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Validity of simplified nutritional appetite questionnaire for Turkish community-dwelling elderly and determining cut-off according to mini nutritional assessment

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ABSTRACT

Background/Objectives: The aim of this study was to determine a cut-off value for the SNAQ according to both the MNA long and MNA short forms and to assess whether the SNAQ can predict malnutrition or risk of malnutrition in the elderly.

Subjects/Methods: Nutritional status was assessed both by the Mini Nutritional Assessment (MNA) long and short forms. All demographic characteristics, mental status, depressive mood, functional status, and frailty were determined. Receiver operating characteristic (ROC) curves were used to calculate the cut-off of the SNAQ according to both the MNA long and short forms for malnutrition or risk of malnutrition. Reliability and validation of the SNAQ was analysed.

Results: We included 905 community-dwelling elderly, but those with middle-stage dementia (MMSE score < 18, $n = 30$) were excluded. The mean age $\pm$ standard deviation (SD) was 71.4 $\pm$ 5.5 years (49.3% female and 50.7% male). The prevalence of well-nourished, risk of malnutrition or malnutrition were 55.2%, 44.8%, respectively according to the MNA-long form. The prevalence of elderly at risk of future weight loss (SNAQ score of ≤ 14) was 31.0% ($n = 268$; 66.0% female, 34.0% male). The area under the curve (AUC) for SNAQ was 0.725 (95% CI 0.690–0.760). The cut-off value of the SNAQ, according to both the MNA long and short forms, was 14 (sensitivity; 50%, 50% and specificity; 84%, 82%, respectively). The Cronbach's alpha reliability coefficient of SNAQ for internal consistency was 0.639.

Conclusion: The SNAQ was reliable and valid as an appetite screening tool in community-dwelling Turkish elderly.

1. Introduction

Evaluation of nutrition is one of the cornerstones of geriatric assessment. Malnutrition is a prevalent geriatric syndrome seen in elderly living in various settings; community-dwelling, nursing home, and hospitalized (Watterson et al., 2009). It is well-known that malnutrition leads to decline in both mental and physical functions, which may lead to early setting in nursing homes and increased mortality (Ahmed & Haboubi, 2010).

Prevention and treatment of malnutrition depends on early detection. There are various screening tools which have been developed for screening of malnutrition and the risk of malnutrition (Phillips, Foley, Barnard, Isenring, & Miller, 2010). The Mini Nutritional Assessment (MNA) is the most commonly used screening tool, which has been validated for Turkish people (Guigoz, Lauque, & Vellas, 2002; Sarikaya et al., 2015; Vellas et al., 2006a). Its sensitivity and specificity for malnutrition is high. It is also useful for the prediction of both morbidity and mortality (Wang & Tsai, 2013). Its predictive value in elderly malnutrition is well known but its use is not prevalent in clinical practice (Rubenstein, Harker, Salva, Guigoz, & Vellas, 2001). Needing a long time to complete may be its major obstacle and may not be practical in busy clinic settings. In addition to taking approximately

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15 min for interview items, performing anthropometric measurements elongates the procedure. Rubenstein et al. developed a six question MNA short form by identifying a subset of questions from the full MNA that has high sensitivity, specificity, and correlates with the full MNA. The MNA short form identifies elderly individuals as well-nourished or at risk of malnutrition (Rubenstein et al., 2001). The Simplified Nutritional Appetite Questionnaire (SNAQ) is validated for both community-dwelling elderly and long term care elderly residents. This is an easy tool, predicts future weight loss, and can be administered in a relatively short time (Wilson et al., 2005). However, the SNAQ has not been designed for clinical use in elderly for assessment of malnutrition.

The first aim of this study was to determine a cut-off value for the SNAQ according to both the MNA long form and the MNA short form for prediction of risk of malnutrion or malnutrition in order to study validity end reliability of the SNAQ for Turkish elderly population.

2. Materials/subjects and methods

We used data from the Kayseri Elderly Health Study (KEHES), which was a cross-sectional population-based cohort study. Full details of the survey methodology, baseline, and follow up data collection were described in previous publications (Akın et al., 2015). Data of mortality was obtained from a retrospective evaluation of the list of the deaths attained from the local health authority (TürkHalkSağlığıKurumu/Kayseri).

Nutrition was assessed by the Turkish version of the MNA long and short forms. The MNA was developed by Guigoz, Vellas, and Garry (1996) and is the most accepted, best validated, and widespread nutritional assessment tool used in geriatric populations (Morley, 2011). Based on the total score, subjects were classified into three categories: < 17 and ≤ 7 as malnutrition, 17–23.5 and 8–11 as risk of malnutrition and ≥ 24 and 12–14 as well-nourished according to the MNA long and short forms, respectively.

An appetite based SNAQ is primarily used to detect risk of future weight loss (Wilson et al., 2005). The SNAQ consists of four questions and each item is scored from one to five (Fig. 1). The total score is calculated by adding the scores for each item. The minimum and maximum scores range between 4 and 20. A score of ≤ 14 is accepted as having a significant risk of a least 5% weight loss within the following six months in community-dwelling elderly.

Functional status was evaluated with the 6-item activities of daily living (ADL) and the 8-item instrumental activities of daily living (IADL). The ADL scale is based on six levels of self-performance including bathing or showering, dressing, carrying out personal toileting, moving from bed to chair, bowel or urine continence, and eating. The (IADL) scale is based on eight levels of self-performance including using the telephone, shopping, cooking, housekeeping, laundry, transportation, ability to take his/her medications, and financial management (Lawton & Brody, 1969).

The Geriatric Depression Scale (GDS) (Yesavage et al., 1983-1982Yesavage ., - et al., 1982Yesavage et al., 1983-1982) and Minimental State Examination (MMSE) (Folstein, Folstein, & McHugh, 1975) scores were performed to screen depression and dementia, respectively. The GDS cut-off point was 14 for the Turkish elderly (Ertan & Eker, 2000) and middle-stage of dementia was defined as an MMSE score of less than 18 (Rolland, Perrin, Gardette, Filhol, & Vellas, 2012).

Frailty was assessed by the FRAIL scale. In the FRAIL scale, there are five domains: **f**atigue, **r**esistance, **a**mbulation, **i**llnesses, and weight **l**oss (Morley, Malmstrom, & Miller, 2012). The elderly were classified as non-frail if the total score is 0, pre-frail if the total score is 1–2, and frail for scores ≥ 3.

Height (cm) and weight (kg) measurements were done while wearing light clothing and without shoes. Body mass index (BMI) was calculated from weight divided by height square meters (kg/m^2). Under nutrition was defined by a BMI $< 21\ kg/m^2$ (Rolland et al., 2012).

The Local Ethics Committee approved the study.

Histogram and q-q plots were examined to assess the data normality. A two-sided independent samples *t* test was applied to compare differences between continuous variables; while a Pearson chi-square test or Fisher exact test were applied to compare differences between categorical variables. Receiver operating characteristic (ROC) curves were used to identify the discriminative effect of SNAQ on MNA. Area under the ROC curves were calculated with 95% confidence intervals. Youden index was calculated for optimal cut-off value. Sensitivity, specificity, and positive and negative predictive values were calculated with 95% confidence intervals. Internal consistency was obtained by the correlation of each item in the SNAQ scale with the scale's total points. The correlation of the SNAQ with the MNA was assessed for convergent validity by Spearsman correlation. To evaluate the scale's reliability, Cronbach's alpha, Spearman–Brown, and Guttman split-half reliability coefficients were calculated. Analyses were conducted using R 3.2.0 (http://www.r-project.org), MVN (Korkmaz, Goksuluk, & Zararsiz, 2014) and easyROC (Goksuluk, Korkmaz, Zararsiz, & Karaagaoglu, 2016) software.

3. Results

We included 905 community-dwelling elderly, but elderly with an MMSE score of less than 18 were excluded from the study ($n = 30$). Fifty-eight patients from the MNA and four patients from the SNAQ were excluded because of incomplete data. Characteristics of study population and nutritional status and relations with other clinical situations according to both the MNA long form and the SNAQ are presented in Table 1. The mean age ± SD was 71.4 ± 5.5 years (49.3% female and 50.7% male). It was found that 54.4% of subjects were well nourished, 42.2% were at risk of malnutrition and 3.3% were at malnutrition. We combined malnutrition and risk of malnutrition to compare well-nourished or not. The prevalence of elderly at risk of future weight loss (SNAQ score of ≤ 14) was 31.0% ($n = 268$: 66.0% female, 34.0% male). The mean ± SD of BMI in study group was 30.6 ± 5.3 kg/m^2. According to BMI, 6.1% (53) of the elderly were undernutrition (BMI $\leq 21\ kg/m^2$). We found that 24.0% (209) of the elderly had depressive mood. According to the FRAIL scale, 54.1% (471) of the elderly were frail and pre-frail. The frequency of mortality was 7.2%.

Malnutrition was significantly associated with advanced age, female gender, lower BMI, frailty status, dependency both in ADL and IADL, mortality, and depressive mood according to the MNA long form. The SNAQ score ≤ 14 was significantly associated with advanced age, female gender, frailty status, dependency in IADL, and depressive mood (Table 1).

The best discriminatory SNAQ score for determining elderly at risk of malnutrition or malnutrition according to the MNA long and short forms were determined from the receiver operating characteristic curve (Figs. 2 and 3). The area under the curves were 0.725 (95% confidence interval, 0.690–0.760) and 0.693 (95% confidence interval, 0.656–0.730), respectively.

The AUC resulted that the SNAQ has a good predictive effect on both the MNA long and short forms ($p < 0.001$, $p < 0.001$, respectively). Thus, we aimed to determine a cut-off value for the SNAQ in order to predict malnutrition according to both the MNA long and short forms. The optimal cut-off value was observed as < 14, based on the Youden index results according to both the MNA long and short forms. With this optimal cut-off value, the sensitivities were 50% and 50%; specificities were 84% and 82%; positive predictive values were 72% and 63%; negative predictive values were 68% and 73% for the MNA long and short forms, respectively (Tables 2 and 3). Correlation between the SNAQ and the MNA long form according to the usual cut-off values of each scale with scatter plots is shown in Fig. 4.

The item-total correlation was $r = 0.392$–0.781 and the correlation between each item and the total score was statistically significant ($p < 0.001$). The SNAQ was significantly correlated with the MNA

Answers scored based on the following numerical scale: a= 1, b = 2, c = 3, d= 4, e= 5

The sum of scores for all individual items constitutes the SNAQ score

1. My appetite is

a. Very poor

b. Poor

c. Average

d. Good

e. Very good

2. When I eat

a. I feel full after eating only a few mouthfuls

b. I feel full after eating about a third of a meal

c. I feel full after eating over half of meal

d. I feel full after eating most of the meal

e. I hardly ever feel full

3. Food tastes

a. Very bad

b. Bad

c. Average

d. Good

e. Very good

4. Normally I eat

a. Less than one meal a day

b. One meal a day

c. Two meals a day

d. Three meals a day

e. More than 3 meals a day

Fig. 1. The Simplified Nutritional Appetite Questionnaire (SNAQ) used community-dwelling adults and nursing home residents (Wilson et al., 2005).

Table 1
Characteristics of participants.

Variables	Total (n = 871)	SNAQ			Total (n = 817)	MNA		
		≤14 (n = 268)	> 14 (n = 603)	p		≤23.5 (n = 366)	> 23.5 (n = 451)	p
Age, year	71.4(5.55)	72.51(5.63)	70.99(5.45)	< 0.001	71.44(5.55)	72.24(5.70)	70.87(5.38)	< 0.001
Gender, female	430(49.3)	177(66.0)	253(42.0)	< 0.001	413(50.6)	216(59.0)	197(43.7)	< 0.001
BMI, kg/m^2	30.60(5.30)	30.43(5.66)	30.66(5.12)	0.551	30.59(5.30)	29.92(5.97)	31.07(4.66)	0.003
BMI, 21 kg/m^2	53(6.1)	21(7.9)	32(5.3)	0.151	50(6.1)	43(11.7)	7(1.6)	< 0.001
Frailty	471(54.1)	193(72.6)	278(46.5)	< 0.001	456(56.2)	257(70.6)	199(44.5)	< 0.001
ADL, dependent	3(0.3)	2(0.8)	1(0.2)	0.223	4(0.5)	4(1.1)	0(0.0)	0.040
IADL, dependent	133(15.3)	54(20.2)	79(13.1)	0.007	131(16.1)	80(21.9)	51(11.3)	< 0.001
Mortality	60(6.9)	25(9.3)	35(5.8)	0.058	56(6.9)	20(4.4)	36(9.8)	0.002
Depression	209(24.0)	115(43.2)	94(15.7)	< 0.001	199(24.5)	140(38.6)	59(13.2)	< 0.001

SNAQ; Simplified Nutritional Assessment Questionnaire, MNA; Mini-Nutritional Assessment, BMI; body mass index (weight/height2), ADL; activities of daily living, IADL; instrumental activities of daily living.

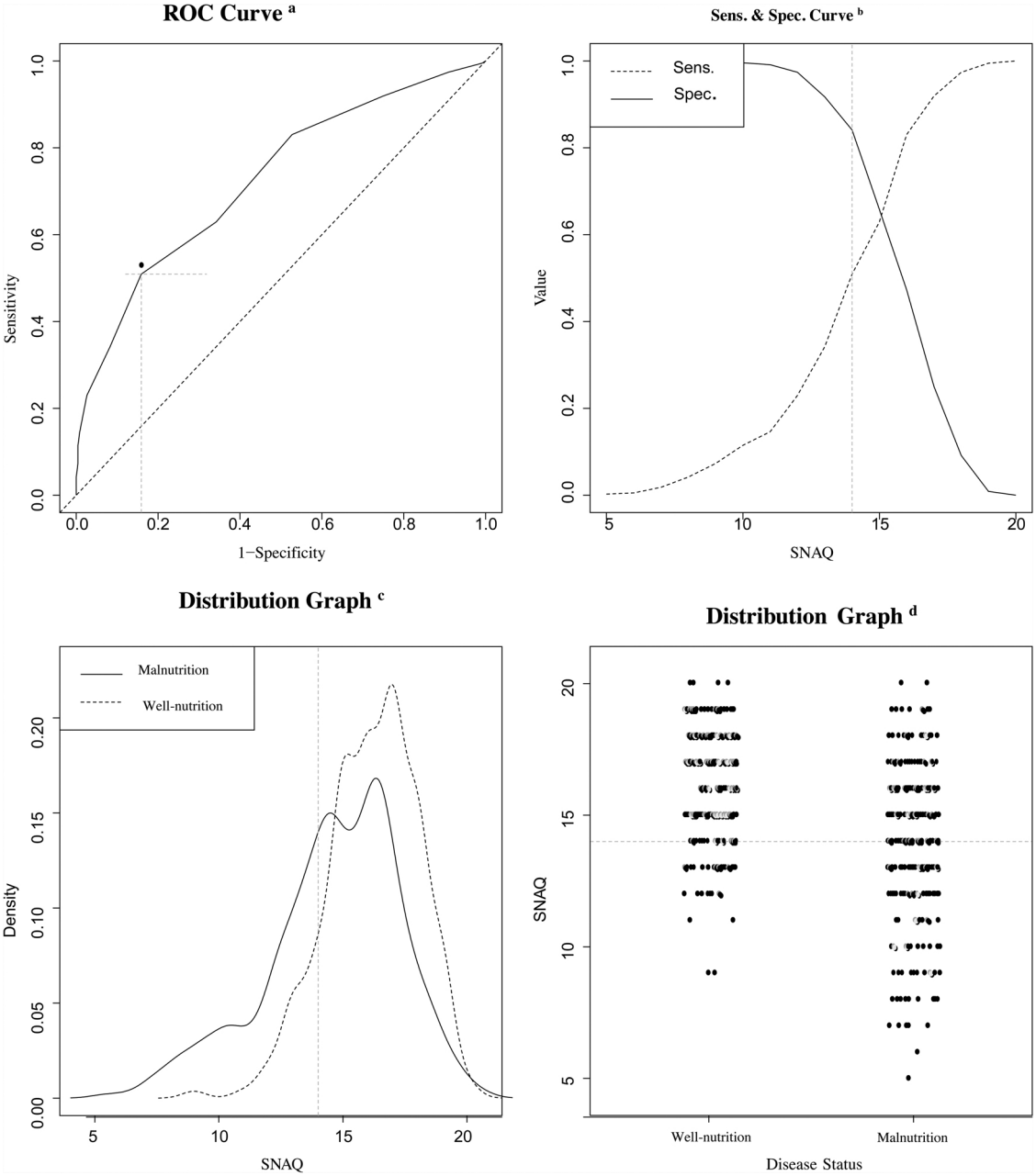

Fig. 2. (a) ROC curve of SNAQ in predicting malnutrition status according to MNA long form, (b) Sensitivity and specificity plot around the cut-off value 14, (c) Distribution plot of SNAQ in patients with and without malnutrition, d. Dot plot of SNAQ in patients with and without malnutrition.

($r = 0.472$, $p < 0.001$). The Cronbach's alpha coefficient of the SNAQ for internal consistency was 0.639. The Guttman split-half and Spearman–Brown reliability coefficients were 0.598 and 0.653, respectively.

4. Discussion

In the present study, the SNAQ showed convincing internal consistency, convergent validity, and reliability. All items evaluated in the scale were significantly correlated with the scale's total score, denoting its internal consistency. The Cronbach's alpha coefficient of the SNAQ for internal consistency was > 0.6, demonstrating homogeneity of the scale and consistency among the responses to the scale. Also, the SNAQ had a good correlation with the MNA. To our knowledge, there is no study comparing the SNAQ with both the MNA long form and the MNA short form in literature.

The MNA is a valid scale for several population settings such as hospitalized patients, nursing home, and community-dwelling elderly. It is strongly associated with functional decline, hospitalization periods, and morbidity-mortality (Vellas et al., 2006b). Although it is a valid and well-known nutritional assessment tool, it is still not a routine nutritional assessment tool in daily care settings or even in geriatric wards (Volkert, Saeglitz, Gueldenzoph, Sieber, & Stehle, 2010). An important limitation of its use is it needs a minimum of 15 min to be completed by qualified staff. However; the MNA provides useful information on current nutritional status but is not a predictive tool for future nutritional status (Poulia et al., 2012). Since the characteristics of a useful malnutrition screening tool can be regarded as simple and easy to use, the MNA short form was developed to shorten its application time. However, it also includes anthropometric measures and application of the MNA short form may not be as easy as it was intended to be. The MNA short form identifies the risk of malnutrition before weight loss or

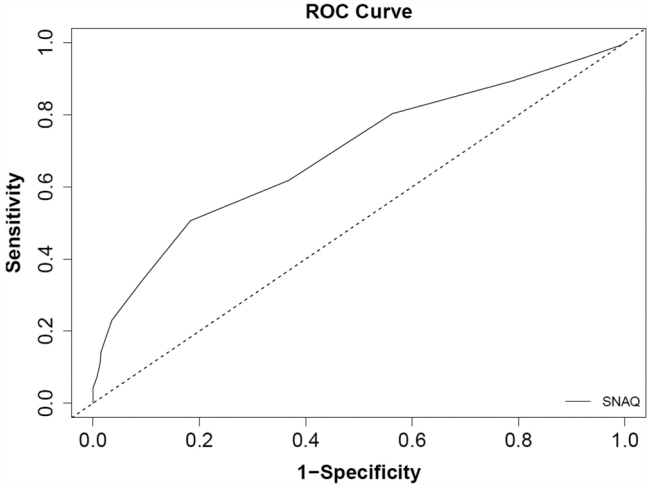

Fig. 3. Roc curve of SNAQ in predicting malnutrition status according to MNA short form.

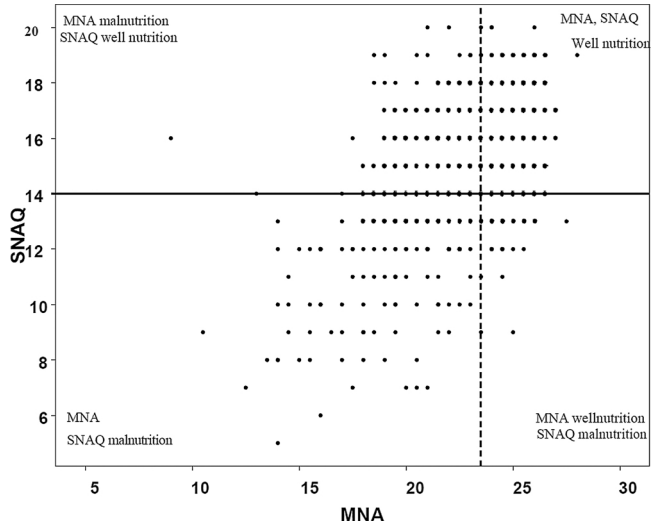

Fig. 4. Scatter plot between MNA and SNAQ with cut-off values.

Table 2
ROC curve results and statistical diagnostic measures for SNAQ < 14 for determining elderly with or without a normal MNA long form.

Statistics	Estimate	Confidence Interval (95%)
ROC curve statistics		
Area under curve	0.725	0.690–0.760
p value	< 0.001	
Diagnostic measures		
Sensitivity	0.503	0.450–0.555
Specificity	0.840	0.803–0.873
Positive predictive value	0.718	0.663–0.758
Negative predictive value	0.676	0.628–0.732

SNAQ, Simplified Nutritional Assessment Questionnaire; MNA, Mini-Nutritional Assessment; ROC, receiver operating characteristic.

Table 3
ROC curve results and statistical diagnostic measures for SNAQ < 14 for determining elderly with or without a normal MNA short form.

Statistics	Estimate	Confidence Interval (95%)
ROC curve statistics		
Area under curve	0.693	0.656–0.730
p value	< 0.001	
Diagnostic measures		
Sensitivity	0.506	0.451–0.561
Specificity	0.817	0.781–0.849
Positive predictive value	0.630	0.577–0.680
Negative predictive value	0.728	0.682–0.771

SNAQ; Simplified Nutritional Assessment Questionnaire, MNA; Mini-Nutritional Assessment, receiver operating characteristic (ROC).

decrease in serum protein levels but the full MNA is needed only if a patient is classified as at risk of malnutrition.

The SNAQ was developed to predict at least > 5% weight loss in community-dwelling elderly (Wilson et al., 2005). Appetite is not routinely evaluated in community-dwelling elderly in clinical settings in our country. The cause of weight loss in elderly can be primarily the result of lack of appetite, which is also associated with frailty, functional decline, and increased mortality (Alibhai, Greenwood, & Payette, 2005). Thus, screening and assessment of elderly appetite needs to happen as early as possible.

In our study, according to the MNA long and short forms, the sensitivity and specificity of the SNAQ ≤ 14 for determining elderly risk of malnutrition or malnutrition were 50%; 50% and 84%; 82%, respectively. In another study in community-dwelling elderly, subjects with SNAQ scores of ≤14 were at a risk of unexpected weight loss within 6 months, with a sensitivity and specificity of 81.6% and 84.6%, respectively (Wang & Tsai, 2013). Lower sensitivity of the SNAQ for determining risk of malnutrition or malnutrition may be related to special characteristics of eating habits, socio-economic, and cultural norms of the Turkish population.

The cut-off of the SNAQ score was determined as ≤14 to predict risk of malnutrition or malnutrition according to both the MNA long and short forms in Turkish community-dwelling populations and it is consistent with the current literature that a SNAQ score ≤14 predicts at least 5% weight loss within 6 months in community-dwelling elderly. Thus, it can be used in early detection of impairment of nutritional status related to anorexia.

In another study, in which both community-dwelling and hospitalized elderly enrolled in a geriatric unit, the SNAQ and MNA scores were found to be correlated (Rolland et al., 2012). The proportion of elderly with a SNAQ score ≤14 was 38.3%, similar to that found in Turkey (31.2%). The AUC for the SNAQ according to an abnormal MNA score was 0.767 (95% confidence interval, 0.69–0.85). The elderly, whose SNAQ score ≤14 were significantly older, more frequently depressed, and frailer than subjects with higher SNAQ scores. In our study, elderly with a SNAQ score ≤14 were significantly associated with age, female gender, frailty status, dependency in IADL, and depression.

Weight loss is a significant component of frailty and functional decline. In literature some studies demonstrated that malnutrition, assessed with the MNA, is independently related to an increased risk of frailty (Akın et al., 2015; Bollwein et al., 2013) and dependency (Lee & Tsai, 2012) in the elderly. Therefore, we evaluated whether there is a relationship between a SNAQ score ≤14 and frailty and dependency. Concordant with literature, a SNAQ score ≤14 was associated with a functional decline and frailty in the elderly. Additionally, Yoshimura et al. indicated an association between depression and nutritional status in the community-dwelling elderly (Yoshimura, Yamada, Kajiwara, Nishiguchi, & Aoyama, 2013). In our study, malnutrition, assessed with both the MNA and the SNAQ, were significantly associated with depression.

The strength of this study is the large sample of community-dwelling elderly, which includes both males and females in similar numbers. There are some limitations in this study. The external consistency, one of the validation steps, was not evaluated by the interrater test (1-week interval between the 2 measurements). Another limitation is the lack of a predictive validity, as we analysed a cross-sectional study retrospectively. A longitudinal study of the cohort is needed to

further validate the SNAQ in Turkish elderly populations.

5. Conclusion

The SNAQ was validated as a screening tool for malnutrition in Turkish community-dwelling elderly. The SNAQ is a test that is easy to use with a relatively non-qualified staff since there is no anthropometric measurement. It is a reliable screening instrument and can be used in clinical practice and research by geriatricians and other health professionals. In Turkey, where malnutrition is common and frequently underdiagnosed, preventive measures could be enforced with the early detection of malnutrition and risk of malnutrition, possibly leading to a decrease in the burden of this condition.

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None.

Conflict of interest

There are no conflicts of interest to declare.

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