Society of Medical Education & Research

2023, Volume 3, Issue 1, Page No: 9-19
ISSN: 3108-4826

Journal of Medical Sciences and Interdisciplinary Research

Nutritional Status Assessment in Elderly Using Different Screening Tools

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Abstract

This study aimed to assess the nutritional health of elderly individuals residing in nursing homes, using different malnutrition screening tools, comparing their effectiveness, and assessing the prevalence of malnutrition in this group. The study included 88 participants (60 males, 28 females) with a mean age of 76.91 ± 8.18 years, all from a private nursing home. Information such as hand grip strength, anthropometric measurements, and serum albumin levels were extracted from medical records. Findings from the screening tools showed that 1.1% of the participants were classified as high-risk by the NSI, 3.4% as medium-risk by the MUST, 3.4% were found malnourished using the MNA, and 10.2% had low risk according to the GNRI. The study showed weak correlations between BMI ($P = 0.032$), mid-upper arm circumference (MUAC) ($P = 0.003$), and calf circumference ($P = 0.009$). In contrast, a strong relationship was found between GNRI scores and albumin levels ($P < 0.001$). In addition, weaker correlations were observed between physical activity level (PAL) ($P = 0.004$) and waist/hip ratio ($P = 0.015$). Mild correlations were noted between NSI and waist/height ratio ($P = 0.040$) and PAL ($P = 0.001$). A negative correlation was found between NSI and MNA scores ($r = -0.419$), while GNRI and MNA scores showed a positive correlation ($r = 0.424$). This study recommends choosing malnutrition screening tools based on the elderly's living conditions—whether in nursing homes, homes, or hospitals—and conducting regular follow-ups with repeated screenings to enable early diagnosis.

Keywords: Nutritional status, Malnutrition screening tools, Elderly, Anthropometric measurements

Introduction

The global population is aging rapidly, driven by a decline in birth rates coupled with longer life expectancies, resulting in what is now referred to as a demographic burden. The World Health Organization (WHO) has prioritized this issue, emphasizing the importance of multi-sectorial strategies to address aging concerns [1]. By 2030, it is anticipated that nearly 20% of the world's population will be aged 65 years or older [2]. Nutrition plays a pivotal role in the physical and cognitive functioning of the elderly [3], and malnutrition is often linked to a variety of health conditions, including depression, comorbidities, dementia, disability, medication side effects, taste changes, and dysphagia [4]. Aging also alters physiological and psychological food-related behaviors, although the exact mechanisms behind these changes in appetite regulation remain unclear [5]. Malnutrition is a widespread issue in older adults, and failure to recognize and address it can complicate the treatment of other health conditions. Furthermore, malnutrition increases the risk of morbidity and mortality by contributing to additional complications. Elderly individuals in hospitals and nursing homes are particularly vulnerable to malnutrition, often due to reduced appetite, which exacerbates its prevalence [6].

The prevalence of malnutrition in elderly populations varies by factors such as location and criteria used for assessment. Reports indicate that malnutrition rates range from 5-10% in community-dwelling older adults, 30-

Access this article online https://smerpub.com/

Received: 19 December 2022; **Accepted:** 25 February 2023

How to cite this article: Guigoz Y, Vellas B. Nutritional Status Assessment in Elderly Using Different Screening Tools. J Med Sci Interdiscip Res. 2023;3(1):9-19. https://doi.org/10.51847/JZjGw02xal

60% in nursing homes, and 15-65% in hospitalized individuals [6-9]. A study spanning from 2007 to 2018, which tracked nursing home residents aged 65 years and older in a 6-month nutritional project, found that 10.5% of initially well-nourished residents developed malnutrition over the study period [10]. Diagnosing malnutrition in older adults can be challenging due to normal age-related physiological changes, which is why regular nutritional screening during routine check-ups is essential [11]. Monitoring the nutritional status of elderly individuals at high risk for malnutrition is crucial [1]. Special attention should be given to those with poor nutritional intake, low BMI, severe cognitive decline, immobility, or advanced age [10].
The approach to managing malnutrition in the elderly involves a systematic process: screening, detection, intervention, monitoring, and evaluation. Malnutrition screening is an efficient and quick method to identify potential nutritional issues early. Several screening tools have been developed for elderly populations, including nutritional risk screening-2002 (NRS-2002), short nutrition assessment questionnaire (SNAQ), SCREEN II, malnutrition universal screening tool (MUST), malnutrition screening tool (MST), subjective global assessment (SGA), mini nutritional assessment (MNA), MNA-short form (MNA-SF), and geriatric nutritional risk index (GNRI). Tools like SGA, NRS-2002, and MNA are commonly employed in clinical settings for malnutrition assessments [12]. These tools have been shown to reveal significant differences in malnutrition rates across populations [13].
Failure to recognize the impact and effectiveness of malnutrition screening, despite the rising prevalence of malnutrition and its detrimental effects on health, often results in delayed diagnosis and treatment [14]. This study aims to assess the nutritional status of elderly individuals by using anthropometric measurements, hand grip strength, and a range of screening tools (MNA, MUST, NSI, and GNRI), while also evaluating the consistency of these tools' findings.

Materials and Methods

This investigation followed a cross-sectional, descriptive, and quantitative design. It was conducted at a nursing home in Ankara, Turkey, with all necessary permissions secured before the study. Inclusion criteria required participants to be over 65 years old, residing in the nursing home for at least six months, and having had serum albumin levels measured within the past three weeks. Those excluded from the study had cognitive impairments from conditions such as Alzheimer's or dementia, severe hearing loss, or were bedridden. A total of 88 individuals voluntarily participated in the study after meeting the inclusion criteria and providing informed consent.
Data collection involved administering a questionnaire through face-to-face interviews, reviewing health records, and conducting anthropometric assessments. The questionnaire gathered demographic and health-related information, while serum albumin values were sourced from the participants' health records. All participants underwent a series of malnutrition screening assessments (MNA, MUST, NSI, GNRI), as well as hand grip strength and other anthropometric measurements.

Ethical Considerations

The study received ethical approval from the University Ethics Committee (decision number 60, dated 12/24/2021) and adhered to the guidelines outlined in the Declaration of Helsinki.

Assessment of Nutritional Status

The malnutrition screening tools used in this research—MNA, MUST, NSI, and GNRI—are well-suited and validated for use with Turkish elderly populations. All tools were administered by a trained dietitian, following the methods described in the literature [15-18].

MNA

The mini nutritional assessment (MNA) is a brief tool used to evaluate the nutritional status of elderly individuals in a variety of settings, such as outpatient clinics, hospitals, and nursing homes. Based on the total score, participants are classified into 3 categories: (I) those scoring below 17 are considered to have protein-calorie malnutrition, (II) scores between 17 and 23.5 suggest a risk of malnutrition, and (III) scores of 24 or higher indicate adequate nutritional status [19].

MUST

The malnutrition universal screening tool (MUST) is a rapid and comprehensive method for nutritional evaluation. Individuals are categorized as having normal nutritional status with scores of 0-1 and as at risk for malnutrition with scores of 2 or greater [20, 21].

NSI

The nutrition screening initiative (NSI) form, developed by the American Academy of Family Medicine, the American Dietetic Association, and the National Aging Council, is used to assess nutritional risk among the elderly. A score ranging from 0 to 2 points signifies low nutritional risk, with follow-up in six months; a score of 3-5 points indicates moderate risk, requiring reassessment in three months; and a score of 6 or more points suggests high nutritional risk.

GNRI

The geriatric nutritional risk index (GNRI), created by Bouillanne *et al.* [22], is employed to assess the nutritional status of elderly individuals in both community and institutional settings. The albumin level, measured within the last 3 months, is a key element in the calculation. GNRI scores categorize individuals as follows: a score < 82 indicates severe risk, 82 to less than 92 indicates moderate risk, 92 to 98 indicates mild risk, and scores > 98 indicate no nutritional risk.

Anthropometric Measurements

In this study, anthropometric assessments were conducted according to established protocols in the literature. Weight was measured using the BC-532 TANITA scale, and various physical measurements, including height, waist circumference (WC), hip circumference (HC), mid-upper arm circumference (MUAC), calf circumference (CC), ulna length, and arm span, were recorded using a non-elastic measuring tape [23]. BMI was calculated by dividing the body weight (kg) by the square of height (m^2). As aging leads to a reduction in muscle mass and an increase in abdominal visceral fat, particularly at the trunk, the accuracy of BMI in evaluating nutritional status may be diminished due to the loss of lean tissue in the limbs. A BMI lower than 23 kg/m^2 is considered a sign of malnutrition [24]. The BMI was categorized as follows: underweight (< 23.0 kg/m^2), normal (24.0–26.9 kg/m^2), and overweight (> 27 kg/m^2) [25]. Hand grip strength was assessed using a hand-held dynamometer. Each participant was asked to squeeze the device three times with both hands, and the average value of these measurements was recorded [26].

Physical Activity Level (PAL)

Participants were questioned about their sleep habits, nocturnal activities (such as using the toilet, changing clothes, or engaging in prayer), and their movements within their private rooms. Observations of physical activity in shared spaces were made at 15-minute intervals. A 24-hour physical activity score was computed based on these observations, and the PAL was calculated accordingly [27].

Statistical Analysis

Data were presented as percentages, means, and standard deviations. To compare the two groups, the t-test was used for normally distributed data, while the Mann-Whitney U test was employed for non-normally distributed data. For comparing more than 2 groups, ANOVA was used for normally distributed data, and the Kruskal-Wallis test was applied for data without a normal distribution. The relationship between continuous variables was examined using the Spearman correlation coefficient. Data were analyzed using SPSS 21 (SPSS Inc., Chicago, IL, USA), with statistical significance set at $P < 0.05$. A linear regression model was used to predict the MNA score and identify the factors influencing it. Initially, univariate regression analysis was conducted on the independent variables, followed by the construction of a multiple regression model using the enter method.

Results and Discussion

A total of 88 participants, consisting of 60 males (68.8%) and 28 females (31.8%), were involved in the research. The average stay duration in the nursing home was 47.13 ± 59.61 months. On average, women (81.18 ± 6.99 years) were older than men (74.92 ± 7.97 years), with this difference being statistically significant ($P = 0.01$). Of the participants, 89.8% (n = 79) had at least one diagnosed chronic condition, with 33.0% experiencing difficulties with chewing or swallowing, and 4.0% reporting problems with appetite. Blood pressure measurements, both systolic and diastolic, showed no significant gender differences. Women had a higher number of snack intakes ($P = 0.014$), but there was no significant gender-based difference in the frequency of main meals ($P > 0.05$) (**Table 1**).

Table 1. Nutritional habits, demographics, and other characteristics of the participants

Variables		Male X̄ ± SD	Female X̄ ± SD	Total X̄ ± SD	P-value
Age (years)		74.92 ± 7.97	81.18 ± 6.99	76.91 ± 8.18	0.001*
Length of stay in a nursing home (months)		36.59 ± 45.15	69.71 ± 78.88	47.13 ± 59.61	0.046*
Number of main meals		2.92 ± 0.28	2.96 ± 0.19	2.93 ± 0.254	0.415
Number of snacks		0.78 ± 0.56	1.14 ± 0.76	0.90 ± 0.64	0.014*
Water intake (mL/day)		1132.50 ± 554.32	942.86 ± 518.672	1072.16 ± 547.51	0.131
Systolic blood pressure (mmHg)		127.66 ± 10.30	127.32 ± 11.59	127.55 ± 10.67	0.893
Diastolic blood pressure (mmHg)		81.17 ± 9.09	81.07 ± 13.49	81.14 ± 10.65	0.967
Education level (n (%))	< Highschool	29 (48.3)	19 (67.9)	48 (54.5)	0.232
	Highschool	19 (31.7)	4 (14.3)	23 (26.1)	
	University	12 (20.0)	5 (17.9)	17 (19.3)	
Chronic diseases (n (%))	Yes	54 (90.0)	25 (89.3)	79 (89.8)	0.919
	No	6 (10.0)	3 (10.7)	9 (10.2)	
Appetite (n (%))	Poor	45 (75.0)	12 (42.9)	4 (4.5)	0.001*
	Mid	14 (23.3)	13 (46.4)	27 (30.7)	
	Good	1 (1.7)	3 (10.7)	57 (64.8)	
Chewing and swallowing problems (n (%))	Yes	17 (28.3)	12 (42.9)	29 (32.9)	0.181
	No	43 (71. 7)	16 (57.2)	59 (67.0)	
Tooth loss (n (%))	Yes	20 (33.3)	9 (32.2)	6 (6.8)	0.415
	No	10 (16.7)	0 (0.0)	29 (32.9)	
	Complete denture	30 (50.0)	19 (67.86)	49 (55.68)	
BMI classification (n (%))	< 23.0	12 (20.0)	4 (14.3)	16 (18.2)	0.355
	23.0-26.9	30 (50.0)	13 (46.4)	43 (48.9)	
	> 27.0	18 (30.0)	11 (39.3)	29 (32.9)	

Abbreviations: SD = standard deviation; BMI = body mass index; descriptive statistics are expressed as frequency (percentage) or mean (standard deviation).
* P < 0.05 obtained from t-test, Mann–Whitney U, and chi-square test.

No significant differences were observed between males and females in terms of hip, waist, mid-upper arm, and calf circumferences, nor BMI measurements. However, when considering other anthropometric values and hand grip strength, significant differences between the sexes were found. Males had considerably higher scores in MNA, GNRI, and NSI (P = 0.044, P = 0.014, and P = 0.044, respectively) (**Table 2**).

Table 2. The anthropometric measurements of the participants and the results of different screening tools

Variables	Male (n = 60)		Female (n = 28)		P-value
	X̄ ± SD	(Min-Max)	X̄ ± SD	(Min-Max)	
Body weight (kg)	76.09 ± 16.03	51.0-123.0	65.98 ± 12.22	47.0-85.3	0.013**
Height (cm)	164.41 ± 6.89	149.5-177.0	149.69 ± 5.56	139.0-162.8	< 0.001**
BMI (kg/m^2)	28.09 ± 5.36	19.9-44.0	29.49 ± 5.41	20.4-42.4	0.202
Waist circumference (cm)	98.99 ± 12.38	78.0-136.0	94.18 ± 9.75	76.0-112.0	0.150
Hip circumference (cm)	101.80 ± 8.47	88.0-133.0	100.38 ± 10.54	86.6-121.0	0.404
Waist-to-hip ratio	0.97 ± 0.73	0.8-1.2	0.90 ± 0.59	0.8-1.1	< 0.001**
Waist-to-height ratio	0.59 ± 0.79	0.4-0.8	0.63 ± 0.67	0.5-0.7	0.042*
Mid-upper arm (cm)	29.30 ± 3.84	21.0-40.0	28.66 ± 3.44	23.0-35.0	0.455
Calf circumference (cm)	35.13 ± 3.69	27.5-43.5	34.55 ± 3.92	29.0-41.5	0.503
Ulna length (cm)	36.74 ± 1.92	32.0-42.0	34.38 ± 1.92	30.0-38.0	< 0.001**
Knee height (cm)	51.14 ± 1.98	42.00-57.00	47.23 ± 2.19	46.00-50.30	< 0.001**
Arm span (cm)	85.84 ± 4.49	77.0-96.5	79.16 ± 3.40	71.0-86.0	< 0.001**

Right-hand grip strength (kg)	27.243 ± 8.38	6.5-48.0	14.92 ± 5.19	6.3-24.0	< 0.001**
Left-hand grip strength (kg)	25.991 ± 8.208	11.7-49.6	15.924 ± 10.78	7.2-27.1	< 0.001**
MNA score	25.05 ± 3.24	15-29	24.23 ± 2.41	17.5-28.5	0.044*
GNRI score	102.20 ± 3.55	92.44-114.70	100.47 ± 3.12	93.80-107.30	0.014*
NSI score	1.3 ± 1.38	0-7	1 ± 1.44	0-5	0.034*

Abbreviations: SD = standard deviation; BMI = body mass index; MNA = mini nutritional assessment; GNRI = geriatric nutritional risk index; NSI = nutritional risk screening; descriptive statistics are expressed as minimum, maximum, and mean (standard deviation); * P < 0.05, and ** P < 0.001 obtained from t-test and Mann–Whitney U.

A weak negative relationship was observed between the NSI and GNRI scores, though it wasn't statistically significant (P = 0.248, r = -0.124). A clear negative correlation was noted between the MNA and NSI scores (P < 0.001, r = -0.419), whereas the MNA score and GNRI were positively correlated (P < 0.001, r = 0.424). Right-hand grip strength was positively associated with both the GNRI (P = 0.04, r = 0.223) and MNA (P = 0.003, r = 0.317) scores, but negatively correlated with the NSI score (P = 0.004, r = -0.310). Left-hand grip strength showed similar trends: positive correlations with GNRI (P = 0.76, r = 0.193) and MNA (P= 0.005, r = 0.302), and a negative correlation with NSI (P = 0.020, r= -0.252). The MNA score had a moderately significant association with albumin (P< 0.001), while weaker relationships were found with BMI (P= 0.032), MUAC (P = 0.003), and calf circumference (P= 0.009). GNRI exhibited a strong correlation with albumin (P < 0.001), as well as a modest relationship with PAL (P = 0.004) and waist-to-hip ratio (P = 0.015). NSI had a significant but lower correlation with waist-to-height ratio (P = 0.040) and PAL (P = 0.001) (**Table 3**).

Table 3. Correlation between MNA, GNRI, and NSI scores and parameters

Variables	MNA score (n = 88)		GNRI score (n = 86)		NSI score (n = 88)	
	rs[a]	P	rs[a]	P	rs[a]	P
Age (years)	-0.127	0.237	-0.137	0.209	0.091	0.402
PAL	0.443	< 0.001**	0.306	0.004*	-0.352	0.001**
Albumin (g/L)	0.471	< 0.001**	0.933	< 0.001**	-0.150	0.164
BMI (kg/m^2)	0.228	0.032*	0.010	0.925	0.103	0.341
Waist-to-hip ratio	0.127	0.238	0.262	0.015*	0.168	0.118
Waist-to-height ratio	0.136	0.205	-0.083	0.450	0.219	0.040
Mid-upper arm (cm)	0.313	0.003*	0.156	0.151	0.013	0.908
Calf circumference (cm)	0.279	0.009*	0.081	0.457	-0.013	0.903
Systolic blood pressure (mmHg)	0.045	0.681	-0.061	0.582	-0.019	0.865
Diastolic blood pressure (mmHg)	0.009	0.932	-0.192	0.081	0.089	0.415

Abbreviations: PAL = physical activity level; BMI = body mass index; *P < 0.05, and **P < 0.001 obtained from Spearman correlation

The participants were categorized based on their scores from the MUST, NSI, MNA, and GNRI screening tools (**Table 4**). Most participants were classified as having no nutritional issues or were at low to no risk of malnutrition. A significant gender difference was observed in the NSI results (P= 0.020), while no significant differences between genders were found for the other screening tools used (**Table 4**).

Table 4. Distribution of participants according to screening tools

Screening Tools	Score	Male (n = 60)		Female (n = 20)		Total (n = 88)		χ^2/ p-value
		N	%	N	%	N	%	
MUST								
Normal	0	57	95.0	28	100	85	96.6	1.449
Low risk	1	1	1.7	-	-	1	1.1	0.484
High risk	2	2	3.3	-	-	2	2.3	
NSI								
Low risk	0-2	48	80.0	15	53.6	63	71.6	7.855
Moderate risk	3-5	11	18.3	13	46.4	24	27.3	0.020*
High risk	≥ 6	1	1.7	-	-	1	1.1	

MNA								
Normal	> 23.5	47	78.3	18	64.3	65	73.9	4.958
Risk of malnutrition	17-23.5	10	16.7	10	35.7	20	22.7	0.084
Malnutrition	< 17	3	5.0	-	-	3	3.4	
GNRI								
Severe	< 82	-	-	-	-	-	-	
Moderate	≥ 82-92	-	-	-	-	-	-	
Mild	≥ 92-98	5	8.3	4	14.3	9	10.2	0.457
No malnutrition	≥ 98	55	91.7	24	85.7	79	89.8	0.306

Abbreviations: MUST = malnutrition screening test; NSI = nutritional risk screening; MNA = mini nutritional assessment; GNRI = geriatric nutritional risk index; χ^2: The chi-square test of independence; descriptive statistics are expressed as frequency (percentage); * P < 0.05 obtained from Fisher–Freeman–Halton test.

Table 5 illustrates how changes in the parameters affect the categorization of participants based on their NSI and GNRI scores. Specifically, for each 1-point increase in the NSI score, the likelihood of being placed in the "malnutrition risk" category compared to "no malnutrition" rises by a factor of 1.732, and the chance of being categorized as "malnourished" instead of "no malnutrition" increases 2.751 times. On the other hand, an increase of 1 point in the GNRI score decreases the odds of being classified as "at risk of malnutrition" by a factor of 0.794 compared to "no malnutrition," and similarly reduces the likelihood of being in the "malnutrition" category by 0.969 times relative to the "no malnutrition" category.

Table 5. Model parameter estimators

MNA classification		B	P-value	Odds ratio	Odds ratio 95% confidence intervals	
					Lower limit	Upper limit
17-23.5 risk of malnutrition	Constant	-2.077	< 0.001			
	NSI score	0.549	0.006	1.732	1.175	2.552
< 17 protein-calorie malnutrition	Constant	-5.309	< 0.001			
	NSI score	1.012	0.007	2.751	1.321	5.728
17-23.5 risk of malnutrition	Constant	22.070	0.013			
	GNRI	-0.230	0.009	0.794	0.668	0.945
< 17 protein-calorie malnutrition	Constant	0.121	0.995			
	GNRI	-0.031	0.863	0.969	0.680	1.382

Abbreviations: NSI = nutritional risk screening; MNA = mini nutritional assessment; GNRI = geriatric nutritional risk index; CI = confidence interval; OR = odds ratio, Overall significance of model; * P < 0.05, ** P < 0.001

When evaluating each predictive factor independently through univariate linear regression, the results revealed that an increase of 1 point in the GNRI score was linked to a rise of 0.33 points in the MNA score. On the other hand, a 1-point increase in the NSI score led to a reduction of 1.163 points in the MNA score. Regarding grip strength, a 1-point gain in right-hand grip strength was associated with an increase of 0.080 points in the MNA score, whereas left-hand grip strength showed a similar relationship with a 1-point rise resulting in a 0.067 increase in the MNA score. The model demonstrated a coefficient of determination (R^2) of 0.631, as detailed in **Table 6**.

Table 6. Univariate linear and multiple linear regression between GNRI, NSI scores, hand grip strength, gender, age

Variables	Univariate linear regression				Multiple linear regression			
	P-value	B	Odds ratio 95% confidence intervals		P-value	B	Odds ratio 95% confidence intervals	
			Lower limit	Upper limit			Lower limit	Lower limit
GNRI score	< 0.001	0.330	0.159	0.500	0.020	0.204	0.033	0.374
NSI score	< 0.001	-1.163	-1.542	-0.785	< 0.001**	-0.799	-1.190	-0.407

HGS left	0.025	0.067	0.009	0.125	0.495	0.029	-0.055	0.113
HGS right	0.011	0.080	0.019	0.141	0.488	0.035	-0.066	0.136
Gender	0.237	-0.818	-2.184	0.548	0.330	0.719	-0.743	2.181
Age	0.870	0.007	-0.072	0.085	0.299	0.039	-0.035	0.112
Constant					0.892	-1.287	-20.035	17.462

Abbreviations: CI = confidence interval; OR = odds ratio; NSI = nutritional risk screening; GNRI = geriatric nutritional risk index; HGS = hand grip strength; ** overall significance of model P < 0.001

Numerous factors, including sarcopenia, cachexia, sensory function decline, and age-related alterations in the gastrointestinal system, contribute to a reduction in energy intake, which in turn raises the likelihood of malnutrition [11]. Older adults are particularly vulnerable to this risk. Studies have shown that more than 60% of elderly individuals residing in institutions such as nursing homes or hospitals are at significant risk of malnutrition [7, 9].

In this analysis, a large proportion of participants were categorized as having low or no risk of malnutrition according to different screening tools: 96.6% using the MUST, 71.6% based on the NSI, 73.9% from the MNA, and 100% according to the GNRI. It is well-established that the WHO's standard BMI thresholds do not appropriately assess the nutritional status of the elderly population. Furthermore, evidence-based guidelines for BMI classification specific to the elderly are not yet available. A meta-analysis indicated a U-shaped relationship between BMI and overall mortality, after accounting for factors like smoking, early deaths, pre-existing conditions, and location, suggesting the lowest mortality risk occurs with a BMI between 24–31 kg/m² [28].

In clinical practice, it is recommended to modify BMI categories for individuals over 65 years of age: < 23 kg/m² indicates low weight, 24–29.9 kg/m² denotes healthy weight, and > 30 kg/m² suggests overweight [25]. The MNA also uses BMI as a parameter, assigning the highest score for individuals with a BMI of ≥ 23 kg/m² [29]. The MUST tool considers a BMI over 20 kg/m² as normal. In our study, 18.19% of the participants had a BMI under 23 kg/m², while just under half (48.8%) fell within the healthy weight range. International guidelines recommend that elderly individuals with a BMI under 23 kg/m² be classified as underweight and referred for nutritional assessment [30]. Additionally, a BMI under 22 kg/m² is commonly used to identify malnutrition, with values up to 27 kg/m² deemed normal for the elderly [31]. The findings from the screening tools in this study varied: the NSI identified 28.4% as at risk or malnourished, the MNA classified 26.1% similarly, the MUST found 3.4% at risk, and the GNRI showed 0% at risk.

Obesity, a key risk factor for various non-communicable diseases, is increasingly prevalent in the elderly, paralleling trends in younger age groups. Notably, abdominal obesity peaks between the ages of 60 and 70 years. The topic of weight loss among the elderly remains complex, with important distinctions between voluntary and involuntary weight loss. Involuntary weight loss often signals underlying chronic conditions, while voluntary weight loss may be beneficial, even with minor reductions in skeletal muscle and bone density [32]. The concept of the "obesity paradox," which posits that mild obesity may enhance survival in certain diseases, is still debated. The evidence supporting this theory remains largely observational and clinical [33]. A study found that being overweight was linked to a reduced risk of cognitive decline, whereas abdominal obesity was associated with a higher likelihood of cognitive impairment, irrespective of sociodemographic, lifestyle, and health factors [34].

The study's screening tools assessed BMI but did not specify upper limits. Among the participants, 29.0% had a BMI exceeding 30 kg/m². For women, the average waist measurement was 94.18 ± 9.75 cm, while men had a mean of 98.99 ± 12.38 cm, both suggesting an elevated risk for abdominal obesity, particularly in women. Sarcopenic obesity (SO) is a condition observed in older adults that involves a reduction in skeletal muscle mass, strength, and function, which significantly affects their quality of life, increasing susceptibility to falls and fractures. While the underlying mechanisms of SO remain poorly understood, making it challenging to establish uniform diagnostic criteria, its prevalence and potential effects remain unclear. It is important to assess for SO in elderly individuals dealing with obesity [35]. This evaluation should include the measurement of muscle mass, strength, and functionality. Malnutrition in older adults affects muscle function early on and hampers daily activities [36]. Therefore, it is recommended to incorporate hand grip strength tests along with other screening tools for evaluating nutritional status [37]. In this research, hand grip strength was assessed with a dynamometer, revealing that both right and left-hand grip strength were positively correlated with higher MNA scores. According to Crichton et al. [38], malnutrition is more prevalent in women over 80, those with multiple comorbidities, and individuals from rural areas. In this study, women showed a higher rate of intermediate malnutrition risk according to the NSI (P = 0.020), while other screening methods revealed no significant gender differences. Given that physical activity, BMI, calf circumference in the MNA, and albumin in the GNRI were all considered, it was expected to find significant correlations between these variables.

Malnutrition can be detected in at-risk individuals through various screening and evaluation methods. Despite growing attention to malnutrition prevention in nursing homes in recent years, its prevalence remains largely unchanged [14, 39]. This ongoing issue may be attributed to the insufficient identification of malnutrition risk and a lack of awareness regarding the actions health professionals can take to reduce this risk [39]. Screening tools play a crucial role in identifying risk factors, guiding early treatment, and addressing nutritional deficiencies [40]. Research comparing different screening tools found that the NRS-2002 demonstrated the highest validity, while the MUST exhibited the greatest specificity in predicting malnutrition risk in elderly outpatients, with a recommendation to validate the NSI using larger sample sizes [41]. Another study concluded that the GNRI better reflects mortality risk compared to the MNA, suggesting it should be prioritized for newly institutionalized elderly individuals [42]. The NSI, being a concise and easy-to-use test that does not involve anthropometric measurements, helps identify elderly individuals at risk. However, because the NSI's primary aim is to raise awareness of potential malnutrition, it may be overly sensitive and misidentify individuals at risk [43]. In this study, moderate malnutrition risk was more frequently identified by the NSI compared to other tools. Although the NSI offers specific benefits, some of its questions are not suited to nursing home environments, limiting its application primarily to raising awareness in these settings [44]. Numerous nutritional screening tools have been developed for the elderly, and their validity is supported by evidence [45]. A study comparing the MNA, MUST, NSI, SNAQRC, SNAQ65+, and MEONF-II screening tools found that all tools yielded compatible results when used in pairs [46]. Regarding the MNA and NSI tests in this study, an increase in total score was linked to a higher risk of malnutrition, while a higher GNRI score correlated with a reduced risk. MNA scores were negatively correlated with the NSI and positively correlated with the GNRI (P < 0.001). However, no significant relationship was found between NSI and GNRI scores (P = 0.248). When examining the impact of MNA classification on NSI and GNRI scores, it was found that a higher NSI score increased the likelihood of being categorized as at risk for or having malnutrition, whereas a higher GNRI score decreased this likelihood. Albumin levels are influenced by both nutritional and non-nutritional factors [47], and low albumin levels are considered an independent risk factor for geriatric malnutrition [48]. While the GNRI, which requires albumin measurement, may be less practical for nursing homes, it was used in this study with a limited sample of individuals whose albumin levels were recorded within the past three weeks. The MNA is widely recommended as the most effective tool for identifying and assessing malnutrition risk in older adults [49] and is considered the gold standard [50]. As the MNA is the most validated and reliable screening tool, encompassing both screening and diagnostic functions, it is considered a more dependable method than others due to its inclusion of anthropometric measurements and other essential variables.

Conclusion

This study highlights the challenge of selecting the most suitable screening tool for nursing homes, as well as determining which tool might be superior to the others. The broad spectrum of malnutrition prevalence can likely be attributed to the wide array of methods and tools available for its assessment. It is crucial to screen elderly individuals at risk of malnutrition using the appropriate screening tools. Regular screening and proper interpretation of relevant factors in elderly populations residing in nursing homes are essential for ensuring their health. Both malnutrition and the risk of malnutrition significantly contribute to increased mortality rates. As such, regular anthropometric assessments combined with relevant screening tests should be implemented for the elderly, alongside early diagnosis and timely intervention plans. In addition to these screening tools, evaluating food services, which play a crucial role in nutritional status in nursing homes, will offer a more comprehensive approach in shaping future intervention studies.

Limitations

This study's limitation lies in its focus on participants from Ankara, the capital of Türkiye, which limits the broader applicability of the results. Additionally, the sample size was restricted due to the inclusion criterion of only those individuals who had albumin values measured within the last three weeks. To ensure the findings are more widely applicable, future research should include a larger and more diverse sample of elderly individuals from various age and education backgrounds, living either in nursing homes or independently, whether alone or with family members.

Acknowledgments: We express our sincere gratitude to all the participants who volunteered in this study for their valuable contributions.

Conflict of Interest: None

Financial Support: None

Ethics Statement: The study was approved by the Non-Interventional Ethics Committee (AMU) on 12/24/2021, with approval number 60.

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