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RELATIONSHIP BETWEEN NUTRITIONAL STATUS, SARCOPENIA, MALNUTRITION AND APPETITE IN COMMUNITY-DWELLING ELDERLY

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Abstract

Objectives: This study aims to examine the relationship between nutritional status, sarcopenia, and malnutrition in community-dwelling elderly.

Materials and Methods: In the study conducted with 198 elderly, the Mini Nutritional Assessment (MNA) and Short Nutritional Assessment Questionnaire 65+ (SNAQ65+) screening tools were used to determine the risk of malnutrition. The SARC-F screening tool was used to identify the risk of sarcopenia. The 24-hour dietary recalls of the individuals were taken by the researcher.

Results: According to MNA 30.3% and according to SNAQ65+ 23.7 (%) of elderly individuals are at risk of malnutrition and 44.4% are at risk of sarcopenia. Females have lower MNA scores than males ($p=0.036$) and higher SARC-F scores ($p<0.001$). Elderly individuals who reported that dental problems prevent them from consuming solid foods are 2.881 times more likely to be at risk of malnutrition compared to those who did not report such problems ($p=0.010$). In addition, perceived appetite status didn't affect malnutrition risk/malnutrition. Dietary folate and vitamin B1 intake of elderly at malnutrition risk/malnourished were lower than normal nutritional status ($p=0.011$, $p=0.038$, respectively).

Conclusion: Elderly individuals living in the community with dental health problems may be at risk of malnutrition. Dietary insufficient folate intake may be a risk factor for malnutrition. Therefore, strategies developed to address dental health and adequate nutrition in the elderly are important in reducing the risk of malnutrition.

Keywords: Aged, malnutrition, sarcopenia, nutritional status, appetite, oral health.

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Introduction

Aging, a natural process of life, is both an inevitable and predictable biological phenomenon, and the elderly population is increasing worldwide day by day. Appetite loss/anorexia, associated with nutritional insufficiency in old age, is a significant risk factor. With aging, acute and chronic illnesses, physiological changes, psychological conditions, and medications can affect appetite mechanisms.[1] Decreased energy and nutrient intake due to appetite loss/anorexia results in an increased risk of protein-energy malnutrition, sarcopenia, bone fragility, and mortality.[2]

Elderly individuals are an important risk group for the development of malnutrition due to decreased physiological capacity, appetite loss/anorexia, reduced access to healthy foods, and the presence of accompanying diseases.[3] Malnutrition in the elderly is a highly significant health issue that affects quality of life, including increased risk of sarcopenia, chronic disease, bone fragility, and mortality.[4] Therefore, clinical guidelines recommend regular screening for malnutrition, assessment of nutritional status, and personalized nutrition support for at-risk groups among all elderly adults.[3]

Sarcopenia is a widespread and advancing disorder that affects skeletal muscles, leading to a decline in muscle mass and strength. Aging is closely associated with progressive and general loss of muscle mass and strength. When comparing healthy elderly individuals aged 60-80 years with younger adults, muscle strength loss ranges from 20% to 40%, while this difference exceeds 50% in those aged over 80 years.[5] Inadequate and/or imbalanced nutrition is commonly observed in the elderly, especially in underweight individuals. Improving diet and nutrition in these individuals plays a significant role in both the prevention and treatment of sarcopenia.[6]

The interaction between appetite, nutritional status, sarcopenia, and inadequate nutrition creates a vicious cycle in elderly individuals. Decreased appetite and inadequate nutrient intake in the elderly lead to malnutrition, resulting in weight loss, muscle wasting, and increased risk of disease. Additionally, deteriorating functional status due to sarcopenia exacerbates in elderly individuals, leading to loss of appetite and paving the way for malnutrition.[7,8] Therefore, understanding the relationship between appetite, nutritional status, sarcopenia, and malnutrition is crucial to improving the health status and preventing mortality in the elderly. Considering the increasing elderly population worldwide, it is believed that the findings of this research will make a significant contribution to the literature to enhance their health outcomes and quality of life. This study was conducted to investigate the relationship between appetite, nutritional status, sarcopenia, and malnutrition in the elderly.

Materials and Methods

This study is a cross-sectional and descriptive community study conducted on 198 elderly individuals aged 65 and over. The research was conducted using a survey form through a face-to-face interview technique. Individuals diagnosed with psychiatric disorders by a physician and those with alcohol or drug dependency were not included in the study. Ethical approval for the study was obtained from the Ankara Yıldırım Beyazıt University Ethics Committee, with approval number 06-304 and date 14/06/2023.

Demographic Characteristics

The survey aims to gather information from participants on topics such as , age, education level, occupation, meal consumption frequency, and oral and dental health.

Mini Nutritional Assessment (MNA)

The MNA (Mini Nutritional Assessment) is a screening tool used to determine the risk of malnutrition in patients. It consists of two parts: the MNA-short form (SF) (screening) and the MNA-long form (assessment). The MNA-SF can be used alone as a screening test or as part of the MNA long form. It is recommended that the MNA-SF be applied primarily to community-dwelling elderly individuals. The MNA-SF section includes 6 questions that assess body weight loss, body mass index (BMI) or calf circumference, mobility, food intake, psychological stress or acute illness, and the presence of neuropsychological problems. When the MNA-SF is used alone, patients are classified as having normal nutritional status (scores between 11-14), at risk of malnutrition (scores between 7-11), or malnourished (scores below 7).[9]

Short Nutritional Assessment Questionnaire 65+ (SNAQ65+)

SNAQ65+ is a screening tool developed by Wijnhoven et al.[10] to identify the risk of malnutrition in community-dwelling elderly individuals. The questionnaire assesses individuals' weight loss, mid-upper arm circumference, appetite, and functional status. Based on the results, the green color indicates normal nutritional status, the orange color indicates malnutrition risk, and the red color indicates malnutrition. The Turkish validity and reliability of the questionnaire were established by Evci et al.[11]

SARC-F Sarcopenia Screening Tool

SARC-F is a screening tool developed for the diagnosis of sarcopenia. The scale consists of 5 main components: strength, assistance in walking, rising from a chair, climbing stairs, and falls. The scale score ranges from a

minimum of 0 to a maximum of 10; a score of 0-3 indicates a healthy status, while a score of 4 or above indicates a symptomatic condition[12]. The validity and reliability of the scale in Turkey were established by Kiş.[13]

24-Hour Dietary Recall

The data obtained from 24-hour food consumption record questionnaires were analyzed using the BeBiS program, which has an international database, and the individuals' average daily energy and nutrient intakes were calculated[14].

Statistical Analyses

Descriptive statistics and frequency tables were utilized to interpret the findings. The Kolmogorov-Smirnov Test was applied to determine if the data conformed to a normal distribution. To compare quantitative data between two independent groups, either the parametric Independent Samples t-test or the non-parametric Mann-Whitney U test was employed. The Spearman Correlation Coefficient was used to explore relationships between quantitative variables when the data did not follow a normal distribution. Correlation coefficients were interpreted as follows: less than 0.2 indicated a very weak relationship, 0.2 to 0.4 weak, 0.4 to 0.6 moderate, 0.6 to 0.8 high, and greater than 0.8 very high. A logistic regression model was utilized to assess multivariate associations between variables. Statistical significance was defined as $p<0.05$. Data analysis was conducted using IBM SPSS Statistics v26.

Results

The average age of individuals is 71.36±6.19 years, with 57.1% being female and 42.9% male. When examining their education levels, it is found that 41.9% are primary school graduates. Among the individuals, 49.0% are retired, and 65.2% are married. The majority (98.5%) live at home, and 63.6% live with their spouses. A significant portion (83.8%) has reported having a disease, with hypertension (46.0%), diabetes (29.3%), musculoskeletal system diseases (28.8%), and cardiovascular diseases (23.7%) being the most common conditions (Table 1).

Among the elderly, 52.0% reported that they prepare their meals at home themselves, 22.7% stated that dental problems prevent them from eating solid foods, and 35.9% indicated that their appetite is moderate. The frequency of those who eat three main meals a day is 58.1%, and the main reasons for skipping main meals are lack of appetite (69.9%) and having no one to prepare the meals (30.1%).Most individuals have two snacks per day (52.0%), do not smoke (86.4%), and do not consume alcohol (99.0%) (Table 2).

Table 1. Descriptive Characteristics of the Individuals

			n=198	%
Age (years)	***Mean±SD***	71.36±6.19		
Sex	Female		113	57.1
	Male		85	42.9
Education level				
	Illiterate		35	17.7
	Literate		16	8.1
	Primary school		83	41.9
	Secondary school		19	9.6
	High school		25	12.6
	Undergraduate		20	10.1
Marital status				
	Married		129	65.2
	Single		69	34.8
Working status				
	Not working		88	44.4
	Retired		97	49.0
	Labourer		3	1.5
	Self-employed		10	5.1
Place of residence				
	Home		195	98.5
	Nursing home		3	1.5
Whom do they live with				
	Alone		32	16.2
	Spouse		126	63.6
	Child		39	19.7
	Carer		1	0.5
Disease status				
	Not present		32	16.2
	Present		166	83.8
Diseases*				
	Hypertension		91	46.0
	Diabetes		58	29.3
	Respiratory diseases		31	15.7
	Endocrine diseases		11	5.6
	Psychiatric disorders		11	5.6
	Musculoskeletal system diseases		57	28.8
	Cardiovascular diseases		47	23.7
	Gastrointestinal system diseases		21	10.6
	Neurological diseases		20	10.1
	Vitamin mineral deficiencies		31	15.7

*More than one answer was given.

Table 2. Characteristics of Individuals' Lifestyles and Eating Habits

		n=198	%
Individuals preparing food at home			
	Him/herself	104	52.5
	Spouse	56	28.3
	Child	35	17.7
	Caregiver-nursing home	3	1.5
Denture tooth			
	Present	95	48.0
	Not present	103	52.0
Missing tooth			
	Present	109	55.1
	Not present	89	44.9
Tooth problem prevents eating			
	Does not prevent	147	74.3
	Only in solid foods	45	22.7
	In all foods	6	3.0
Perceived appetite			
	Poor	5	2.5
	Average	71	35.9
	Good	85	42.9
	Very good	37	18.7
Number of main meals			
	1	2	1.0
	2	81	40.9
	3	115	58.1
Reason for skipping main meals*			
	Loss of appetite	58	69.9
	Lack of preparer	25	30.1
Number of snacks			
	Not snacking	5	2.5
	1	74	37.4
	2	103	52.0
	3	16	8.1
Tobacco smoking			
	Yes	27	13.6
	No	171	86.4
Alcohol consumption			
	Yes	2	1.0
	No	196	99.0

*Less than 3 main meals were evaluated as skipping main meal

According to the MNA screening score, 30.3% of elderly individuals are at risk of malnutrition (female: 31.0%, male: 29.4%) and 1.5% are malnourished. The MNA screening score is higher in male compared to female (p=0.036). It was determined that 44.4% of individuals are at risk of sarcopenia. The total SARC-F score is

significantly higher in male than in female (<0.001), and 29.4% of male and 55.8% of female are at risk of sarcopenia (Table 3).

Table 3. Risk of malnutrition and sarcopenia in elderly individuals

		Female (n=113)	Male (n=85)	P#	Total (n=198)
MNA-SF	Mean±SD	11.78±1.76	12.24±1.83	**0.036***	11.97±1.79
		n (%)	**n (%)**		**n (%)**
	Normal nutritional status	76 (67.3)	59 (69.4)		135 (68.2)
	At risk of malnutrition	35 (31.0)	25 (29.4)		60 (30.3)
	Malnourished	2 (1.7)	1 (1.2)		3 (1.5)
SNAQ65⁺					
	Normal nutritional status	81 (71.7)	61 (71.8)		142 (71.7)
	At risk of malnutrition	29 (25.7)	18 (21.2)		47 (23.7)
	Malnourished	3 (2.6)	6 (7.0)		9 (4,6)
SARC-F	Mean±SD	3.93±2.42	2.49±2.38	**<0.001**	3.31±2.51
	No sarcopenia risk	50 (44.2)	60 (70.6)		110 (55.6)
	Sarcopenia risk	63 (55.8)	25 (29.4)		88 (44.4)

*p<0.05, #Mann-Whitney U test MNA-SF: Mini Nutritional Assessment-Short Form, SNAQ65⁺: Short Nutritional Assessment Questionnaire 65⁺, SARC-F: Sarcopenia screening tool

In Table 4, a weakly significant negative correlation was found between the total MNA screening score and the total SARC-F score (p<0.001).

Age, sex, education level, marital status, disease status, and appetite status were not found to have a significant effect on the risk of malnutrition (p>0.05). Elderly individuals who reported that dental problems hinder their consumption of solid food were found to be 2.881 times more likely to be at risk of malnutrition compared to those who did not report such hindrance (p<0.05) (Table 5).

The dietary intake of vitamin B1 and folate is significantly lower in elderly individuals at risk of malnutrition and those with malnutrition (p=0.038 and p=0.011, respectively). The intake of other dietary nutrients is similar between those at risk of malnutrition/malnourished and those with normal nutritional status (p>0.05). The dietary nutrient intake is also similar between those at risk of sarcopenia and those not at risk (p>0.05) (Table 6).

Table 4. The relationship between MNA and SARC-F total scores

	MNA-SF	
	r	**P**
SARC-F	-0.006	**<0.001**

Spearman's correlation, MNA-SF: Mini Nutritional Assessment-Short Form, SARC-F: Sarcopenia screening tool

Table 5. Analysis of Factors Affecting the Risk of Malnutrition Using Logistic Regression

							%95 C.I.	
Risk factors	**β**	**SE**	**Wald**	**df**	**p**	**OR**	**Lower**	**Upper**
Dental problems (solid food)	1.058	0.412	6.581	1	**0.010***	2.881	1.284	6.466

*p<0.05 β: Regression coefficient, SE: Standard error, Wald: Chi-square, df: degree of freedom, p: significance level, OR: Odds Ratio, C.I.: Confidence Interval

Table 6. Comparison of dietary energy and nutrient intakes of individuals according to malnutrition and sarcopenia risk status

	Malnutrition risk and malnourished	**Normal nutritional status**	**p¶**	**No risk of sarcopenia**	**Sarcopenia risk**	**p¶**
Energy (kcal)	1620.21±649.33	1663.17±746.21	0.758	1705.29±767.87	1579.76±641.44	0.359
Carbohydrate (gr)	195.69±102.01	192.35±98.14	0.900	198.38±105.93	187.20±90.16	0.551
Carbohydrate (%)	48.03±11.28	46.76±8.66	0.383#	46.76±10.54	47.66±8.21	0.514#
Protein (gr)	62.57±28.46	62.08±26.59	0.903	64.30±26.03	59.65±28.37	0.052
Protein (%)	16.17±4.68	15.81±3.82	0.507	16.18±5.52	15.61±3.51	0.740
Fat (gr)	63.05±26.41	69.53±35.46	0.422	70.55±37.22	63.60±26.29	0.538
Fat (%)	35.83±11.00	37.39±8.31	0.162	37.06±9.69	36.68±8.71	0.931
Vitamin A (mcg)	981.63±709.07	1029.65±687.43	0.165	961.39±506.69	1080.59±870.43	0.898
Vitamin E (mg)	18.05±10.56	17.73±9.95	0.943	17.28±9.55	18.52±10.81	0.580
Vitamin B1 (mg)	0.82±0.39	0.96±0.53	**0.038***	0.94±0.53	0.89±0.43	0.504
Vitamin B2 (mg)	1.17±0.74	1.27±0.86	0.066	1.27±0.91	1.20±0.70	0.364
Vitamin B6 (mg)	1.23±0.62	1.35±0.59	0.114	1.34±0.60	1.28±0.61	0.393
Folate (mcg)	303.46±154.14	361.64±187.06	**0.011***	356.84±192.68	325.99±159.53	0.297
Vitamin C (mg)	102.66±94.19	128.66±97.87	0.002	118.181±96.32	122.36±98.89	0.673
Sodium (mg)	2362.00±2223.19	2194.15±1434.56	0.870	2310.29±1420.03	2169.13±2041.65	0.052
Potassium (mg)	2522.76±1466.99	2653.78±1183.04	0.066	2623.66±1275.96	2597.64±1287.51	0.798
Calcium (mg)	616.26±303.22	700.32±306.87	0.073#	679.55±312.50	666.09±302.65	0.812
Magnesium (mg)	247.62±120.28	268.92±127.98	0.154	267.39±128.281	255.57±122.05	0.393
Phosphorus (mg)	986.18±476.62	1050.05±505.64	0.261	1065.68±519.74	984.78±464.29	0.212
Iron (mg)	9.87±5.32	10.19±5.06	0.495	10.39±5.02	9.69±5.26	0.107
Zinc (mg)	8.46±4.41	8.58±4.01	0.442	8.67±4.21	8.14±4.01	0.103

*p<0.05, #Independent samples t-test, ¶Mann Whitney U test

Discussion

According to the study findings, 30.3% of elderly individuals are at risk of malnutrition and 44.4% are at risk of sarcopenia. Females have lower MNA screening scores than males (p=0.036) and higher SARC-F scores (p<0.001). Elderly individuals who reported that dental problems prevent them from consuming solid foods are 2.881 times more likely to be at risk of malnutrition compared to those who did not report such problems (p=0.010).

In a multi-center study conducted in Turkey, 49.1% of the elderly were found to be at risk of malnutrition, and 6.7% were malnourished.[15] In a study by Ülger et al.[16], 28.0% of the elderly in the community were observed to be at risk of malnutrition. In this study, using the MNA screening tool, 30.3% of the elderly in the community were found to be at risk of malnutrition and 1.5% were malnourished. According to the SNAQ65+ screening tool, 23.7% of individuals were at risk of malnutrition and 4.6% were malnourished. Studies conducted in Turkey indicate that the prevalence of malnutrition risk among the elderly in the community ranges approximately from 28.0% to 49.1%, supporting the findings of this study.

There are numerous physiological, socioeconomic, and neuropsychological factors related to nutrition that can lead to malnutrition. A meta-analysis has identified that hospitalization, reliance on assisted feeding, poor physical function, and reduced appetite are significant determinants of malnutrition. However, there is inconsistency in the findings regarding the effects of dental health, swallowing difficulties, cognitive function, depression, living conditions, medication usage and/or polypharmacy, constipation, and periodontal disease on malnutrition.[17]Another study indicated that in individuals over the age of 65 in the community, female sex, being single, impaired social resources, and poor quality of life are the main determinants of malnutrition risk.[18] In this research, the MNA score for females was found to be lower than that for males. While female sex may be considered a risk factor for malnutrition, logistic regression analysis showed no significant impact of age, sex, educational level, marital status, presence of chronic disease, or appetite status on malnutrition risk. Additionally, it was found that having dental problems that prevent the consumption of solid foods increases the risk of malnutrition by 2.881 times compared to those without such problems. Among the participants, 52.0% reported having dentures and 55.1% reported missing teeth. Tooth loss or dental problems can lead to difficulties in chewing and the inability to consume solid foods. The prevalence of malnutrition is higher among elderly individuals who are malnourished due to dental problems.[19] Toniazzo et al.[20], in a systematic review, found a significant association between the decrease in the number of functional and average teeth and malnutrition. Research supports the findings of this study, suggesting that elderly individuals who have chewing problems and difficulty consuming solid foods due to dental issues may be at risk of malnutrition.

The prevalence of sarcopenia among the elderly worldwide is reported to range between 10-16% and is more commonly seen in individuals with underlying health conditions.[21,22] In a study conducted in Turkey, sarcopenia was found in 11.8% of elderly individuals living in rural areas of the eastern region and 21.6% of those living in urban areas.[23] Another study reported that 50.2% of the elderly in the community in Turkey had sarcopenia.[24] In this study, 44.4% of the individuals (female: 55.8%, male: 29.4%) were found to have sarcopenia, and females had higher SARC-F scores than males ($p<0.001$). The wide range of prevalence across studies may be attributed to different diagnostic criteria, geographical regions, access to healthcare services, and other factors.

Malnutrition and sarcopenia are clinically significant and interrelated in their pathophysiologies. In a study examining the relationship between malnutrition parameters and sarcopenia diagnostic criteria, strong associations were found regarding muscle mass, and less strong associations were observed concerning muscle strength and physical performance. In malnourished elderly individuals, the risk of sarcopenia may increase due to decreased muscle protein synthesis.[25] In this study, a weakly negative significant relationship was found between the total MNA screening score and the total SARC-F score ($r=-0,306$, $p<0.001$), indicating that the malnutrition risk increases with the sarcopenia risk. The findings are similar to those of previous studies, but due to the weak relationship, more research is needed to obtain clearer results about the complex relationship between malnutrition and sarcopenia.

Inadequate and unbalanced nutrition can lead to the body not receiving essential nutrients in the elderly, increasing the risk of malnutrition. Nutritional quality in older adults is influenced by various factors, including economic status, functional limitations, sex, place of residence, smoking habits, and oral health. Poor nutritional quality often involves low intake of fruits, vegetables, legumes, and whole grains, coupled with high consumption of calorie-dense, nutrient-poor foods high in added sugars. This dietary pattern results in a decreased intake of essential macro and micronutrients.[26] A study conducted in Turkey found that elderly individuals at risk of malnutrition had lower intakes of energy, protein, carbohydrates, fats, vitamins A, E, B1, B2, B6, folate, C, and minerals such as calcium, magnesium, iron, and zinc compared to well-nourished individuals[15]. In this study, elderly individuals at risk of malnutrition/malnourished had lower dietary intakes of vitamins B1 and folate ($p=0.038$, $p=0.011$; respectively).Reduced dietary folate intake in the elderly can lead to folate deficiency, affecting age-related sensory function, appetite, dysphagia, and chewing disorders.[27] Additionally, folate deficiency in the elderly is associated with anemia, Alzheimer's disease, cardiovascular diseases, depression, muscle weakness, and frailty.[28] Although perceived appetite was better in most elderly in this study and appetite was not a risk factor for malnutrition, dietary insufficient folate intake may be a risk factor for appetite loss and muscle weakness. Based on the findings, inadequate dietary intake of folate may be a risk factor for malnutrition and related health problems. In addition, the similarity in other dietary macro-

nutrient and mineral intakes between groups in this study is contradictory compared to other studies, and further research is needed.

Nutrition is a crucial component in the prevention and treatment of sarcopenia. Adequate dietary intake of the macronutrient protein can prevent sarcopenia and muscle loss. Among micronutrients, selenium and magnesium are noted for their muscle performance-enhancing effects. Omega-3 fatty acids can help preserve muscle mass.[6] A study observed that the intake of polyunsaturated fatty acids, monounsaturated fatty acids, omega-3, vitamin E, vitamin B6, magnesium, iron, copper, sodium, and caffeine could reduce the likelihood of sarcopenia and low muscle strength.[29]According to the results of the SarcoPhAge study, individuals with sarcopenia consumed less dietary protein, fat, potassium, magnesium, phosphorus, iron, and vitamin K compared to those without sarcopenia.[30]In this research, the dietary intake of energy, macronutrients, and micronutrients was similar between individuals at risk of sarcopenia and those not at risk. This may be due to differences in demographic characteristics, health status, or lifestyles among the elderly affecting sarcopenia risk.

Conclusion

Elderly individuals living in the community may be at risk of malnutrition, which can lead to the development of sarcopenia and various health problems. Dental issues are a significant factor in the risk of malnutrition in the elderly, and it is important to take measures to protect dental health, such as oral care, regular dental check-ups, and healthy eating. The relationship between dietary intake of folate and malnutrition should be supported by more studies. Further research is also needed to examine the impact of nutrition on the risk of sarcopenia.

Ethical Considerations: Ethical approval for the study was obtained from the Ankara Yıldırım Beyazıt University Ethics Committee, with approval number 06-304 and date 14/06/2023.

Conflict of Interest: The authors declare no conflict of interest.

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