

Impact of quality of life on nutritional risk and malnutrition: a cross-sectional study in elderly patients

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ABSTRACT

Objectives: To investigate prevalence of malnutrition and nutritional risk, related factors, and the association between nutritional status and quality of life in the elderly.

Material and Method: Cross-sectional study. Participants; elderly (≥ 65 years) patients without severe hearing and vision impairment and dependency on a bed or wheel chair who admitted internal medicine outpatient clinics. Measurements; the mini nutritional assessment questionnaire, Charlson comorbidity index, the World Health Organization quality of life (WHOQOL-OLD) questionnaire. Intervention; none.

Results: The study included 532 patients with a mean age of 70.8 ± 5.4 years. The median Mini Nutritional Assessment score was 26, and the total prevalence of nutritional risk and malnutrition was 26.7%. There were significant differences between the nutritional groups regarding the educational, living, and marital status, smoking history, presence of any systemic disease, Charlson Comorbidity Index, and polypharmacy ($p < 0.05$). WHOQOL-OLD and its subdomain scores had a significant relationship with having nutritional risk or malnutrition ($p < 0.001$). Total WHOQOL-OLD score and the Charlson Comorbidity Index were significant independent risk factors for developing nutritional risk and malnutrition.

Conclusion: Having nutritional risk or malnutrition in the elderly were significantly associated with the Charlson Comorbidity Index and the WHOQOL-OLD total and its subdomain scores.

Keywords: Elderly, nutritional status, malnutrition, health-related quality of life, comorbidity.

INTRODUCTION

The aging population has emerged as a new demographic trend in recent years. There is an inverse relationship between increased life expectancy and quality of life, most probably due to chronic diseases and disability (1,2). Besides, a substantial proportion of community-dwelling elderly lacks an adequate nutrient intake leading to an increased risk for malnutrition (1,3,4). Food is not only required for physiological well-being, but it also contributes to social, cultural, and psychological quality of life (4). So, aging and increased risk of malnutrition lead to a low quality of life as well as physical, mental, and social disabilities (5).

As a significant and common public health problem in older adults, the prevalence of malnutrition and associated factors show substantial variations based on the nutritional screening tools and the studied population's characteristics (4,5). In previous studies, the rate of malnutrition ranged from 20 to 30% in clinical

settings and from 2 to 8% in older adults in community-residences (2). Several physiological, socio-economic, and neuropsychological health-related factors influence the nutritional status, including depression, social isolation, and frailty status. Thus, the real-time knowledge about the prevalence of malnutrition in a specified population alerts the physicians dealing with older adults.

The assessment of nutritional risk is a strong determinant of interventions to prevent malnutrition and manage different aspects of quality of life, including its physical and mental components (1). Identifying people with malnutrition or nutritional risk includes some inherent difficulties (3). Besides the use of a diverse set of instruments for the evaluation of malnutrition and its risk, there is still a lack of a gold standard for the optimal definition of malnutrition. Nevertheless, the Mini Nutritional Assessment (MNA) has been recommended for its higher efficiency to predict malnutrition in the elderly (6,7).

In this study, we aimed to determine the prevalence of malnutrition and associated factors and analyze the association between the nutritional status of the older adults indicated by the MNA and their quality of life indicated by the World Health Organization Quality of Life (WHOQOL-OLD) questionnaire.

MATERIAL AND METHOD

The study was carried out with the permission of Erzurum Regional Training and Research Hospital Clinical Researchs Ethics Committee (Date: 06.01.2020, Decision No: 2020/01-06). All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki.

Patients

The MNA questionnaire was applied to all consecutive patients who were 65 or older and admitted to the Internal Medicine Outpatient Clinics after obtaining their consent between 01.01.2020 and 01.07.2020. Patients who had communication problems such as severe hearing (n=235) and vision impairment (n=192) or were dependent on bed or wheelchair (n=59) were not evaluated. A total of 532 patients were included in the study.

Several sociodemographic and clinical variables, including age, sex, body mass index (BMI), educational and marital status, living status (alone, with relatives, or residential care center), history of smoking, comorbidities, and drugs used, were evaluated. The patients were classified based on BMI values as underweight (BMI < 18.5 kg/m²), normal (18.5–24.9 kg/m²), or overweight (BMI ≥ 25 kg/m²). Patients using five or more drugs were grouped as polypharmacy. The Charlson Comorbidity Index (CCI) was calculated for each patient using the website www.mdcalc.com/charlson-comorbidity-index (8).

Questionnaires and Scales

Nutritional status was evaluated using the MNA questionnaire that was translated and validated in the Turkish language (9). MNA includes 18 items for the anthropometric measurements, dietary intake, global health assessment, and self-assessment of health and nutrition. The patients were categorized as satisfactory nutritional status (scores ≥24), nutritional risk (scores between 17 and 23.5), and malnutrition (scores <17) (1).

The WHOQOL-OLD questionnaire was applied to the patients to assess their quality of life. The WHOQOL-OLD contains six different subdomains: sensory abilities, autonomy, past, present, future activities, social participation, death and dying, and intimacy (1). Higher scores represent a higher self-rated quality of life. The 30-item Geriatric Depression Scale (GDS) was used to evaluate depression. A GDS score >10 was regarded as

depression (10, 11). Cognitive ability was assessed using the Mini-Mental State Examination (MMSE), commonly used to monitor dementia and cognitive states (12, 13). The MMSE score ranges from 0 (impaired) to 30 (normal). Scores below 24 were regarded as cognitive impairment (14). The Hendrich II Fall Risk Model (HIIIFRM) was used to analyze the factors associated with fall risk. The HIIIFRM score ranges from 0 to 16, where scores ≥5 were considered a high risk for falls (15).

Anthropometric Measurements

The anthropometric evaluation included body circumference (calf, arm) and triceps skinfold thickness. All measurements were carried out in the morning after an overnight fast of at least 8 hours. The BMI values were calculated as the bodyweight divided by the square of the height (kg/m²). The calf and arm circumferences were measured using a non-elastic tape measure. For calf measurements, the tape measure was placed around the calf without compressing the subcutaneous tissue and was moved along the calf's length to obtain the maximal circumference while the patient was lying down, and the leg was angled 90° at the knee. Calf circumference values were recorded as the average of the measurements from two trials for each leg, which were averaged again to get the overall measurement (16). Forearm circumference (mid-upper arm circumference) was measured at the midpoint between the acromion and olecranon bones while the arm was angled 90° at the elbow (17). For the measurement of triceps skinfold thickness, while the patients were standing and the arms were free at both sides, the arms were angled 90°, and the midpoint between the shoulder and the acromion was marked with a pencil. The skinfold was measured at the marked point. The anthropometric measurements were performed twice by experienced nurses and averaged later.

Biochemical analyses included hemoglobin (g/dL), fasting blood glucose (mg/dL), HbA1c (%), total cholesterol (mg/dL), low density lipoprotein (LDL) cholesterol (mg/dL), triglyceride (mg/dL), albumin (mg/dL), ferritin (ng/mL), vitamins B12 (pg/mL) and D (ng/mL) and B9 (folic acid) (ng/mL). Glomerular filtration rate (mL/min) was calculated using the Modification of Diet in Renal Disease (MDRD) formula (18).

Statistical Analysis

The primary outcome of the study was the prevalence of nutritional risk and malnutrition. The analysis of the factors associated with nutritional risk and malnutrition and the association between nutritional risk and the quality of life were the secondary outcomes.

Descriptive statistics were given as mean ± standard deviation or median [interquartile range-IQR] for the continuous variables depending on their distribution.

Numbers and percentages were used for categorical variables. The Kolmogorov-Smirnov test was used to check normal distribution. The One-Way ANOVA test was used to compare more than two independent groups when the numerical variables had a normal distribution. For variables without normal distribution, the Kruskal-Wallis test was applied.

For the analyses in which non-parametric tests were used, the differences between the groups were evaluated with the Tukey test when data was homogeneous based on its distribution. The Games-Howell test was used in situations where data was not homogeneous. The Dwass-Steel-Critchlow-Fligner test was used to evaluate the differences between the groups. To compare the differences between categorical variables, Pearson Chi-Square and Fisher-Freeman-Halton tests were used in 2x2 tables. Spearman correlation coefficients were calculated to analyze the relationships between numerical variables. Univariate and multivariate logistic regression analyses were performed to

analyze the demographic and clinical factors that impact nutritional risk and malnutrition. Statistically significant demographic and clinical characteristics in the univariate analysis were included in the multivariate analysis. For statistical analysis and figures, Jamovi (version 1.6.3, retrieved from <https://www.jamovi.org>) and JASP (version 0.13.1, retrieved from <https://jasp-stats.org>) software were used. The significance level (p-value cutoff) was set at 0.05 in all statistical analyses.

RESULTS

There were 532 patients with a mean age of 70.8±5.4 years. The female to male ratio was 1.1. The majority of the patients lived with their relatives. Although hypertension was the most significant comorbid disease (358 patients, 67.3%), there was no comorbidity in 249 patients (46.8%). The median CCI score was 4. The demographic and clinical characteristics of the study group were given in **Table 1**.

Table 1. Demographic and clinical characteristics of the study groups

	Overall (n=532)	Groups			p-values
		Satisfactory nutritional status (n=390)	Nutritional risk (n=83)	Malnutrition (n=59)	
Age (year) [†]	70.8±5.4	70.7±5.4	70.9±6.0	71.4±4.4	0.514
Sex[‡]					0.938
Male	253 (47.6)	187 (47.9)	38 (45.8)	28 (47.5)	
Female	279 (52.4)	203 (52.1)	45 (54.2)	31 (52.5)	
Educational status[‡]					<0.001
Illiterate	125 (23.5)	69 (17.7) ^a	28 (33.7) ^b	28 (47.5) ^b	
Primary	307 (57.7)	230 (59.0) ^a	46 (55.4) ^a	31 (52.5) ^a	
Secondary-college	76 (14.3)	67 (17.2) ^a	9 (10.8) ^a	0 (0.0) ^b	
University	24 (4.5)	24 (6.2) ^a	0 (0.0) ^b	0 (0.0) ^{a,b}	
Living status[‡]					<0.001
Alone	136 (25.6)	88 (22.6) ^a	33 (39.8) ^b	15 (25.4) ^{a,b}	
With relatives	344 (64.7)	291 (74.6) ^a	45 (54.2) ^b	8 (13.6) ^c	
Residential care center	52 (9.8)	11 (2.8) ^a	5 (6.0) ^a	36 (61.0) ^b	
Marital status[‡]					<0.001
Single	38 (7.1)	28 (7.2) ^a	5 (6.0) ^a	5 (8.5) ^a	
Married	333 (62.6)	289 (74.1) ^a	40 (48.2) ^b	4 (6.8) ^c	
Divorced/widowed	161 (30.3)	73 (18.7) ^a	38 (45.8) ^b	50 (84.7) ^c	
Smoking [‡]	208 (39.1)	145 (37.2) ^a	30 (36.1) ^a	33 (55.9) ^b	0.019
Comorbidity[‡]					
Hypertension	358 (67.3)	239 (61.3) ^a	62 (74.7) ^b	57 (96.6) ^c	<0.001
Diabetes mellitus	210 (39.5)	149 (38.2)	37 (44.6)	24 (40.7)	0.548
Any systemic disease	283 (53.2)	172 (44.1) ^a	54 (65.1) ^b	57 (96.6) ^c	<0.001
Systemic disease[‡]					<0.001
Absent	249 (46.8)	218 (55.9) ^a	29 (34.9) ^b	2 (3.4) ^c	
Coronary artery disease	84 (15.8)	66 (16.9) ^a	14 (16.9) ^{a,b}	4 (6.8) ^b	
Chronic heart failure	17 (3.2)	10 (2.6) ^a	5 (6.0) ^a	2 (3.4) ^a	
Chronic renal failure	40 (7.5)	34 (8.7) ^a	4 (4.8) ^a	2 (3.4) ^a	
Cerebrovascular accident	66 (12.4)	18 (4.6) ^a	11 (13.3) ^b	37 (62.7) ^c	
Chronic liver failure	10 (1.9)	7 (1.8) ^a	1 (1.2) ^a	2 (3.4) ^a	
Malignancy	23 (4.3)	6 (1.5) ^a	11 (13.3) ^b	6 (10.2) ^b	
Chronic obstructive pulmonary disease	43 (8.1)	31 (7.9) ^a	8 (9.6) ^a	4 (6.8) ^a	
Charlson comorbidity index [‡]	4.0 [2.0-14.0]	4.0 [2.0-10.0] ^a	5.0 [3.0-13.0] ^b	8.0 [4.0-14.0] ^c	<0.001
Polypharmacy [‡]	215 (40.4)	121 (31.0) ^a	42 (50.6) ^b	52 (88.1) ^c	<0.001
Mini Nutritional Assessment [‡]	26.0 [6.0-29.0]	26.0 [19.0-29.0] ^a	19.0 [11.0-26.0] ^b	9.0 [6.0-17.0] ^c	<0.001

[†]mean±standard deviation, [‡]n (%), [‡]median (IQR), Each subscript letter denotes a subset of group categories whose column proportions do not differ significantly from each other at the 0.05 level.

The median MNA score was 26 [6-29]. Based on the MNA scores, 83 patients (15.6%) had nutritional risk, and 59 patients (11.1%) had malnutrition; 390 patients (73.3%) had satisfactory nutritional status. The combined prevalence of malnutrition (nutritional risk and malnutrition) was 26.7%. The comparison of different nutritional status (satisfactory nutritional status, nutritional risk, and malnutrition) for various variables was given in **Table 1**. Significant differences were found between the groups regarding their education, living and marital status, smoking history, systemic diseases, CCI scores, and polypharmacy status. Malnutrition was more common in patients with low education, those living in residential care centers, and those who were divorced or widowed ($p < 0.001$ for each). Smoking was significantly associated with malnutrition ($p = 0.019$). Hypertension and any systemic disease were more common in patients with nutritional risk and malnutrition ($p < 0.001$ for

both). Cerebrovascular accident was the most common systemic disease (62.7%) in the patients with malnutrition ($p < 0.001$). The CCI score was significantly higher in malnourished patients ($p < 0.001$). Polypharmacy was more frequent in the patients with malnutrition (88.1%) than in the patients with nutritional risk (50.6%) and satisfactory nutritional status (31.0%).

Outcomes of the questionnaires, anthropometric measurements, and laboratory analyses were summarized in **Table 2**. The median total WHOQOL-OLD scores were 27.0, 36.0, and 56.0 in patients with malnutrition, nutritional risk, and satisfactory nutritional status, respectively; the differences between the groups were significant ($p < 0.001$ for all). The WHOQOL-OLD and its domain scores were significantly associated with nutritional risk and malnutrition. There were significant differences between the groups regarding all subdomain scores of the WHOQOL-OLD ($p < 0.001$). The rates of

Table 2. Questionnaires, anthropometric measurements and laboratory values of the study groups

	Overall (n=532)	Groups			p values
		Satisfactory nutritional status (n=390)	Nutritional risk (n=83)	Malnutrition (n=59)	
Questionnaires					
WHOQOL-OLD total score ^β	50.0 [22.0-94.0]	56.0 [29.0-94.0] ^a	36.0 [27.0-68.0] ^b	27.0 [22.0-41.0] ^c	<0.001
Sensory abilities ^β	9.0 [4.0-17.0]	10.0 [5.0-17.0] ^a	7.0 [4.0-13.0] ^b	5.0 [4.0-8.0] ^c	<0.001
Autonomy ^β	9.0 [3.0-17.0]	10.0 [3.0-17.0] ^a	6.0 [4.0-12.0] ^b	5.0 [3.0-6.0] ^c	<0.001
Past, present, and future activities ^β	8.0 [3.0-17.0]	9.0 [5.0-17.0] ^a	6.0 [4.0-12.0] ^b	5.0 [3.0-8.0] ^c	<0.001
Social participation ^β	8.0 [3.0-17.0]	9.0 [4.0-17.0] ^a	6.0 [4.0-13.0] ^b	4.0 [3.0-7.0] ^c	<0.001
Death and dying ^β	8.0 [3.0-16.0]	9.0 [4.0-16.0] ^a	5.0 [3.0-11.0] ^b	4.0 [3.0-7.0] ^c	<0.001
Intimacy ^β	8.0 [3.0-16.0]	9.0 [4.0-16.0] ^a	6.0 [4.0-13.0] ^b	4.0 [3.0-6.0] ^c	<0.001
Geriatric depression scale ^β	8.5 [0.0-21.0]	8.0 [0.0-20.0] ^a	9.0 [5.0-21.0] ^b	17.0 [6.0-20.0] ^c	<0.001
Depression [‡]	142 (26.7)	50 (12.8) ^a	36 (43.4) ^b	56 (94.9) ^c	<0.001
Mini Mental State Examination ^β	26.0 [5.0-29.0]	26.0 [6.0-29.0] ^a	25.0 [7.0-29.0] ^b	9.0 [5.0-27.0] ^c	<0.001
Dementia [‡]	102 (19.2)	24 (6.2) ^a	27 (32.5) ^b	51 (86.4) ^c	<0.001
Hendrich II fall risk model ^β	3.0 [2.0- 9.0]	3.0 [2.0- 4.0] ^a	8.0 [3.0- 11.0] ^b	10.0 [8.5- 11.0] ^c	<0.001
Fall risk [‡]	203 (38.2)	97 (24.9) ^a	50 (60.2) ^b	56 (94.9) ^c	<0.001
Anthropometric measurements					
Body mass index (kg/m ²) [†]	23.2±3.5	25.1±1.5 ^a	19.7±1.6 ^b	16.1±1.0 ^c	<0.001
Body mass index (kg/m ²) [‡]					
<18.5	67 (12.6)	0 (0.0) ^a	67 (47.2) ^b	0 (0.0) ^c	<0.001
18.5-24.9	247 (46.4)	174 (44.6) ^a	73 (51.4) ^b	174 (44.6) ^c	
≥ 25	218 (41.0)	216 (55.4) ^a	2 (1.4) ^b	216 (55.4) ^b	
Triceps skin fold thickness (mm) ^β	16.0 [7.0-26.0]	17.0 [9.0-26.0] ^a	13.0 [9.0-18.0] ^b	9.0 [7.0-16.4] ^c	<0.001
Calf circumference (cm) [†]	35.47±5.54	38.13±3.12 ^a	30.66±2.81 ^b	24.66±2.23 ^c	<0.001
Forearm circumference (cm) [†]	25.89±5.58	28.33±3.68 ^a	22.01±2.98 ^b	15.19±1.9 ^c	<0.001
Laboratory analyses^β					
Hemoglobin (g/dL)	13.1 [8.4-18.1]	13.8 [10.9-18.1] ^a	11.1 [8.4-17.2] ^b	10.2 [8.4-13.1] ^c	<0.001
Fasting blood glucose (mg/dL)	86.0 [48.0-268.0]	87.0 [71.0-268.0] ^a	82.0 [58.0-185.0] ^b	71.0 [48.0-245.0] ^c	<0.001
Creatinine (mg/dL)	0.8 [0.3-3.1]	0.8 [0.6-2.8] ^{a,b}	0.9 [0.4-2.9] ^a	0.7 [0.3-3.1] ^b	0.007
Albumin (mg/dL)	4.6 [3.1-5.4]	4.7 [3.5-5.4] ^a	3.7 [3.4-4.6] ^b	3.2 [3.1-3.6] ^c	<0.001
Total cholesterol (mg/dL)	185.0 [41.0-321.0]	196.0 [88.0-321.0] ^a	106.0 [78.0-263.0] ^b	85.0 [41.0-198.0] ^c	<0.001
LDL (mg/dL)	142.0 [32.0-247.0]	149.0 [89.0-247.0] ^a	99.0 [56.0-174.0] ^b	79.0 [32.0-146.0] ^c	<0.001
Triglyceride (mg/dL)	163.0 [41.0-326.0]	174.0 [59.0-326.0] ^a	101.0 [67.0-236.0] ^b	86.0 [41.0-168.0] ^c	<0.001
Ferritin	22.0 [1.8-124.0]	28.1 [6.8-124.0] ^a	8.4 [1.8-56.1] ^b	5.6 [1.9-17.0] ^c	<0.001
Folic acid	6.5 [1.6-10.1]	6.9 [3.9-10.1] ^a	3.7 [1.9-7.6] ^b	2.4 [1.6-6.1] ^c	<0.001
Vitamin D	15.6 [2.1-41.1]	17.0 [5.8-41.1] ^a	6.2 [2.8-21.3] ^b	3.7 [2.1-16.4] ^c	<0.001
Vitamin B12	248.5 [85.0-413.0]	258.0 [169.0-413.0] ^a	174.0 [94.0-325.0] ^b	136.0 [85.0-186.0] ^c	<0.001
HbA1C (%)	5.7 [4.1-13.2]	5.7 [4.9-11.3] ^a	5.2 [4.4-10.9] ^b	4.6 [4.1-13.2] ^c	<0.001
Glomerular filtration rate (ml/min)	69.0 [16.0-89.0]	74.0 [18.0-89.0] ^a	51.0 [18.0-78.0] ^b	45.0 [16.0-88.0] ^b	<0.001

[†]mean±standard deviation, [‡]n (%), ^βmedian (IQR), Each subscript letter denotes a subset of group categories whose column proportions do not differ significantly from each other at the 0.05 level.

depression, dementia, and fall risk were significantly higher in patients with nutritional risk and malnutrition (Table 2). We also detected significant differences between the groups in terms of the anthropometric measurements, including BMI, BMI category, triceps skinfold thickness, the calf and forearm circumferences, and laboratory parameters (Table 2).

There were significant correlations between the MNA score and total WHOQOL-OLD and subdomain scores (Table 3). Increased MNA scores (indicating a satisfactory nutritional status) were associated with increased scores in WHOQOL-OLD and its subdomain (indicating a higher quality of life). Besides, a positive correlation was found between the MNA and MMSE scores ($r=0.545$, $p<0.001$) while there were negative correlations between the MNA score and the GDS and HIFIRM scores ($r=-0.462$, $r<0.001$ and $r=-0.380$, $p<0.001$, respectively).

Univariate and multivariate logistic regression analyses of the variables for nutritional risk and malnutrition were given in Table 4. Most of the independent variables were

significantly associated with nutritional risk according to the univariate analysis (Table 4). Multivariate logistic regression analysis showed that total WHOQOL-OLD score (OR=1.40, CI 95%:1.30-1.52, $p<0.001$) and CCI score (OR=1.73, CI 95%:1.34-2.23, $p<0.001$) were the significant independent risk factors for the development of nutritional risk and malnutrition.

DISCUSSIONS

In the present study, we showed significant associations between malnutrition risk and quality of life. Besides, meaningful relationships between the MNA score and depression, cognitive impairment, and a higher fall risk were also detected in older adults. As one of the first studies focusing on evaluating the association between quality of life and nutritional risk in Turkish elderly patients, the overall prevalence of nutritional risk and malnutrition was relatively high. Nutritional status and quality of life in elderly patients were regarded as the indicators for each other.

Depending on the study groups' characteristics and the country of the study, reported prevalence of nutritional risk and malnutrition shows significant variation. The combined rates of nutritional risk and malnutrition (based on the MNA scores) range from 14.3% to 82.6% (1,4,5,7,19-22). Several factors have been speculated to explain these variations. Living in institutions with menus for three meals that may lack essential nutrients was regarded as an underlying factor (22). Extended family support was suggested as another factor; for example, living in crowded families prevents loneliness and social isolation (4). In our study, the combined malnutrition risk was the highest among the patients living in residential care centers and the lowest in

Table 3. Correlation of Mini Nutritional Risk Assessment with patient reported outcomes and WHOQOL-OLD score

	Mini nutritional assessment	
	r	P
Geriatric Depression Scale	-0.462	<0.001
Mini Mental State Examination	0.545	<0.001
Hendrich II fall risk model	-0.380	<0.001
WHOQOL-OLD total score	0.693	<0.001
Sensory abilities	0.673	<0.001
Autonomy	0.683	<0.001
Past, present, and future activities	0.654	<0.001
Social participation	0.666	<0.001
Death and dying	0.677	<0.001
Intimacy	0.641	<0.001

Table 4. Univariate and multivariate logistic regression analyses of the variables for the development of nutritional risk and malnutrition

	Univariate		Multivariate	
	Crude OR [95%CI]	crude p value	Adjusted OR [95%CI]	crude p value
Age	1.02 [0.98-1.05]	0.397	-	-
Sex: Female vs. male	1.06 [0.72-1.56]	0.764	-	-
Educational status: Ref. literate (primary+secondary-college+university) vs. illiterate	3.03 [1.98-4.64]	<0.001	0.68 [0.32-1.43]	0.308
Living status: Ref. relatives				
Alone	2.99 [1.90-4.73]	<0.001	0.58 [0.14-2.37]	0.447
Residential care center	0.15 [0.07-0.31]	<0.001	1.14 [0.38-3.42]	0.813
Marital status: Ref. married with single+divorced/widowed	6.37 [4.18-9.72]	<0.001	2.13 [0.53-8.49]	0.285
Smoking: Present vs. absent	1.35 [0.91-1.99]	0.134	-	-
Comorbidity: Present vs. absent	0.06 [0.01-0.24]	<0.001	2.15 [0.13-35.43]	0.592
Hypertension: Present vs. absent	0.31 [0.19-0.50]	<0.001	1.44 [0.62-3.37]	0.400
Charlson comorbidity score	0.56 [0.50-0.62]	<0.001	1.73 [1.34-2.23]	<0.001
WHOQOL-OLD total score	1.24 [1.19-1.29]	<0.001	1.40 [1.30-1.52]	<0.001
Depression: Present vs. absent	0.08 [0.05-0.13]	<0.001	1.17 [0.40-3.42]	0.770
Dementia: Present vs. absent	0.05 [0.03-0.09]	<0.001	0.53 [0.15-1.86]	0.322
Fall risk: Present vs. absent	0.11 [0.07-0.17]	<0.001	1.88 [0.76-4.61]	0.171

OR: odds ratio, CI: confidence interval

patients living with relatives. Evaluation of these factors in a homogenous manner may not help reach a definitive conclusion; therefore, the complexity of the problem may necessitate prospective large-scale studies.

The general health status of elderly patients is a critical variable that predicts the nutrition risk. Coexisting diseases and their related indexes such as the CCI and the use of multiple medications (polypharmacy) might be used as the indicators for this purpose (3, 7). Polypharmacy may have a negative impact on nutritional status due to drug-food interactions or gastrointestinal complaints (3,7). Our results were consistent with these studies. The presence of multiple comorbidities has been speculated as a significant risk factor for malnourishment in elderly patients (23). Although the relationship between comorbidities and malnutrition remains obscure, it has been thought that these comorbidities may have a negative impact on the nutritional status of the patients. In association with polypharmacy, comorbidities, as reflected by the CCI in the present study, may be regarded as indicators for developing malnutrition. Therefore, those who provide care for elderly patients are recommended to pay attention to the presence or absence of such factors because of their close association with malnutrition.

The educational, marital, and living status are thought to impact the nutritional quality of older adults significantly (1,7). Living alone or widowed older men are more vulnerable to nutritional risk because of difficulty buying and preparing food (1). In this study, we found that elderly illiterate, divorced, or widowed people living alone or in residential care centers were the riskiest group for malnutrition (4). The lower level of education was significantly associated with malnutrition (23). Sex discrepancy in nutrition is regarded as a complex and poorly understood issue (3). Some researchers reported that female sex is an independent risk factor for developing poor nutritional status, but we did not find any association between sex and nutrition (3,5,6). These controversial results might be affected by multiple unidentified confounders among the patients' demographic and clinical characteristics (4). Therefore, reciprocal associations of several demographic and clinical features should be considered while evaluating these findings.

The association between the presence or severity of depression and nutritional status was also investigated. There was a significant negative correlation between the GDS and MNA scores in the present study. In the BRIGHT trial, patients with more depressive symptoms were at moderate or high risk of malnutrition (3). In previous studies, nutritional disorders and malnutrition are regarded as modifiable risk factors for preventing

and progression of age-related cognitive impairment (24-26). It was also mentioned that there was a relationship between malnutrition and the severity of cognitive impairment and that good nutritional status is associated with normal cognition. In this study, we showed a significant positive correlation between the MMSE and MNA scores. Poor nutritional status has been speculated as a significant factor for falls, especially in elderly patients, based on community-based studies (27). As opposed to our findings, Adly et al. (27) demonstrated a significant association between malnutrition and fall risk assessment scores using various scales. In light of this evidence, we may conclude that poor nutritional status in the elderly may reflect many underlying problems, such as impaired motor function, psychological abnormalities, and cognitive and functional impairment. So, efforts should be made to improve nutritional status considering these outcomes, especially in the elderly.

The strongest associations between nutritional risk and the physical health and sensory abilities subdomains of the WHOQOL-OLD scale has been reported in previous studies (1,3,5). Physical health status may be regarded as a critical factor for routine daily activities such as eating and walking; however, close associations between the other domains are also possible (1). Sensory abilities such as sight, touch, smell, and taste may also impact both malnutrition and the quality of life. Our study showed that the total WHOQOL-OLD score and all subdomain scores were significantly correlated with the risk of malnutrition, as opposed to findings in other studies (3). Some studies have also reported similar findings (1). Using several scales for quality of life, other studies have shown that mental and physical components had a critical impact on nutritional status (7,19). Therefore, we may conclude that older adults' nutritional status may be directly related to all aspects of the quality of life, and the elderly individuals with nutritional risk are more likely to score lower on all or some domains of quality of life scales.

Considering the study's limitations, there may be controversial cause-and-effect relationships between the primary outcomes of the risk of malnutrition and the quality of life. Besides, the inclusion of only the patients admitted to the outpatient clinics was regarded as another limitation. Causality of the associated variables were lacked due to the cross-sectional design of the study. It is better to assess the likelihood of adverse causality and temporal relationships between quality of life, malnutrition risk, and other relevant variables. On the other hand, the present study had several important strengths, including the use of MMSE, GDS, and HIIFRM.

CONCLUSION

The prevalence of nutritional risk and malnutrition was high among elderly patients. The study also showed how various demographic and clinical factors were associated with malnutrition or nutritional risk. Nutritional risk and malnutrition were associated with the total WHOQOL-OLD score and the CCI score. Besides, there were significant correlations between all subdomains of the WHOQOL-OLD questionnaire and malnutrition. Having poor quality of life and higher comorbidities were the main determinants of malnutrition and nutritional risk in the multivariate analysis. The present findings contribute to the understanding of nutritional risk and its potential determinants. Results also underline the association between quality of life and nutritional status. These findings may help prevent nutritional risk and determine appropriate interventions, especially for the elderly population.

Clinical Implications

The combined prevalence of nutritional risk and malnutrition was 26.7% in the elderly patients.

There were significant correlations between all subdomains of the WHOQOL-OLD questionnaire and malnutrition and nutritional risk assessed with MNA.

Rates of depression, dementia, and fall risk were significantly higher in patients with nutritional risk and malnutrition.

Nutritional risk and malnutrition were significantly associated with the WHOQOL-OLD and CCI scores. Having poor quality of life and higher comorbidities were the main determinants of malnutrition and nutritional risk in the multivariate analysis.

ETHICAL DECLARATIONS

Ethics Committee Approval: The study was carried out with the permission of Erzurum Regional Training and Research Hospital Clinical Researchs Ethics Committee (Date: 06.01.2020, Decision No: 2020/01-06).

Informed Consent: All patients signed the free and informed consent form.

Referee Evaluation Process: Externally peer-reviewed.

Conflict of Interest Statement: The authors have no conflicts of interest to declare.

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Author Contributions: All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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