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Nutritional Status Correlated with Frailty Among Elderly

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Abstract

Nutritional status is a critical issue for older adults and is closely linked to various health problems. Insufficient or excessive dietary intake can impair the body's ability to manage physical disorders and diseases, leading to increased weakness in this population. This research aimed to analyze the correlation between nutritional status and frailty in the elderly. This research utilized a cross-sectional design, employing consecutive sampling to gather data from 65 patients in four nursing homes. Participants were elderly individuals over 45 years old, residing in nursing homes, cooperatives, and willing to participate. Sample size determination was performed using G*power 3.1.9.7 software, with a medium effect size of 0.41, a p-value of 0.05, and a power of 0.90. Non-parametric tests were used for data analysis, employing the MNA-SF and Frailty Index Questionnaire-40 (FI-40) instruments. The average age of participants was 75.92 (±9.45) years, with the majority of the sample being elderly, and women constituted 80% of all participants. There was a significant correlation between nutritional status and frailty (p=0.005 <0.05), with a moderate negative relationship (r=-0.344). This research concluded that the better the nutritional status, the lower the frailty level. This research indicated that better nutritional status was linked to reduced frailty in the elderly, highlighting the need for healthcare teams to implement strategies that enhance patient adherence in managing factors that negatively affect nutrition.

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INTRODUCTION

Elderly individuals are defined as those aged 60 years and above. World Health Organization (WHO) mentioned that the elderly population ranges from 60 to over 90 (World Health Organization, 2020); meanwhile, Indonesian Ministry of Health categorizes elderly individuals as those between 45 to 70 years and older, or precisely those aged 60 and above, who are more likely to experience health-related issues (Indonesian Ministry of Health, 2023). Old age is the final stage in the human life cycle, marked by various physical, psychological, and social changes (Santini et al., 2020). Physically, elderly experience declining body organ function, such as vision, hearing, and mobility (Phua et al., 2022). In addition, psychologically, seniors can also face challenges such as depression, loneliness, and cognitive decline. Meanwhile, from a social perspective, elderly people often experience marginalization, loss of roles, and changes in social relationships (Maharani et al., 2019).

A common phenomenon among the elderly is malnutrition or inadequate nutrition intake (Bakhtiari et al., 2020). Malnutrition is a critical issue for this age group, as it can lead to a decline in immune system function (Eggersdorfer et al., 2022). This occurs due to a lack of nutritional intake needed to maintain the body's immunity (Calder, 2021). Therefore, a decreased body endurance often causes weakness or frailty, impacting overall health (Chi et al., 2021). The occurrence of weakness or frailty can limit the ability of elderly people to perform daily activities independently, so they need help from other people (Fang et al., 2019).

Based on data from the *Badan Pusat Statistik (BPS)*, the number of older adults (aged ≥60 years) in Indonesia will reach around 32.74 million (11.56%) of the total population in 2023. (Badan Pusat Statistik, 2023) evaluates the prevalence of malnutrition risk across various countries using malnutrition screening tools (Leij-Halfwerk et al., 2019). The analysis reveals varying levels of malnutrition risk prevalence: 28.0% (n = 127), 17.5% (n = 30), and 8.5% (n = 32). Through a meta-regression approach, it was found that the prevalence of malnutrition risk is significantly higher among adults over 80 years old ($p < 0.0001$), women ($p = 0.03$), and those with comorbid conditions ($p < 0.0001$) (Leij-Halfwerk et al., 2019). In the latest research conducted by Rizki Amelia et al, the elderly population with inadequate nutritional intake shows a prevalence of frailty, reaching 55% or around 16.5 million (Amelia et al., 2023). In addition, data from (Rizka et al., 2021) shows that the incidence of frailty in elderly people with a history of malnutrition in Indonesia reaches 18,7. This data indicates how vital good nutritional status is in preventing or delaying the onset of frailty in the elderly.

A longitudinal study by Hai et al, revealed that the elderly who were either malnourished or at risk of malnutrition faced a 2.5-fold higher risk of experiencing a decline in physical function over the following two years (Hai et al., 2021). The impact that can arise is an increased risk of death (Yu et al., 2021). A recent meta-analysis showed that elderly with malnutrition have a two times higher risk of death than those with normal nutritional status (Rodríguez-Mañas et al., 2021). Therefore, comprehensive nutritional interventions are needed to overcome nutritional status problems that can affect weakness in the elderly (Lin et al., 2021). A systematic review recommended adequate protein intake, oral nutritional supplements, and physical exercise as an integrated intervention to improve older adults' nutritional status, muscle mass, and physical function (Gielen et al., 2021).

Previous research examining the association between nutritional status and frailty among the elderly primarily focuses on patients experiencing acute stress, such as hip fractures resulting from low-energy trauma (Liu et al., 2020). In contrast, the current study investigates all elderly individuals residing in nursing homes, irrespective of specific health conditions (Mugica-Errazquin et al., 2021). This research aims to analyze the correlation between nutritional status and frailty among the elderly. This study hypothesizes that there is a significant correlation between nutritional status and frailty.

METHODS

The research design was a cross-sectional study. The data were collected from September 2024 to October 2024 in four homes in Malang and Lawang regions, East Java, Indonesia. Sample calculations in this study used the G*power software version 3.1.9.7 with a medium effect size of 0.41, (Jamain et al., 2020) p-value 0.05, and power set at 0.90. Based on the calculation results, the sample obtained was 54 participants, with a dropout rate of 20% to avoid loss of follow-up; finally, the total sample was 65 participants. The sampling was carried out using a consecutive sampling technique. The inclusion criteria were: elderly > 45 years old (WHO, 2020), have lived at the nursing home for a long time ≥ one month, and cooperative and willing to be a research respondent. Elderly with critical condition/seriously ill and severe dementia were excluded from this study. Since dementia is a condition of decreased brain abilities, such as memory, thinking ability, and mental intelligence, it can cause elderly people to experience difficulty in understanding the context of conversations and expressing their feelings. (Kim & Karceski, 2021) . The independent variable in this study was nutritional status, while the dependent variable was frailty; both variables were measured on an ordinal scale. Additionally, sociodemographic data, such as age, gender, marital status, and education level were collected. The instrument used was the Mini Nutritional Assessment Short Form (MNA-SF) created by Vellas B, Villars H, Abellan G, et al. (2006). MNA-SF was valid and can be recommended as a screening tool for assessing the nutritional status of the elderly (Krishnamoorthy et al., 2021). The MNA-SF is a validated screening tool designed to evaluate the nutritional status of elderly individuals. It was developed as a simplified version of the original Mini Nutritional Assessment (MNA) to facilitate rapid and accurate nutritional assessments in clinical and community settings (Vellas et al., 2006). The MNA-SF provides a maximum score of 14, with scores of 12–14 indicating normal nutritional status, scores of 8–11 identifying individuals at risk of malnutrition, and scores below 7 suggesting the presence of malnutrition. The reliability and validity test result showed that MNA-SF had a sensitivity of 92% and a specificity of 73.8% for the calf-circumference (CC) version. In comparison, the body mass index (BMI) version had a sensitivity of 72% and a specificity of 95.6%, with a Cronbach's Alpha of 0.71 for the full-form MNA (Krishnamoorthy et al., 2021). In contrast, the Frailty Index Questionnaire-40 (FI-40) assesses frailty in elderly populations based on accumulated health deficits. Each deficit is scored as either present (1) or absent (0), and overall frailty is determined by dividing the number of deficits present by the total number of possible deficits. The resulting scores categorize individuals into different frailty levels: normal (0-1), pre-frailty (11-20), and frailty (21-40), with higher scores reflecting greater degrees of frailty. The data were collected by visiting nursing homes and asking elderly people to participate in the research. After obtaining consent from participants, the MNA-SF and FI-40 questionnaires will be filled in by researchers by conducting direct interviews with each participant. The Spearman correlation test was used to analyze the research objectives, "correlation between nutritional status and frailty among nursing home elders," because it tests the relationship of categorical data. Testing the relationship between two variables on an ordinal scale and data that is not normally distributed. Three things must be read in the Spearman test; namely, significant results if the p-value is more than 0.05; the strength of relationship category (r) is 0.00-0.199 (very weak), 0.20-0.399 (weak), moderate (0.40-599), 0.60-0.799 (strong) and very strong (0.80-1.00); and the direction of the relationship is positive (+) or negative (-) (Inayah & Aini, 2019). Sociodemographic parameters are explained using descriptive statistics, such as frequency distribution, percentage, mean, and standard deviation. A p-value of 0.05 or less was considered significant in all statistical analyses. Spearman correlation test and Mann Whitney U test were used to analyze the relationship of sociodemographic variables with MNA-SF and FI-40. Bivariate data analysis was carried out using the non-parametric Spearman correlation test to examine the strength and

direction of the relationship between nutritional status and weakness. The Spearman correlation test will also show the significance value. All data was analyzed using SPSS version 25 (Inayah & Aini, 2019). This research was approved by the committee research and ethics of the Faculty of Medicine, University of Muhammadiyah Malang (UMM), number E.5.a/277/KEPKUMM/X/2024.

RESULTS

The average age of participants was 75.92 (±9.45) years, with most of the sample being elderly. Women constitute 80% of all participants, making women the majority of participants in this research. Most participants were widows/widowers, with 31 people or 47.69%. On average, most participants' educational history showed that 29.23% had completed junior high school. As many as 63.08% of participants did not drink coffee, and showed that 52.31% consumed tea. Based on patient characteristics, age and coffee consumption significantly influenced or were associated with frailty (Table 1).

Table 1. Participant characteristics and their correlation with nutritional status and frailty

Characteristic			Mean (SD)	*n* (%)	Significance with	
					MNA-SF	F1-40
Age (years)			75.92(±9,45)			
					0.869[#]	**0.05**[#]
Age category	Pre elderly (45-59)		56.00(±3,56)			
				4 (6.15)		
	Elderly (60>)		77.23 (±8,24)	61 (93.85)		
Gender					0.388[¥]	0.582[¥]
	Male			13 (20)		
	Female			52 (80)		
Marital Status	Married			13 (20)	0.275*	0.807*
	Widowed			31 (47.69)		
	Divorced			11 (16.92)		
	Single			10 (15.38)		
Education Level	No Education			4 (6.15)	0.128*	0.453*
	Primary School			14 (21.54)		
	Middle School			19 (29.23)		
	High School			20 (30.77)		
	College/University			8 (12.31)		
Consumption of caffeinated beverages						
	Coffee				0.560[¥]	**0.005**[¥]
	Yes			24 (36.92)		
		1x/day		15 (23.08)		
		2-3x/day		2 (3.08)		
		1x/ week		5 (3.08)		
		1-2x/month		2 (7.69)		
	No			41 (63.08)		
	Tea				0.608[¥]	0.532[¥]
	Yes			34 (52.31)		
		1x/day		20 (30.77)		
		2-3x/day		7 (10.77)		
		1x/ week		4 (6.15)		
		1-2x/month		3 (4.62)		
	No			31 (47.69)		

Notes: ¥Spearman Rho correlation test, #Mann-Whitney U Test, Standard Deviation (SD), Total number (n%)**.**

Based on the results of the MNA-SF questionnaire, it was found that 50.8% of participants were in the malnutrition risk category, 46.2% were in the normal category, and 3.1% were in the malnutrition category. According to the statistical test results on Frailty Index-40, as many as 60% of participants were included in the normal category, 38.5% were in the pre-frail category, and 1.5% were in the frailty category. Statistical analysis revealed that the p-value was 0.005 < α= 0.05 (H1 was accepted), with a negative correlation value (-0.344), which means there is a significant correlation between nutritional status and frailty, in which the better the nutritional status, the lower the frailty level (Table 2).

Table 2. Statistical test results

Variables		*n* (%)	Significance p-value (r)
MNA-SF	Malnutrition	2 (3.1)	0.005 (-0.344)
	Risk of malnutrition	33 (50.8)	
	Normal	30 (46.2)	
Frailty	Normal	39 (60.0)	
	Pre- Frail	25 (38.5)	
	Frailty	1 (1.5)	

Notes: Standard Deviation (SD), Total Number (*n*), Strength of relationship (*r)*

DISCUSSION

Main Findings

The results of the analysis show that age is significantly related to *frailty*. This is supported by Setiati et al, who revealed that the prevalence of frailty in this study among elderly Indonesians in outpatient care was 25,2% (Setiati et al., 2019). Risk factors for frailty are age and nutritional status (Norazman et al., 2020). Prognostic factors for worsening frailty are 70 years or older, negative quality of life (moderate or poor QoL), and slow walking speed (Soenarti et al., 2024). A prognostic score was developed to predict the worsening of frailty at 12 months (Deschasse et al., 2022).

The analysis of coffee consumption shows that coffee consumption is only significantly related to *frailty*. The protective effect of coffee against weakness is likely due to the antioxidants and bioactive compounds such as caffeine and phenolics contained in it. This current result is supported by (Pang et al., 2023), who showed that consuming more than 488 grams of caffeinated coffee per day was associated with a lower risk of weakness than individuals who did not drink coffee. However, the results of a recent study by Zhang et al, contrary to these findings, state no significant relationship between coffee consumption and frailty (Zhang et al., 2023).

Based on the results of statistical tests, this research shows a significant relationship between nutritional status and frailty among the elderly. The correlation coefficient obtained in this study shows a weak negative correlation between nutritional status and frailty, which means that the better the nutritional status, the lower the frailty level. This result is corroborated by Hong et al. (2019), who revealed that nutritional status was significantly related to the level of frailty in elderly patients treated in hospitals (Hong et al., 2019). In this study, it was explained that if nutritional status improved, then the level of frailty in elderly patients tended to reduce.

Nutritional status has a significant influence on frailty in the elderly population, where malnutrition in the form of macronutrient deficiencies such as calories and protein, or micronutrients such as vitamin D and calcium can cause a decrease in muscle mass and bone health, thereby increasing the risk of frailty (Kirk et al., 2021). Nutritional deficiencies reduce muscle

strength and physical abilities and contribute to chronic inflammation and oxidative stress, which are detrimental to physical and mental function (Cahyawati et al., 2022). Quality of life and cognitive function are also affected, and good nutrition is positively associated with both. Therefore, appropriate nutritional interventions, including increasing protein and micronutrient intake, are essential in preventing and reducing frailty, making it a strategic step to maintain the health of the elderly and reduce the overall risk of physical frailty (Cruz-Jentoft & Woo, 2019).

Strength and Limitations

This research contributes to showing that there is a significant relationship between nutritional status and frailty among the elderly. Using a cross-sectional design, this study identified a weak negative correlation between nutritional status and frailty. The use of valid instruments such as MNA-SF and FI-40 are also a strength of this study, as it ensures accurate and reliable data for assessing nutritional status and frailty in the elderly. The weakness of this research is that it uses a cross-sectional design that only describes the prevalence or specific characteristics in the population, so it cannot determine the cause and effect of the two variables.

CONCLUSION

This research showed that there was a significant correlation between nutritional status and frailty among elderly, namely that the better the nutritional status, the lower the level of frailty. Therefore, caregivers and health teams should develop strategies and provide interventions to increase patient compliance in controlling factors that can cause decreased nutritional status.

SUGGESTION

Nursing home caregivers must recognize the importance of nutritional status in the elderly, as poor nutrition can increase the risk of frailty. Interventions that can be implemented include providing a balanced diet, ensuring adequate protein intake, and meeting the necessary micronutrients like vitamin D, calcium, and iron. Additionally, educating the elderly about the importance of regular meals and preventing nutritional deficiencies can help reduce the risk of frailty. Future research could conduct longitudinal studies to further explore the relationship between nutritional status and frailty in older adults, as well as examine other influencing factors such as underlying medical conditions or socio-economic factors. The latest comprehensive nutritional interventions recommend a combination of adequate protein intake, oral dietary supplements, and physical exercise as an integrated intervention that can enhance the nutritional status, muscle mass, and physical function of elderly. Moreover, patients who have experienced a decline in nutritional status also need to be given stimulation so that the effects of weakness do not worsen.

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CONFLICTS OF INTEREST

The authors affirm that there is no known competing conflict of interest.

AUTHOR CONTRIBUTIONS

UYD, EWM: contributed significantly to the data collection, analysis, interpretation, conceptualization, and design results. UYD, EWM: closely developed or examined the text for essential intellectual elements. UYD, EWM: final checks and submission.

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