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Nutritional determinants of health-related quality of life in community-dwelling and institutionalized older adults: Nutritional assessment scores, dietary acid load, and anthropometric measurements

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ABSTRACT

Aim: This study aimed to investigate the relationship between nutritional parameters and health-related quality of life in institutionalized and community-dwelling older adults.

Methods: The Mini Nutritional Assessment (MNA) and Short Nutritional Assessment Questionnaire 65+ were used as nutritional assessment tools. The three-day dietary record was used to determine nutrient intakes and the data were analyzed in the Nutrition Information System, a food analysis software. Anthropometric measurements related to nutritional status were also recorded. The Short-Form-36 (SF-36) health-related quality of life scale was used to assess life quality.

Results: Correlation analysis showed that SF-36 physical component scores were negatively associated with body mass index (BMI) and SF-36 mental component scores were positively associated with MNA in community-dwelling older adults. In institutionalized older adults, both SF-36 scores were positively correlated with MNA and muscle mass. Furthermore, multiple linear regression analyses showed that both SF-36 scores were positively associated with MNA and negatively associated with BMI in all participants. However, dietary acid load was not significantly associated with SF-36 scores.

Conclusions: The MNA was almost the only nutritional parameter positively correlated with SF-36 physical and mental component scores. Therefore, it is thought that MNA, a nutritional assessment tool, can also be considered in assessing quality of life.

Keywords: care home, dietary acid load, nutritional status, older adult, quality of life

INTRODUCTION

Aging is a period of irreversible structural and functional changes that occur in all cells, tissues, and organisms with the passage of time [1]. There is no doubt that the world population is aging rapidly. The elderly population in the world has increased by 22.5% in the last five years. At the end of the year 2020, the proportion of the geriatric population (≥ 65 years) in the world was reported as 9.5% [2]. In addition, the projections indicate that the proportion of people over 60 years old will almost double between 2015 and 2050 from 12% to 22% [3].

Elderly health is generally affected by social, cultural, economic, and environmental factors. In addition to progressive biological changes, factors such as polypharmacy, oral and dental health problems, economic issues, loneliness, and difficulties accessing health and social services make older adults more vulnerable to diseases [4]. The aging process reflects the interaction between these factors and progressive biological changes. Physiological and social disadvantages predispose older adults to malnutrition. Malnutrition can be simply defined as any nutritional imbalance and usually manifests itself when nutrient intake is less than the requirement. As a result of this imbalance, body weight, body composition, and physical functions are affected [5].

Moreover, the “anorexia of aging” is a term used to describe age-related changes that occur as adults get older, leading to decreased energy intake and increased likelihood of malnutrition [6]. The appetite may decrease due to many diseases, medication, surgery, and other treatment processes [7]. Loss of appetite affects the food consumption of older adults, resulting in a significant decline in dietary energy and nutrient intake [8]. Due to loss of appetite and the associated altered feelings of hunger and satiety, body weight cannot be stabilized [9]. Weight loss and malnutrition may lead to reduced mobility, development of sarcopenia, and thus decreased quality of life [10]. On the other hand, the loss of functional capacity may result in immobility, and thus difficulties in daily living activities such as shopping, cooking, and eating may impair nutritional status. Therefore, poor quality of life and malnutrition are two closely interacting health elements [11].

Alkaline/acid balance of a diet is another nutritional parameter that is as important as the adequacy of dietary energy and nutrients in the fight against malnutrition. High dietary acid load has been reported to be associated with several health conditions that directly affect quality of life, including insulin resistance, sarcopenia, fractures, hypertension, and chronic kidney disease [12, 13].

The quality of life of community-dwelling and institutionalized older adults has been compared in few studies [14-16]. However, it is difficult to state that there are many studies in the literature on nutritional determinants of quality of life in different healthcare settings. Therefore, this study aimed to investigate the association between nutritional parameters and health-related quality of life in institutionalized and non-institutionalized older adults. The study is particularly noteworthy in terms of assessing the relationship between dietary acid load and health-related quality of life in older adults.

METHODOLOGY

Study Procedure and Sampling

This descriptive and cross-sectional study was conducted on community-dwelling and institutionalized individuals over 65 years old. The participants were older adults living in their own homes in the center of Balıkesir Province or residing in Balıkesir Nursing Home-Elderly Care and Rehabilitation Center. Individuals with health problems or severe diseases that would make data collection difficult were excluded from the study. These health conditions included neurodegenerative diseases (dementia, stroke, etc.), chronic renal failure (receiving hemodialysis and/or continuous ambulatory peritoneal dialysis), end-stage renal disease, history of cancer, hyperparathyroidism, liver diseases (cirrhosis, liver failure, etc.), and receiving hormone therapy. In addition, body composition analysis procedures in accordance with the method were taken into consideration [17]. For this reason, older adults who ate or drank in the last 4 hours, who engaged in heavy physical activity in the last 48 hours, and who drank alcohol in the last 24 hours were not included in the study. Besides, individuals who drank water just before the measurements and who had a pacemaker were excluded.

There were 66 older adults who met the inclusion criteria in the nursing home. Therefore, it was aimed at including all 66 older adults in the study. Clear explanations were provided for participants about the aim of the study. However, 53 older adults signed a voluntary participation form in accordance with the Declaration of Helsinki protocols (World Medical Association). On the other hand, we took care to ensure that the number of community-dwelling older adults was close to the number of nursing home residents included in the study. Therefore, using the simple random sampling method, 98 community-dwelling older adults who were from different regions of Balıkesir City Center were visited. There were 72 community-dwelling older adults who met the inclusion criteria, and finally 57 participants who signed the voluntary participation form in accordance with the Declaration of Helsinki protocols were informed in detail about the aim of study (**Figure 1**).

The descriptive features of the participants were recorded by a general questionnaire. The nutritional assessment tools (Mini Nutritional Assessment [MNA] and Short Nutritional Assessment Questionnaire 65+ [SNAQ65+]) and a three-day dietary record were applied with face-to-face interview. The anthropometric measurements were taken by well-trained researchers. Besides, the Short-Form-36 (SF-36) health-related life quality scale was used to assess quality of life.

Ethical Issues

This study was approved by the Ethics Committee at Gazi University on 23 October 2015 with approval number 124102.

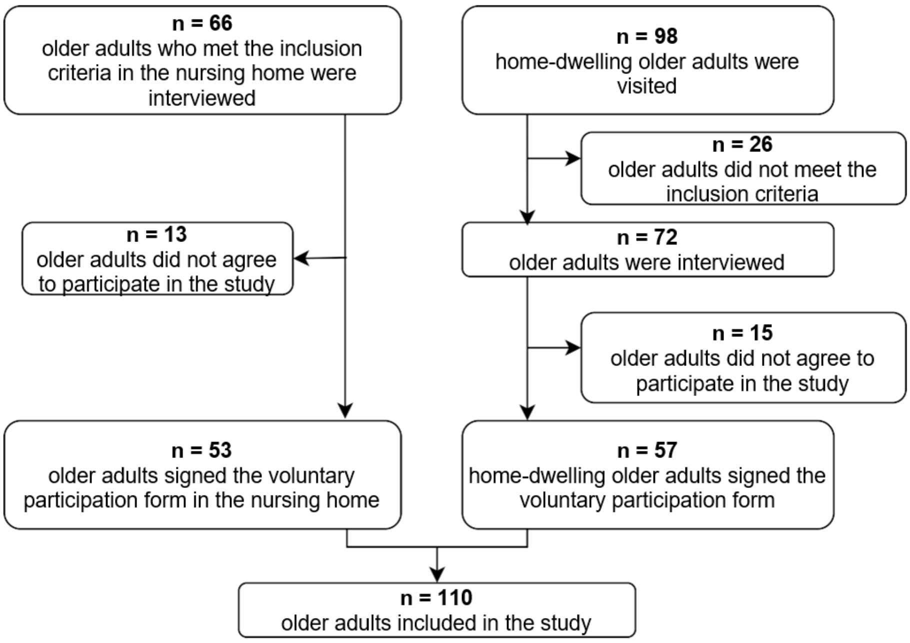

Figure 1. Flow of participants during the study (Source: Authors' own elaboration)

In addition, research permission was provided by the Ministry of Family and Social Policies of the Republic of Turkey on 25 January 2016 with permission number 73595336-605.01-18650. Written informed consents were obtained from the participants.

Measures

Nutritional parameters

Dietary intake: Daily energy and nutrient intakes were determined using three consecutive days of dietary records (two weekdays and one weekend day). A photographic food and meal atlas "food and nutrition photo catalogue" was used to determine portion sizes [18]. The data obtained were analyzed using the Nutrition Information System (BeBiS) [19], a food analysis software, and the daily dietary intake of protein, phosphorus, potassium, magnesium, and calcium of each participant was determined.

Dietary acid load: For the assessment of the dietary acid load, the potential renal acid load (PRAL) and net endogenous acid production (NEAP) equations based on dietary protein, phosphorus, potassium, magnesium, and calcium were used [20].

$$Estimated\ PRAL\ \left(\frac{mEq}{day}\right) = \left(Protein\left[\frac{g}{day}\right] \times 0.49\right) + \left(Phosphorus\ \left[\frac{mg}{day}\right] \times 0.037\right) - \left(Potassium\ \left[\frac{mg}{day}\right] \times 0.021\right) - \left(Magnesium\ \left[\frac{mg}{day}\right] \times 0.026\right) - \left(Calsium\ \left[\frac{mg}{day}\right] \times 0.013\right). \quad (1)$$

$$Estimated\ NEAP\ \left(\frac{mEq}{day}\right) = \frac{\left(Protein\left[\frac{g}{day}\right] \times 54.5\right)}{\left(Potassium\left[\frac{mEq}{day}\right]\right)} - 10.2. \quad (2)$$

Nutritional assessment

MNA: The MNA consists of two parts (screening and assessment) and includes 18 items on anthropometric (body mass index [BMI], upper middle arm and calf circumference), global (e.g., living independently, medications, dementia), dietary (e.g., full meal consumption, protein, fruit-vegetable, and fluid intake), and self-assessment (e.g., self-view of nutritional status and mode of feeding) [8, 21]. The first six items and the following 12 items are the screening and assessment sections, respectively; besides, the sum of the screening and assessment scores is calculated as the full MNA evaluation score. The MNA has been designed and validated to provide a fast and practical assessment of nutritional status in community-dwelling and institutionalized older adults [22]. It was also declared as the preferential assessment tool for the assessment of nutritional status of care home residents by a working group within the national food and health plan in Belgium [23]. The maximum full MNA score is "30" and a score less than "24" classifies subjects as "at risk of malnutrition" [22].

SNAQ65+: The study in [24] reported that there was no quick and easy-to-apply nutritional assessment tool for community-dwelling older adults. To this end, they developed SNAQ65+ to assess the nutritional status of older people. The criteria were developed using 15-year mortality data in community-dwelling older adults and validated in an independent sample. The SNAQ65+ consists of four stages and in the first stage, unintentionally weight loss in the last 6 months is questioned. If the weight loss is 4 kg or more, the subject is classified as "undernourished". On the other hand, if the weight loss is less than 4 kg, the subject goes to the second stage, in which the mid-upper arm circumference (MUAC) is measured. If the MUAC is less than 25 cm, the subject is classified as "undernourished". However, if the MUAC is 25 cm or more, the subject goes to the third stage. At this stage, it is questioned whether there was a poor appetite experience in the previous week. If there was no appetite loss, the subject is classified as "nutritionally normal". On the other hand, if there was a poor appetite experience, the subject goes to the fourth stage. It is questioned whether the subject is able to walk up and down a staircase of 15 steps without resting at this stage. If the subject is not using stair steps in daily life, one of the following questions is asked: "Are you able to walk outside for 5 minutes without resting?" or "Are you able to move your wheelchair for 5 minutes without resting?". If the answer is "yes", the subject is classified as "nutritionally normal"; otherwise he/she is classified as "nutritionally at risk" (**Figure 2**).

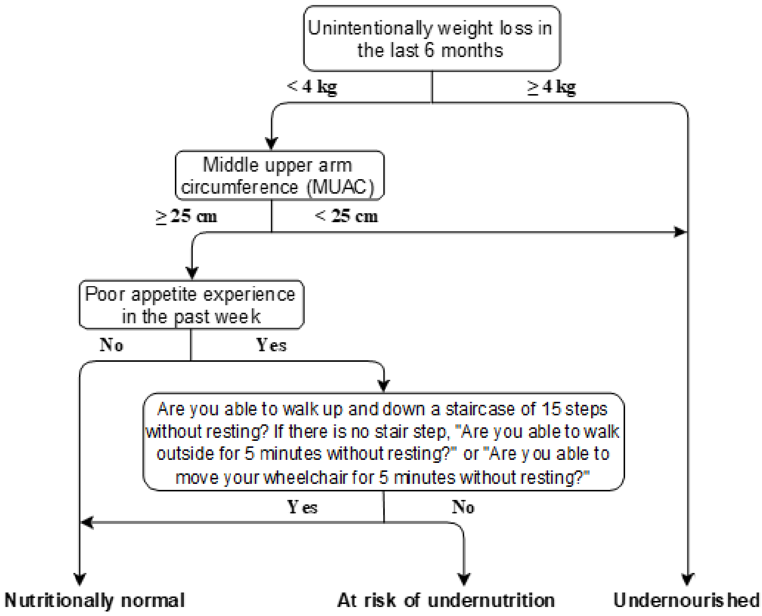

Figure 2. SNAQ65+ (Source: Authors' own elaboration)

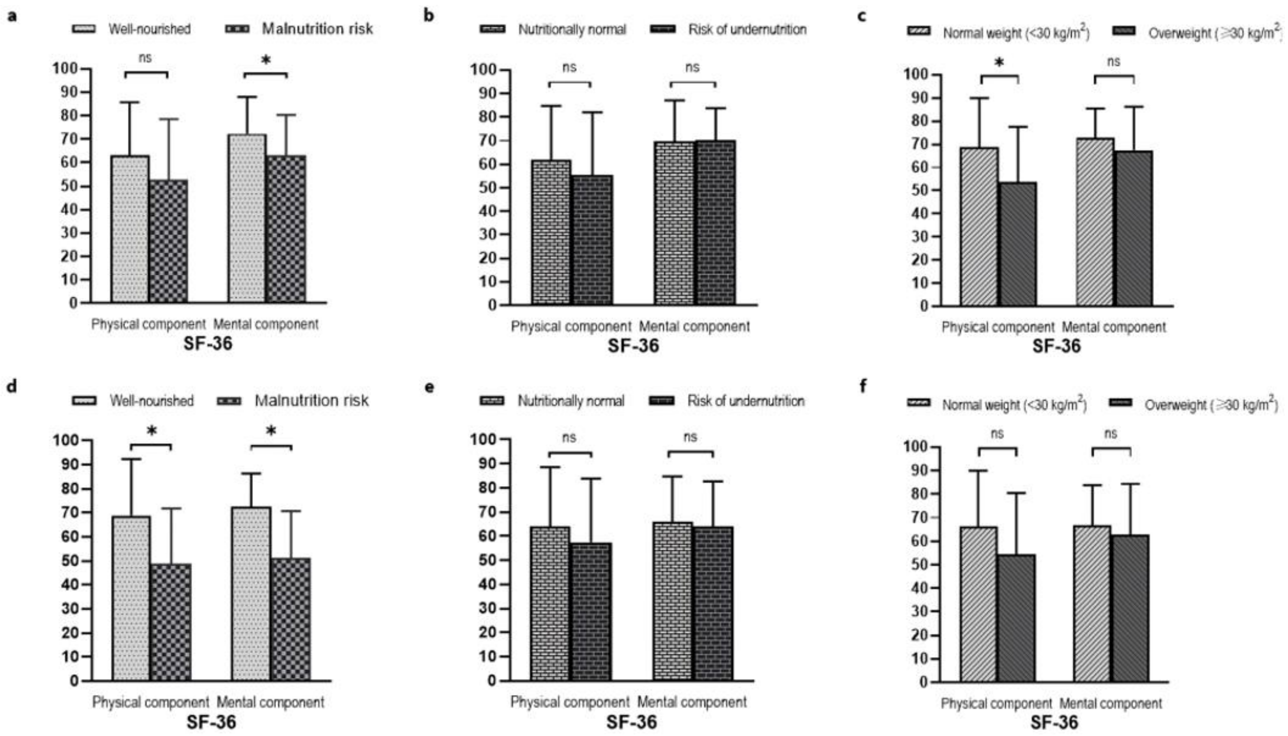

Figure 3. SF-36 summary scale scores according to MNA, SNAQ 65+, and BMI outcomes in community-dwelling and institutionalized older adults: (a) SF-36 physical and mental component scores according to MNA groups in community-dwelling older adults, (b) SF-36 physical and mental component scores according to SNAQ65+ groups in community-dwelling older adults, (c) SF-36 physical and mental component scores according to BMI groups in community-dwelling older adults, (d) SF-36 physical and mental component scores according to MNA groups in institutionalized older adults, (e) SF-36 physical and mental component scores according to SNAQ65+ groups in institutionalized older adults, (f) SF-36 physical and mental component scores according to BMI groups in institutionalized older adults (*p < 0.05, ns: p > 0.05) (Source: Authors' own elaboration, using SPSS program)

Anthropometric measurements: All anthropometric measurements were performed in accordance with the methods. The height was measured with the head position in Frankfort horizontal plane using a portable stadiometer with 0.1 cm. Body weight was measured in thin clothes using a calibrated bioelectrical impedance analyzer (Tanita BC 730, Tanita Corp., Tokyo, Japan), to the closest 0.1 kg [25]. The BMI value was calculated by dividing body weight by height squared (kg/m^2), and the BMI classification accepted by the WHO was considered [26]. The bioelectrical impedance analyzer was also used to analyze body composition. It obtains impedance measurement by penetrating a small alternating current of 800 µA with an impedance of 50 kHz. As already mentioned, the body composition analysis procedures were considered [17]. Care was taken to perform the analysis barefoot and in thin clothes. In addition, MUAC and calf circumference were measured for nutritional assessment scores (MNA and SNAQ65+). For MUAC, the midpoint between olecranon and acromion was marked when the elbow was flexed at a 90° angle. The arms were released and the circumference measurement was taken from individual's non-dominant arm in standing posture [27]. For calf circumference, the knee was flexed at a 90° angle while the sole of the foot was on a flat platform. A non-elastic tape with 0.1 cm was moved up and down along the calf and the maximum measurement value was recorded [28].

Quality of life

The SF-36 is one of the most commonly used scales for the assessment of health-related quality of life. It is not specific to any age or disease group and includes general health concepts. It consists of 36 items, most of which are 5- or 6-point Likert-type. The scale gives eight sub-scores and two summary scores. The average of the four sub-scores (physical functioning, physical role limitations, bodily pain, and general health perception) refers to the "physical health summary scale score". On the other hand, the average of the remaining sub-scores (social functioning, emotional role limitations, vitality, and general mental health) refers to the "mental health summary scale score". Each sub-score and summary score is assessed on a scale of 0 to 100 points [29].

Statistical Analysis

SPSS version 21.0 (SPSS Inc., Chicago, IL, USA) was used for statistical evaluation of the data. Descriptive characteristics were expressed as "n (%)". Normality and homogeneity were evaluated using Kolmogorov-Smirnov and Levene's tests, respectively. Mann-Whitney U test was used to evaluate some nutritional parameters and SF-36 summary scale scores according to place of residence (home/nursing home).

Similarly, in **Figure 3**, Mann-Whitney U test was used to evaluate the statistical difference between the groups in terms of the SF-36 summary scale scores. In addition, the presence of malnutrition/undernutrition risk, being overweight/obese, and PRAL positivity according to the place of residence were evaluated by Pearson's Chi-square test. Spearman's rho correlation was used to evaluate the relationship between the SF-36 summary scale scores and nutritional parameters. Finally, multiple linear regression analysis was used to predict the SF-36 summary scale scores by nutritional parameters. A "*P* < 0.05" level was chosen as statistical significance.

Table 1. General characteristics of participants (n = 110)

Characteristics		n (%)
Gender	Male	49 (44.5)
	Female	61 (55.5)
Marital status	Married	92 (83.6)
	Single	18 (16.4)
Residence	Home	57 (51.8)
	Nursing home	53 (48.2)
Education	Non-literate	21 (19.1)
	Literate	15 (13.6)
	Primary school	60 (54.6)
	Middle school and over	14 (12.7)
Diagnosed disease	Yes	96 (87.3)
	No	14 (12.7)
Care	Having a caregiver	14 (12.7)
	Self-care	96 (87.3)

RESULTS

The general characteristics of the participants are given in **Table 1**. The mean age was 75.0 ± 6.6 years (not shown in **Table 1**) and the majority of the participants were women (55.5%). The percentage of participants with at least one diagnosed chronic disease was 87.3%. In addition, 12.7% of the participants were receiving formal or informal care.

Figure 3 shows the SF-36 physical and mental component scores according to the outcomes of MNA, SNAQ65+, and BMI in community-dwelling and institutionalized older adults. Both SF-36 summary scale scores were significantly higher in well-nourished participants than in participants at risk of malnutrition according to the MNA in institutionalized older adults ($p < 0.05$). On the other hand, only the mental component scores of well-nourished participants were significantly higher than those of participants at risk of malnutrition according to the MNA in community-dwelling older adults ($p < 0.05$). Besides, there was no statistically significant difference in SF-36 summary scale scores between nutritionally normal participants and participants at risk of undernutrition according to the SNAQ65+ ($p > 0.05$). Finally, participants with normal BMI values (< 30 kg/m^2) had higher SF-36 physical component scores than participants who were overweight (≥ 30 kg/m^2) in community-dwelling older adults ($p < 0.05$).

The mean MNA, BMI, muscle mass, PRAL, NEAP, and SF-36 summary scale scores of community-dwelling and institutionalized older adults were given in **Table 2**. While the BMI values of community-dwelling older adults were significantly higher than those of institutionalized older adults ($p < 0.05$), the muscle mass, PRAL, and NEAP values were significantly lower ($p > 0.05$).

In addition, 56.1% of community-dwelling older adults were overweight/obese according to the BMI, while this percentage was 34.0% in institutionalized participants ($p < 0.05$). The percentage of PRAL negativity was 49.1% in community-dwelling older adults, while no negative PRAL value was found in institutionalized older adults ($p < 0.05$).

Table 3 shows the relationship between the SF-36 summary scale scores and nutritional parameters. BMI was negatively associated with SF-36 physical component scores in community-dwelling older adults ($r = -0.412$, $p = 0.001$). Meanwhile, MNA scores were positively associated with SF-36 mental component scores ($r = 0.377$, $p = 0.004$). On the other hand, in institutionalized older adults, the nutritional parameters correlated with both SF-36 summary scale scores were MNA score ($r = 0.502$, $p < 0.001$ for physical component; $r = 0.590$, $p < 0.001$ for mental component) and muscle mass ($r = 0.377$, $p = 0.006$ for physical component; $r = 0.425$, $p = 0.002$ for mental component).

Table 4 shows the multiple linear regression analysis of variables that may be associated with SF-36 physical component scores. MNA, SNAQ65+, BMI, muscle mass, PRAL, NEAP, and place of residence were selected as explanatory variables. These seven variables explained 35.7% of the variation in the SF-36 physical component score. Higher MNA score and muscle mass were found to be associated with higher physical component score ($B = 2.583$, $p < 0.001$ for MNA and $B = 0.715$, $p = 0.022$ for muscle mass), while higher BMI was associated with lower physical component score ($B = -1.793$, $p < 0.001$).

Table 2. The nutritional characteristics and SF-36 summary scale scores of community-dwelling and institutionalized older adults

Characteristics	Community-dwelling older adults	Institutionalized older adults	Test value*	p-value
	Mean ± Standard deviation	Mean ± Standard deviation		
MNA	24.8 ± 3.0	24.1 ± 3.7	Z = -0.756	0.450
BMI (kg/m^2)	31.0 ± 7.2	27.7 ± 5.5	Z = -2.381	0.017
Muscle mass (kg)	44.5 ± 7.8	47.4 ± 7.2	Z = -2.327	0.020
PRAL (mEq/d)	-0.36 ± 12.8	17.2 ± 8.4	Z = -6.912	< 0.001
NEAP (mEq/d)	45.9 ± 20.3	61.9 ± 9.6	Z = -5.411	< 0.001
SF-36 physical component	60.1 ± 23.9	62.1 ± 24.9	Z = -0.380	0.704
SF-36 mental component	69.7 ± 16.5	65.3 ± 18.6	Z = -1.615	0.106
	n (%)	**n (%)**	**Test value****	**p-value**
MNA				
Malnutrition risk (< 24 points)	16 (28.1)	18 (34.0)	$\chi^2 = 0.446$	0.504
Well-nourished (24 to 30 points)	41 (71.9)	35 (66.0)		
SNAQ 65+				
Risk of undernutrition	15 (26.3)	16 (30.2)	$\chi^2 = 0.204$	0.652
Nutritionally normal	42 (73.7)	37 (69.8)		
BMI				
Normal (< 30 kg/m^2)	25 (43.9)	35 (66.0)	$\chi^2 = 5.448$	0.020
Overweight/obese (≥ 30 kg/m^2)	32 (56.1)	18 (34.0)		
PRAL				
Negative PRAL	28 (49.1)	-	$\chi^2 = 34.925$	< 0.001
Positive PRAL	29 (50.9)	53 (100)		

Note. *Mann-Whitney U test & **Pearson's Chi-square test and Fischer's exact test

Table 3. Correlation between the nutritional parameters and SF-36 summary scale scores

	SF-36 physical component		SF-36 mental component	
	r*	p	r*	p
Community-dwelling older adults				
MNA	0.230	0.085	0.377	0.004
BMI	-0.412	0.001	-0.114	0.400
Muscle mass	0.109	0.418	0.261	0.051
PRAL	0.163	0.225	0.052	0.700
NEAP	0.133	0.326	-0.017	0.900
Institutionalized older adults				
MNA	0.502	< 0.001	0.590	< 0.001
BMI	-0.122	0.385	0.018	0.898
Muscle mass	0.377	0.006	0.425	0.002
PRAL	-0.006	0.964	-0.106	0.450
NEAP	-0.128	0.362	-0.185	0.185

Note. *Spearman's rho correlation

Table 4. Multiple linear regression analysis of the variables that can affect the SF-36 physical component scores

SF-36 physical component	B	SEM	β	t	p-value
MNA	2.583	0.653	0.352	3.955	**< 0.001**
SNAQ 65+[a]	2.752	4.455	0.051	0.618	0.538
BMI	-1.793	0.335	-0.489	-5.360	**< 0.001**
Muscle mass	0.715	0.308	0.226	2.320	**0.022**
PRAL	0.560	0.364	0.323	1.537	0.127
NEAP	-0.285	0.246	-0.211	-1.158	0.250
Residence[b]	8.500	5.241	0.177	1.622	0.108

Note. R^2: 0.357; [a]SNAQ 65+: 0 risk of undernutrition, 1 not under nutrition; [b]Residence: 0 care home, 1 home; & SEM: Standard error of mean

Table 5. Multiple linear regression analysis of the variables that can affect the SF-36 mental component scores

SF-36 mental component	B	SEM	β	t	p-value
MNA	2.362	0.477	0.447	4.952	**< 0.001**
SNAQ 65+[a]	-2.179	3.254	-0.056	-0.670	0.505
BMI	-0.750	0.244	-0.284	-3.068	**0.003**
Muscle mass	0.445	0.225	0.195	1.978	0.051
PRAL	0.461	0.266	0.368	1.730	0.087
NEAP	-0.312	0.179	-0.321	-1.739	0.085
Residence[b]	9.209	3.828	0.266	2.406	**0.018**

Note. R^2: 0.340; [a]SNAQ 65+: 0 risk of undernutrition, 1 not under nutrition; [b]Residence: 0 care home, 1 home; & SEM: Standard error of mean

The same explanatory variables were selected for multiple linear regression analysis aiming to identify the determinants of SF-36 mental component scores (**Table 5**). These variables explained 34.0% of the variation in SF-36 mental component scores. Higher MNA score was associated with higher SF-36 mental component score (B = 2.362, p < 0.001). On the other hand, lower BMI was associated with higher SF-36 mental component score (B = -0.750, p = 0.003). In addition, living at home was associated with a higher SF-36 mental component score than living in a care home (B = 9.209, p = 0.018).

DISCUSSION

Improving the quality of life institutionalized and community-dwelling older adults may lead to substantial savings in health expenditures. It was reported that malnutrition in community-dwelling and institutionalized older adults decreased the quality of life, increased the care burden, and thus imposes a significant burden on health expenditures [30]. We anticipate that improvement in nutritional status may result in improved quality of life. Therefore, we find it worthwhile to examine the nutritional determinants of health-related quality of life in older adults.

In the present study, we have found that the prevalence of malnutrition risk as 34.0% in nursing home residents and 28.1% in community-dwelling older adults according to the MNA scores. Also, these percentages were 30.2% in nursing home residents and 26.3% in community-dwelling older adults according to the SNAQ65+. As can be seen, the prevalence of malnutrition was quite similar in both groups. However, BMI values of community-dwelling older adults were significantly higher than those of nursing home residents. Contrary to our findings, in a study conducted with older adults aged ≥ 70 years old in China, there was no statistically significant difference between nursing home residents and community-dwelling participants in terms of BMI values [31]. The reason for this difference in the present study may be that institutionalized older adults do not have difficulty in accessing different foods and regularly consume adequate and balanced meals. However, the statistically significant difference in terms BMI was not effective enough to make a significant difference in SF-36 summary scale scores. The study in [15], which found similar results, reported that there was no statistically significant difference between community-dwelling and institutionalized older adults in terms of all aspects of quality of life. The older adults who had severe health conditions were excluded from the present study. Therefore, it is thought that the participants in both groups may have similar health-related quality of life levels.

There were also significant differences between the two groups in terms of PRAL and NEAP values. It was particularly striking that all institutionalized older adults had positive PRAL value. The significant difference in favor of institutionalized older adults in terms of dietary protein intake is sufficiently explanatory for this finding. We think that even if adequate and balanced menus in terms of energy and nutrients are planned by care home nutritionists, the older adults may prefer protein-rich foods and meals and consume less fruits and vegetables.

Both the significant correlation values in **Table 3** and the significant difference between the groups in **Figure 3** suggest that SF-36 mental component scores are sensitive to MNA and SF-36 physical component scores are sensitive to BMI in community-dwelling older adults. On the other hand, MNA scores had strong positive correlations with both SF-36 physical and mental component scores in institutionalized older adults. In a study conducted with home-dwelling older adults, MNA scores were found to be positively correlated with SF-36 summary scale scores and it was also reported that well-nourished older adults had significantly higher SF-36 summary scale scores than older adults at risk of malnutrition. In the same study, BMI values were found to be negatively correlated with SF-36 mental component scores [8]. The study in [32] reported that SF-36 sub-scores were positively associated with MNA scores in Vietnamese rural older adults. The study in [33] found a significant positive correlation between health-related quality of life measured by the 15D and MNA scores in home-dwelling older adults aged ≥ 75 years. In a study conducted on a large sample of community-dwelling older adults in Greece, MNA scores of participants with high health-related quality of life were significantly greater than those of participants with low health-related quality of life [34]. The study in [35] specified that life quality was positively associated with MNA scores and negatively associated with BMI values in non-institutionalized older adults. The study in [36] also reported that there were statistically significant differences between two MNA groups (MNA ≥ 24 and MNA < 24) in terms of overall scores and all specific domains scores (physical, psychological, social and environmental) of life quality scale in institutionalized older adults. The study in [37] reported that health-related quality of life was negatively associated with being malnourished (according to MNA) in a large sample of Brazilian institutionalized older adults. In another study conducted with community-dwelling older adults, the mean SF-36 summary scale scores were reported to be significantly different between MNA groups. The life quality scores of nutritionally compromised individuals were significantly lower than those of well-nourished individuals. Moreover, similar to our results, SF-36 summary scale scores had a high positive correlation with the MNA scores [38]. Based on the findings of this study and the literature review, we can state that MNA scores are strongly associated with life quality indicators in both community-dwelling and institutionalized older adults.

Another nutritional parameter associated with the SF-36 health-related quality of life scale scores was muscle mass. Muscle mass was found to be positively correlated with both physical and mental component scores, especially in institutionalized older adults (**Table 3**). Similar to the results of the present study, It was reported that as after a 12-week systematic strength training program in elderly men, the physical and mental component scores of the health-related quality of life scale increased in parallel with increasing muscle mass [39]. The study in [40] also found that older adults with poor quality of life had lower muscle mass. Even though high protein intake has possible negative consequences such as high dietary acid load, its contribution to increased lean body mass may positively affect quality of life parameters.

Multiple linear regression analysis showed that SF-36 summary scale scores were positively associated with MNA scores and negatively associated with BMI values (**Table 4** and **Table 5**). Similar to the present findings, higher MNA/MNA-SF scores and lower BMI values were found to be associated with higher SF-36 summary scale scores in studies conducted with home care patients and home-dwelling older persons [8, 11]. SF-36 mental component scores were found to be associated with place of residence as well as MNA and BMI. Living at home was associated with higher mental component scores. Institutional care may be advantageous in terms of professional health care. However, the higher SF-36 mental component scores in older adults, most of whom lived with their families, points to the relationship between “living with family” and “mental well-being”. Individuals with poor mental status may prefer institutional care or living with family may be beneficial for mental health. The question of whether mental health is a cause or effect is important and needs further study.

It has been stated that higher dietary acid load may be associated with insulin resistance, hypertension, and chronic kidney disease [12, 13]. In addition, the studies conducted in different populations have reported that higher dietary acid load is associated with lower bone mineral density, higher serum triglyceride levels, and the risk of metabolic syndrome [41-43]. It is obvious that these health conditions can directly affect quality of life. One of the hypotheses of this study was that dietary acid load would indirectly affect life quality parameters. However, both correlation and regression analyses showed that PRAL and NEAP values were not associated with SF-36 summary scale scores. On the other hand, in the present study, the PRAL positivity of institutionalized older adults was significantly higher than that of community-dwelling older adults. It is thought that this may be due to the difference in dietary protein intake. Mean daily dietary protein intake was 41.9 ± 22.1 g/day in community-dwelling older adults and 85.9 ± 16.7 g/day in institutionalized older adults ($p < 0.05$; not reported in the results). The most important factor for this situation is undoubtedly the more professional nutritional services provided in care homes and the making of nutritional plans considering the adequacy of energy and nutrients.

The multiple linear regression models showed that the SNAQ65+ was not significantly associated with SF-36 summary scale scores (**Table 4** and **Table 5**). Although the SNAQ65+ is advantageous in terms of ease of use and practicality compared to the MNA, it does not query some important factors associated with undernutrition such as neuropsychological problems, polypharmacy, dietary intake, and self-assessment. Therefore, it is possible to suggest that the MNA is a very strong nutritional assessment tool compared to the SNAQ65+ in predicting health-related quality of life in older adults.

CONCLUSION

The association between nutritional status and quality of life were examined with different statistical models. Anthropometric parameters such as BMI and muscle mass were significantly associated with different components of the SF-36 quality of life scale in older adults. However, the association between the dietary acid load and health-related quality of life should be investigated in studies with larger samples. Finally, MNA was found to have a positive relationship with quality-of-life parameters. All these findings suggest that periodic nutritional screening of older adults is critical. Periodic nutritional screening of institutionalized older adults by the nursing home health care team is quite important. Community-dwelling older adults should also be periodically screened for nutritional status within the scope of home health services. As part of this screening, retrospective dietary records and anthropometric measurements should be obtained and nutritional status should be evaluated using a comprehensive screening tool such as MNA. We believe that nutritional screening and nutritional interventions accordingly are important for preventing malnutrition-related comorbidity and improving quality of life.

Study Limitations

For the participation of institutionalized older adults, study permission was obtained from a single center. Private nursing homes did not give permission for the study. Older adults with chronic diseases were not included in the study. In addition, older adults not eligible for body composition analysis procedures or those with pacemakers were also excluded from the study. All these issues limited the study to be conducted on a large sample. Lastly, some participants had difficulties in keeping a three-day dietary record. Therefore, support for dietary recording was obtained from family members with whom the participants were living or caregivers.

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Data sharing statement: Data supporting the findings and conclusions are available upon request from the corresponding author.

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