

Research Article

Relationship between Nutritional Status, Frailty, and Cognitive Function among Elderly at Dr. H. Moch. Ansari Saleh General Hospital Banjarmasin

Hubungan Status Gizi dengan *Frailty* dan Fungsi Kognitif pada Lansia di RSUD Dr. H. Moch. Ansari Saleh Banjarmasin

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ABSTRACT

The elderly often have nutritional problems. The risk of malnutrition can stimulate the prevalence of frailty and declining cognitive function in the elderly. The study aimed to analyze the relationship between nutritional status, frailty, and cognitive function in the elderly at Dr. H. Moch. Ansari Saleh Hospital Banjarmasin. This study was analytic observational using a cross-sectional method. A sample of 93 elderly was obtained using a total sampling technique according to the inclusion and exclusion criteria. The nutritional status assessment was done using the Mini Nutritional Assessment-Short Form (MNA-SF), the Edmonton Frailty Scale (EFS), and the Mini-Mental State Examination (MMSE). The results showed that the mean of Mini Nutritional Assessment score was 12.00 ± 2.126 , the average frailty score was 4.41 ± 1.872 , and the average value of cognitive function was 25.98 ± 2.923 . Data were analyzed using the Spearman's non-parametric correlation test with a 95% confidence level. The correlation test results between nutritional status and frailty obtained $p=0.000$ and $r=-0.490$. The correlation test results between nutritional status and cognitive function obtained $p=0.000$ and $r=0.595$. In short, there is a relationship between nutritional status on frailty and cognitive function in the elderly at Dr. H. Moch. Ansari Saleh General Hospital Banjarmasin, it means that the good nutritional status in the elderly, the risk of frailty syndrome will decrease and improve cognitive function.

Keywords: Cognitive function, elderly, frailty, nutritional status

ABSTRAK

Lanjut usia (lansia) sering mempunyai masalah nutrisi. Risiko malnutrisi dapat mempengaruhi terjadinya *frailty* dan penurunan fungsi kognitif pada lansia. Tujuan penelitian ini untuk menganalisis hubungan antara status nutrisi dengan *frailty* dan fungsi kognitif pada lansia di RSUD Dr. H. Moch. Ansari Saleh Banjarmasin. Penelitian ini observasional analitik menggunakan metode *cross-sectional*. Sampel sejumlah 93 lansia diperoleh menggunakan teknik total sampling sesuai kriteria inklusi dan eksklusi. Penilaian status nutrisi memakai *Mini Nutritional Assessment-Short Form* (MNA-SF), *Edmonton Frailty Scale* (EFS), serta *Mini Mental State Examination* (MMSE). Hasil penelitian menunjukkan rata-rata nilai *Mini Nutritional Assessment* $12,00 \pm 2,126$, rata-rata nilai *frailty* adalah $4,41 \pm 1,872$, dan rata-rata nilai fungsi kognitif adalah $25,98 \pm 2,923$. Analisis data menggunakan uji korelasi non-parametrik *Spearman* dengan tingkat kepercayaan 95%. Hasil uji korelasi hubungan antara status nutrisi dengan *frailty* didapatkan nilai $p=0,000$ dan $r=-0,490$. Hasil uji korelasi hubungan antara status nutrisi dengan fungsi kognitif didapatkan nilai $p=0,000$ dan $r=0,595$. Kesimpulan penelitian ini terdapat hubungan antara status nutrisi terhadap *frailty* dan fungsi kognitif pada lansia di RSUD Dr. H. Moch. Ansari Saleh Banjarmasin, artinya semakin baik status gizi pada lansia maka risiko terjadinya *frailty* akan menurun dan meningkatkan fungsi kognitif.

Kata Kunci: Fungsi kognitif, *frailty*, lansia, status nutrisi

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INTRODUCTION

The elderly is the final stage of the growth and development of a human. According to data from the Ministry of Health of the Republic of Indonesia, the prevalence of the elderly in 2017 was 9.03% (23.66 million), increasing by 0.81% from 8.2% in 2014 (1,2). In Banjarmasin City, the number of elderly aged 60 years or more was around 44,493 people in 2017 (3). The high number of elderly can cause problems in a country if the health status of the elderly declines, which results in a decreased independence, higher susceptibility, and dependency on others. It will become an economic burden for the government due to their unproductivity (1,4).

The elderly are prone to frailty and changes in cognitive function. Frailty is a syndrome that results in a physiological decline in the body and even death. Frailty has five characteristics: weakness, decreased walking speed, low physical activity, fatigue, and decreased body weight. The risk of frailty increases with age; 30% occurs in those older than 80 years and about 7% in the elderly aged 65 years or older (2,5).

Malnutrition can lead to an increased risk of frailty and impaired cognitive function that affects the quality of life of the elderly. Malnutrition can happen due to physiological changes in the body, chronic disease, low understanding about nutritious intake, and low economic status (5-7). The risk of malnutrition in the elderly can be prevented by nutritional intake screenings, including a mini nutritional assessment (MNA) instrument (8). This MNA instrument is specifically for the elderly, relatively simple, in a short duration, and its validity has been tested in several studies (9,10).

Impaired cognitive function is approximately experienced by 39% of the elderly between 50 to 59 years and increases to 85% in the elderly aged 80 years and older. A decreased cognitive function can be in the form of forgetfulness, which is the mildest form of cognitive impairment. However, if left untreated, it can develop into serious diseases, such as Alzheimer's disease. Research on the relationship between nutritional status and cognitive function in the elderly has been carried out by Noviansyah by measuring nutritional status using body mass index (BMI) and obtained a significant relationship (11-13). This study assessed the relationship between nutritional status and cognitive function and frailty in the elderly in Dr. H. Moch. Ansari Saleh Hospital Banjarmasin by measuring nutritional status using the mini nutritional assessment-short form (MNA-SF) instrument, the frailty using the Edmonton Frailty Scale (EFS), and the cognitive function using the Mini-Mental State Examination (MMSE) instrument.

METHODS

This is a cross-sectional study conducted from August to September 2019. The population of this study was the elderly at the Geriatric Polyclinic of Dr. H. Moch. Ansari Saleh Hospital Banjarmasin. From the entire population, 93 elderly who met the criteria were included in this study. The inclusion criteria were elderly aged 60 years or older and willing to participate in the study after obtaining the informed consent. The elderly with neuropsychiatric problems, vascular diseases such as stroke, visual and hearing impairments, and unable to write and read were

not included in this study. The independent variable in this study was nutritional status, and the dependent variable was the state of frailty and cognitive function in the elderly.

This study has obtained ethical clearance through the ethical clearance letter No. 420/KEPK-FK UNLAM/EC/VIII/2019 and No. 421/KEPK-FK UNLAM/EC/VIII/2019 issued by the Health Research Ethics Commission, Faculty of Medicine, University of Lambung Mangkurat. The study began by explaining the procedure to the respondents before they agreed to participate in the study. Physical examinations were conducted by the doctor in charge of the geriatric polyclinic. Measurements of body weight, height, and assessment of nutritional status using MNA-SF, frailty with EFS, and cognitive status with MMSE were carried out by the same person who had been previously trained. Statistical analysis was performed using the Spearman's non-parametric correlation test at a 95% confidence level since the data were not normally distributed and the relationship was linear.

RESULTS

Most of the elderly in this study were aged 60-74 years (79.6%), male (53.8%), high school graduates (37.6%), with a BMI range of 25-29.9 kg/m² (Table 1). In contrast, elderly women had lower nutritional status (11.26±2.431) than elderly men (12.64±1.558). The average value of frailty in elderly women was higher (4.98±2.155), while the average value of the cognitive function in elderly women was lower (25.19±3.002) than the counterparts.

The age group in this study was divided based on the World Health Organization (WHO) criteria: the elderly category for those aged 60-74 years and the old category for those older than 75 years (14). The age category of 60-74 years had a higher average nutritional status (12.27±2.029) than the age category of >75 years. The highest average frailty was found in the age category of >75 years (5.26±1.593) compared to the age group of 60-74 years. The average value of the cognitive function in the age group of 75 years was lower than those aged 60-74 years.

The elderly with advanced education level (secondary school-college) had a higher average value of nutritional status than the elderly with primary school education level. The average value of the cognitive function in the elderly with advanced education was higher than the elderly with primary school education. The highest average frailty value was found in those with junior high school (5.71±2.289), compared to the elderly with elementary school education (5.37±1.606), senior high school education (4.00±1.940), and college education (4.00±1.556). The body mass index (BMI) categories of respondents in this study were divided into four groups based on WHO criteria: underweight, normal, overweight, and obese (15). The number of overweight elderly (38.7%) and obese elderly (7.5%) in this study was higher than the underweight elderly (16.1%).

The score of the Spearman test correlation coefficient (*r*) between nutritional status and frailty in this study was -0.490, with *p*=0.000, meaning that the higher the nutritional status score, the lower the frailty score. The Spearman test results also showed that nutritional status had a significant positive correlation (*r*=0.595; *p*<0.000) with cognitive function. The declining value of nutritional status in the elderly means lower value of cognitive function.

Table 1. Mean of Mini Nutritional Assessment-Short Form (MNA-SF), Edmonton Frailty Scale (EFS), Mini-Mental State Examination (MMSE) in the Elderly at Dr. H. Moch. Ansari Saleh general hospital Banjarmasin

Category	n (%)	Mean of nutritional status \pm SD	Mean of frailty \pm SD	Mean of cognitive function \pm SD
Age Group (n=93)				
60-74 years	74 (79.6%)	12.27 \pm 2.029	4.19 \pm 1.885	26.09 \pm 2.527
\geq 75 years	19 (20.4%)	10.95 \pm 2.223	5.26 \pm 1.593	25.53 \pm 4.182
Gender (n=93)				
Male	50 (53.8%)	12.64 \pm 1.558	3.92 \pm 1.441	26.66 \pm 2.700
Female	43 (46.2%)	11.26 \pm 2.431	4.98 \pm 2.155	25.19 \pm 3.002
Education Level				
Elementary School	19 (20.4%)	10.68 \pm 2.029	5.37 \pm 1.606	23.26 \pm 3.494
Junior High School	7 (7.5%)	10.29 \pm 3.352	5.71 \pm 2.289	24.43 \pm 2.760
Senior High School	35 (37.6%)	12.60 \pm 1.649	4.00 \pm 1.940	26.97 \pm 1.689
College	32 (34.4%)	12.50 \pm 1.867	4.00 \pm 1.556	26.84 \pm 2.592
BMI (n=93)				
Underweight (<18.5 kg/m ²)	15 (16.1%)	9.40 \pm 2.131	4.93 \pm 1.668	23.40 \pm 3.979
Normal (18.5-24.9 kg/m ²)	35 (37.6%)	11.66 \pm 1.924	4.31 \pm 2.097	25.97 \pm 2.915
Overweight (25-29.9 kg/m ²)	36 (38.7%)	13.17 \pm 1.207	4.25 \pm 1.826	26.86 \pm 1.775
Obese (\geq 30 kg/m ²)	7 (7.5%)	13.29 \pm 1.254	4.57 \pm 1.397	27.00 \pm 2.236

Table 2. Spearman's Non-Parametric Correlation Test Results of Relationship of Nutritional Status, Frailty, and Cognitive Function in the Elderly at Dr. H. Moch, Ansari Saleh General Hospital Banjarmasin

Dependent variable	N	Nutritional Status	
		P	r
Frailty	93	0,000	-0,490
Cognitive Function		0,000	0,595

DISCUSSION

This study shows that the proportion of elderly with malnutrition, frailty, and decreased cognitive function was higher in elderly women than in elderly men. These results are similar to research by Joymati *et al.*, that elderly women have a higher risk of malnutrition than elderly men (16). Women have a greater risk of malnutrition because of the habit of prioritizing other family members and often sharing food, so the nutritional intake of the female elderly is low (16). Frailty that is more frequent among elderly women is likely because of several factors, such as finance and education level, that affect the awareness level on the health aspect (17,18). A study by Rotar found that the risk of cognitive decline was higher in women than in men, which was associated with lower estradiol levels in older women (19,20).

Increasing age is associated with a decrease in nutritional status in the elderly. Research by Novianti stated that increasing age is associated with reduced muscle, so the risk of malnutrition (undernutrition) increases (21). The effect of age on frailty is related to the aging process and oxidative stress, which disrupts cells and body tissues that will stimulate chronic inflammation, resulting in frailty (22). Research by Brigola *et al.*, in 2019 also found that the elderly older than 74 years had a greater risk of experiencing frail and pre-frail than those aged lower than 74 years (17). Increasing age will always be followed by physical changes, a decrease in anatomical function such as the shrinking of the brain, and biochemical changes in the central nervous system, leading to a decline in

cognitive function (23-25). This is in line with the research results by Wu that there is a significant relationship between age and cognitive decline in the elderly (26).

The education level of the elderly is related to their ability to understand health information, one of which is about nutritional intake. Elderly with higher education could better understand nutritional intake information (27). Education is a process of adding life experience, and it is also a process of intellectual stimulation that will affect a person's cognitive (28). The elderly with a basic education level is more at risk of experiencing impaired cognitive function than those with higher education due to low mental experience and lack of environmental stimulation on intellectual development (29). The correlation of education with frailty in the elderly can be influenced by various factors, such as health level, habits, or financial condition. Research by Hoogendijk *et al.*, explained that a low education level would result in a lack of knowledge about healthy food and bad habits in the elderly, thereby increasing the likelihood of experiencing frailty (30).

Besides being associated with a decrease in nutritional status, increasing age is also associated with an increase in BMI in the elderly. This is caused by a reduced level of activity, metabolic processes, and hormonal changes that result in the accumulation of body fat (31,32). The research by Sheehan *et al.*, in 2013 explains that an increase in BMI intensifies the risk of frailty due to fatigue, decreased walking speed, and decreased activity level (33). The mechanism of the relationship between BMI and cognitive decline is currently not clear. A low BMI value can be prompted by decreased body weight as a precursor of dementia, while a high BMI can be due to an increase in muscle mass and fat mass. A higher fat-free mass may play a role in reducing the risk of dementia in the elderly population. Another possibility is that higher BMI values are caused by increased fat deposits other than in the abdominal area. BMI values are associated with cognitive impairment in the early elderly group (aged 60-69 years), while this relationship is absent in the older elderly group (34,35).

Malnutrition, in this case is undernutrition, is a condition of

reduced nutrient intake for the body, which can be in the form of deficiencies of macronutrients (calories, protein, and fat), micronutrients (vitamins and minerals), and antioxidants. The cause of undernutrition is influenced by inadequate food intake and disturbances in the digestive system (16,36). Calorie deficiency affects weight loss and muscle strength, while protein deficiency affects protein synthesis failure, resulting in changes in muscle mass. In addition, deficiency of micronutrients, such as vitamin D, increases frailty risk due to fractures. Antioxidants are protective against free radicals. Insufficient antioxidant intake results in oxidative stress, causing cells and tissues disruption. Protein intake deficiency is significantly associated with frailty in the elderly (2). Some of the crucial roles of protein are cell regeneration and protein synthesis for muscle mass improvement so that improving protein intake will prevent weakness and decrease muscle mass in the elderly, thereby reducing the risk of frailty in the elderly (2).

Patterns and quality of diet are related to frailty in the elderly. Elderly people in China with a high score of diet quality index international (DQI-I) have a reduced chance of frailty risk (37). Malnutrition has a significant effect on changes in muscle mass, activity levels, and health levels, which also happen among the elderly. Therefore, malnutrition experienced by the elderly has a significant influence on the increased risk of frailty in the elderly (18). This proves that nutritional status has a role in the occurrence of frailty in the elderly. Good nutritional status will reduce the risk of frailty in the elderly.

Nutritional status can be used as a predictor to determine cognitive decline. Regular and good nutritional status monitoring can prevent Alzheimer's (38). Research conducted by Ramachandran on 100 elderly respondents found a strong positive correlation between nutritional status and cognitive function (39). Another study found that vitamin B6, vitamin C, and vitamin E intakes were

associated with cognitive function (40).

Carbohydrates are essential for brain function because glucose is the primary energy source for the brain. However, as in DM, chronic excess glucose can contribute to reduced synaptic plasticity and high levels of inflammation that can contribute to cognitive deficits (41). Vitamins B6, B12, and folic acid can reduce the risks of cognitive impairment and dementia because they can reduce the increasing plasma homocysteine levels that can cause pathological changes through direct vascular and neurotoxic mechanisms (38,42). Due to insufficient macronutrients and micronutrients, malnutrition can interfere with energy management processes in cortical neurons, increase the neuron susceptibility to oxidative damage, and stimulate the hippocampus to produce a neuroinflammatory response. It can decrease the plasticity of neurons, synapses, and hippocampus cells, thus contributing to cognitive decline (43). Good nutritional status obtained by consuming macronutrients and micronutrients can slow the decline in cognitive function in the elderly, it will reduce the risk factors for Alzheimer's in the elderly.

These study results contradicted the research results by Wahid in 2018 that nutritional status did not show a significant relationship with cognitive function with p -value=0.217 (28). This is because the nutritional status was measured using BMI in his study, while in this study, nutritional status was assessed using the MNA instrument. The measurement of nutritional status in the elderly is more accurate using the MNA instrument because there are several assessments to precisely determine the nutritional status of the elderly, including anthropometric assessment to assess BMI, general assessment, short dietary assessment, and subjective assessment (44). This study concluded that in the elderly, good nutritional status is associated with decreased frailty and improved function.

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