research Subject (n=71)*

Characteristics	Frequency n=71	Percentage %
Age average \pm SD (years)	68,68 \pm 6,35	
60–64 years old	23	32,4
65–69 years old	16	22,5
70–74 years old	18	25,4
>75 years old	14	19,7
Sex		
Male	29	40,8
Female	42	59,2
Education		
Primary School	13	18,3
Junior High School	18	25,4
Senior High School	29	40,8
Bachelor	11	15,5
Job		
Unemployment	5	7
Retired	18	25,3
entrepreneur	28	39,4
Housewife	20	28,3
Weight, average \pm SD	61,12 \pm 11,17	
<50 kg	10	14,1
50-54 kg	12	16,9
55-59 kg	7	9,9
60-64 kg	16	22,5
65-69 kg	12	16,9
\geq 70 kg	14	19,7
Height, average \pm SD	157,65 \pm 6,73	
145-149 cm	7	9,9
150-154 cm	17	23,9
155-159 cm	19	26,8
160-164 cm	14	19,7
165-169 cm	9	12,7
\geq 170 cm	5	7
Body Mass Index, mean \pm SD	24,64 \pm 3,9	
<19	4	5,6
19-<21	4	5,6
21-<23	17	23,9
\geq 23	46	64,8

The results of the nutritional examination of subjects using MNA showed that 39 subjects (54.9%) subjects had normal values. There were 32 subjects (45.1%) who experienced malnutrition and who were at risk of experiencing malnutrition. Of all the elderly subjects who underwent cognitive function test using examination, 61 people (85.9%) were abnormal, while 10 people (14.1%) had normal results. The average MoCA INA score was 19.80 ± 4.18 . VCAT examination results on subjects found out that 38 subjects (53.5%) had dementia, 20



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subjects (28.2%) subjects had mild cognitive impairment, and 13 subjects (18.3%) had normal results. The mean score of VCAT was 17.24 ± 5.17 . This can be seen in table 2 below.

Table 2. Characteristic of MNA, MoCA INA and VCAT

Variable	Mean \pm SD	N (71)	Percentage (%)
MNA			
Normal		39	54,9
Malnourished and risk of malnourished		32	45,1
MoCA INA	19,80 \pm 4,18		
Normal		10	14,1
Abnormal		61	85,9
VCAT	17,24 \pm 5,17		
Normal		13	18,3
Mild Cognitive Impairment		20	28,2
Demensia		38	53,5

From the result of this study, 32 of 61 subjects who had abnormal MoCA values were malnourished and at risk of malnutrition and 29 of 61 subjects were in normal nutritional status. While 10 subjects who had normal MoCA values also had normal nutritional status. Fisher exact test results showed the value of $p = 0.002$ ($\alpha < 0.05$), means that there is a relationship between nutritional status and MoCA score. This can be seen in table 3 below.

Table 3. Association between MNA and MoCA-INA

	MoCA abnormal	MoCA normal	P
Status Nutrisi			
Malnourished and risk of malnourished	32	0	
Normal	29	10	0,002
Total	61 (85,9%)	10 (14,1%)	

Using VCAT, there were 23 subjects who classified dementia are malnourished and 8 subjects who classified MCI are malnourished. Chi Square test results showed the p value = 0,004 ($\alpha < 0.05$). This can be seen in table 4 below.

Tabel 4. Association between MNA and VCAT

	VCAT Demensia	VCAT MCI	VCAT Normal	P
Status Nutrisi				
Malnourished and risk of malnourished	23	8	1	
Normal	15	12	12	0,004
Total	38	20	13	

Discussion

This study involved 71 respondents who were elderly, which most of elderly (42 subjects) were women. Research conducted by Hai, et al (2016) concerning the relationship of nutrition with cognitive impairment in elderly in China found that more female subjects than men.⁷ One reason explaining why women have greater life expectancy than men is due to the hormone estrogen. The hormone estrogen has several properties that cause women tend to be more protective from diseases such as cardiovascular disease. This results in woman having a lower risk of cardiovascular disease. Then estrogen can also increase antioxidants which are protective for blood vessels.⁸



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The subject's body mass index had a mean of 24.64 with the largest BMI group in this study, which was ≥ 23 kg/m² with 46 subjects (64.8%). Other relevant studies mentioned the mean BMI in the elderly is 25.1. Another study conducted to assess the relationship of nutrition and congenital disorders mentioned the mean BMI in the elderly studied was 25.1 kg/m².⁹ Research conducted by Jura and Kozak in 2016 concluded that the elderly tends to experience weight gain due to reduced physical activity in the elderly. This resulted in reduced energy expenditure and caused increased energy storage in the body. The second reason why older people tend to gain weight is the increase in adipose tissue with age.¹⁰

The results of the nutritional status examination showed that 32 subjects (40.8%) were malnourished and at risk of experiencing malnutrition. Other research on the nutritional status of the elderly in Medan states that the majority of the elderly are at risk of malnutrition ie 59.2% of all subjects.¹¹ Alzahrani et al (2017) in their study also mentioned that 76.6% of the elderly had a risk of malnutrition.¹² The elderly are vulnerable populations of nutritional disorders. This can be caused by several things including changes in the body composition of the elderly that affect their nutritional status. Fat and muscle tissue are tissue that are often reduced in the elderly. The cause of the loss of these tissues are usually due to the presence of comorbidities or other diseases, lack of food intake, and the occurrence of sarcopenia or reduced muscle mass due to the aging process.¹³

MoCA INA examination in this study found that 61 subjects (85.9%) who had abnormal results with an average MoCA score of 19.89 ± 4.18 . Relevant research states that 85.5% of elderly people have abnormal MoCA INA score.¹⁴ Another study conducted by Wahid and Sudharma in 2018 in one of the social institutions in Jakarta revealed that 69.5% of the elderly experienced a decline in cognitive function.¹⁵ Research conducted by Lee, et al in 2019 also revealed that the elderly experienced a decline in cognitive function with an average MoCA value of 18.8.¹⁶ Cognitive function examination results using VCAT obtained a mean value of 17.24 ± 5.1 . There were 38 subjects (53.5%) had dementia, 29 subjects (28.2%) had mild cognitive impairment and only 13 (18.3%) subjects had normal cognitive function. Another study using VCAT conducted by Kandiah, et al in 2015 showed that from 132 subjects with cognitive impairment based on VCAT scores, the mean VCAT was 17 ± 9.0 . While on the same subject the average MoCA value of 23 ± 7.0 was obtained. This study showed that the VCAT value is relevant to the MoCA value in the study.¹⁷ Another study using VCAT conducted by Lim, et al in 2018 mentioned that the mean VCAT value of 120 subjects with cognitive impairment was 14.17 ± 5.05 .¹⁸

Decreased of cognitive function in elderly is an increasingly common problem today. Decreased of cognitive function in elderly can be physiological or pathological. Some of the causes include reduced of gray and white matter volume, accumulation of beta amyloid in the cerebral, decreased hippocampal volume, reduced neuron volume and reduced communication between neurons.¹⁹

Based on Fisher's Exact test statistical analysis of 71 subjects, the results showed that there was a significant relationship between nutritional status and cognitive function, where tools for assessing cognitive function use MoCA-INA with a p value of 0.002 and using VCAT with a p value of 0.004. Research conducted by Zoghbi et al in 2013 said that there was a relationship between nutritional status and cognitive function in elderly with a relationship strength value of $r = 0.208$ ($p = 0.028$).⁵ Other studies in Indonesia that are relevant to this study concluded that there is a correlation between malnutrition and cognitive function in the elderly with a weak degree of correlation ($p < 0.005$). The study used MMSE to examine cognitive function and MNA.⁴

Malnutrition is a condition that is currently increasing in number of cases, especially in the elderly. Elderly has several factors that can increase the risk of nutritional disorders. Some of these factors include socioeconomic factors, decreased taste and boiling function, decreased mobility and decreased dental and oral health. There are several causes of subjects who experience impaired nutritional status in this study. Most causes are due to lack of food containing protein intake. Kaplan et al in 2001 stated that protein intake can improve cognitive function, especially memory in the elderly. This is caused by a protein that will increase extracellular amino acids in the hypothalamus and can indirectly increase neurotransmitters in the brain.²⁰



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Another cause of nutritional disorders in this study was the lack of vegetable intake in respondents. Morris et al in 2018 mentioned that green vegetables are beneficial in reducing cognitive function in the elderly. Morris et al concluded that green vegetables containing lots of lutein, folate, β -carotene, and phylloquinone are useful as neuroprotectors in the brain and reduce oxidative stress in brain neurons.²¹ The reduced circumference of the upper arm and calf were also common finding in this study. Taylor et al's 2012 study concluded that there is a relationship between upper arm circumference and waist circumference with dementia. Taylor et al mentioned that the decrease in arm circumference was influenced by decreased nutritional status in the elderly due to lack of food intake, which causes a decrease weight. The reduced nutritional status will cause cerebral atrophy which is usually found in dementia.²²

This study has limitation because only assessed the relationship between nutritional status and cognitive function without assessing other factors that can affect both. Several other factors that can affect cognitive function in the elderly such as illnesses suffered by respondents other than those contained in the exclusion criteria, socioeconomic factors, stress factors, etc. were not analyzed in this study. Besides the age of the subjects themselves can cause a decrease in cognitive function. This makes it difficult to conclude that nutritional factors are the only factors that affect cognitive function in the elderly.

Conclusion

There is significant relationship between nutritional status and cognitive function in elderly.

Suggestion

Further research needs to be done on the factors that influence the disturbance of nutritional status in declining subjects so that they can provide information about the causes of the disorder.

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