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Research Article
Short Nutritional Assessment Questionnaire as a Malnutrition Screening Tool for Hospitalized Patients

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Abstract

Background and Objective: Nutritional screening upon hospital admission is important to ensure prompt and effective interventional management and to reduce the incidence of hospital complications. This study aimed to screen and evaluate the nutritional status of patients admitted to a tertiary care centre using the Short Nutritional Assessment Questionnaire (SNAQ) and to assess the relationship between malnutrition and length of hospital stay. **Materials and Methods:** One thousand patients were recruited from the medical wards of Kasr Al Ainy Hospital. All enrolled patients were screened for malnutrition using the SNAQ. Body mass index (BMI), haemoglobin and albumin levels were measured. The predictors of hospital stay were assessed. **Results:** Of the 1000 patients, 522 (52.2%) were male and their ages ranged from 18-97 years. The median (IQR) BMI was 25.9 (22.8-29.4). A total of 550 patients were malnourished, with SNAQ scores ≥2. The frequency of anaemia and hypoalbuminemia differed significantly in malnourished patients (SNAQ≥2) from that in non-malnourished patients ($p<0.001$). A long hospital stay was significantly associated with higher SNAQ scores ($r = 0.318$, $p\leq0.001$) and was inversely associated with BMI and albumin, while a low BMI was the most independent predictor of a long hospital stay (95% CI for the beta coefficient=0.125-0.033). **Conclusion:** The SNAQ is a simple and quick tool for screening malnutrition risk among hospitalized patients.

Key words: Body mass index, hospitalized patients, length of hospital stay, malnutrition, screening

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Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Malnutrition is a state in which an imbalance in nutrient intake results in one of two main outcomes: undernutrition or obesity[1]. Estimating the prevalence of malnutrition among hospitalized patients is challenging[2]. Malnutrition is attributed to various factors, such as age, chronic illness, medication intake, lack of organized nutritional screening strategies and failure to recognize the condition[3,4].

Nutritional impairment is strongly implicated in an increased risk of infection, impaired healing processes and a poor quality of life. Simple screening and assessment tools have been applied for the early recognition of malnourished hospitalized patients and consequent early nutritional intervention and outcome amelioration[5]. Such tests include the Subjective Global Assessment (SGA) and the Mini-Nutritional Assessment (MNA) and its short form (SF-MNA).

A Short Nutritional Assessment Questionnaire (SNAQ) was developed in the Netherlands[6] and has been proven to be valid, quick and reproducible for predicting weight loss and detecting and treating malnourished patients in the early stages of hospitalization[7]. Untrained personnel can administer the SNAQ and no equipment is required; furthermore, the results of screening lead to a treatment plan.

In hospital settings, there is a clear awareness that malnutrition impacts patients' course of treatment as well as the length and cost of their hospital stay. These impacts substantiate the importance of initial nutritional screening for hospitalized patients to facilitate early management and better outcomes.

A well-established body of literature on malnutrition in hospitalized patients discusses its prevalence, nutritional risk factors and associated consequences[8,9]. However, in Egypt, published data on the nutritional state of hospitalized patients are limited and the existing information focuses mainly on the elderly population[10].

Therefore, the aim of this study was to use the SNAQ to screen and evaluate the nutritional status of patients admitted to a tertiary care centre and to identify patients at a high risk of malnutrition. The secondary objective was to assess the relationship between malnutrition and clinical outcomes, mainly length of hospital stay.

MATERIALS AND METHODS

Study design and population: This was an observational cross-sectional study in which patients aged ≥18 years with chronic illnesses who were admitted to the internal medicine wards at Kasr Al Ainy Hospital from June 2016 to October 2017 were recruited to screen for malnutrition and its relationship to hospital stay. There were 1000 total participants. All patients admitted to hospital wards who agreed to participate were included in the study; pregnant females, patients who were clinically unstable and cognitively non-cooperative (demented or unconscious) and those with a length of hospital stay of ≤24 h were excluded from the study. Some data were collected from the patients' files.

The study protocol was revised and approved by the Medical Research Committee of the Faculty of Medicine of Cairo University. Informed consent was obtained from each participant. All procedures conformed to the ethical guidelines of the 1975 Helsinki Declaration.

Assessment of the nutritional status of the study patients: The questions were precoded prior to data collection to facilitate data entry and analysis.

- **Anthropometric measures:** Anthropometric measurements (namely, weight, height and BMI) were performed using a calibrated scale. According to WHO[11], the participants were classified as normal if their BMI was 18.5-24.9 kg m^{-2}, overweight if their BMI was above 25.0 kg m^{-2} and underweight if their BMI was <18.5 kg m^{-2}
- **Short nutritional assessment questionnaire (SNAQ):** The SNAQ is based on three questions regarding weight loss (greater than 6 kg over the last 6 months or greater than 3 kg over the last month), poor appetite and the use of supplemental drinks or tube feeding over the past month. The collected data were mostly qualitative but were expressed quantitatively as the answers were weighted (1-5). Scores indicating moderate malnourishment (=2 points) and severe malnourishment (≥3 points) mandate nutritional intervention, while a score of 1 point indicates that no intervention is needed[6]

Patient files: A separate sheet was used to collect the required data from the patients' medical records, with an emphasis on the following data:

- **Medical history:** Type of disease, disease duration, age at disease onset, length of hospital stay
- **Laboratory data:** Haemoglobin levels (Hb%) were collected to diagnose anaemia and serum albumin was used to assess protein-energy status. Both factors are considered identifiable routine biomarkers of nutritional state. Hb% was measured using an automated

haematology analyser (Sysmex Corp., Kobe, Japan) and expressed in g dL^{-1}, while albumin was measured using an automated device (Peckman, Dade Behring Company) and expressed in mg dL^{-1}

Data collection and statistical analysis: The data were coded, entered and analysed using the statistical package SPSS version 21. Numbers and percentages were used to summarize qualitative variables. The data distribution was tested by the Kolmogorov-Smirnov test (KS-test). Medians and IQRs were used to summarize quantitative variables when the data were normally distributed. Analysis of variance (ANOVA) was used for continuous variables. The Mann-Whitney U test was used to compare differences between two independent groups. Spearman's rho nonparametric correlation was used to test the association between quantitative variables. A generalized linear model with gamma was used to identify the independent predictors of hospital stay (dependent variable). A p-value ≤ 0.05 was considered statistically significant. Tables are used to illustrate the results.

RESULTS

A total of 1000 patients completed the questionnaire. A total of 522 males (52.2%) and 478 females (47.8%) aged 18-97 years participated in the study. Demographic, anthropometric and laboratory descriptive data are summarized in Table 1.

The patients were classified according to their BMI as normal weight (321 patients, 32.1%), underweight (BMI less than 18; 41 patients, 4.1%) and overweight and obese (418 patients, 41.8%; 220 patients, 22%, respectively). The most prevalent comorbidities were renal disease (321 patients, 32.1%), followed by hepatic disease (214 patients, 21.4%). The current study demonstrated that of 1000 patients, 732 (73.2%) had anaemia, (defined as an Hb% level less than 12 g dL^{-1}) and 587 (58.7%) of them had a serum albumin level less than 4 mg dL^{-1}.

We classified approximately 450 (45%) patients as non-malnourished and not in need of intervention, while 550 (55%) were malnourished (SNAQ$\geq$2) and required nutritional intervention.

The relationships between malnutrition and different background and clinical characteristics are illustrated in Table 2. The study revealed that SNAQ scores was significantly negatively correlated with BMI, haemoglobin and albumin (r-value: -0.25, -0.242 and -0.307, respectively; $p<0.001$).

The correlations between the length of hospital stay and malnutrition parameters are shown in Table 3.

Table 1: Clinical background data of the enrolled participants

	Description (n = 1000)	
Variables	No.	Percentage
Sex		
Male	522	52.2
Female	478	47.8
Age (years) median (IQR)	51	39-58.5
Weight (kg) median (IQR)	72	65-82
Height (cm) median (IQR)	167	160-175
BMI (kg m^{-2}) median (IQR)	25.9	22.8-29.4
Medical disease distribution		
Diabetes mellitus	141	14.1
Hypertension	142	14.2
Renal	321	32.1
Hepatic	214	21.4
Cardiac	61	6.1
Respiratory	44	4.4
Neoplasm	95	9.5
Other comorbidities$^{\infty}$	144	14.4
Haemoglobin% (g dL^{-1}) Median (IQR)	10	8.6-11.3
Albumin (mg dL^{-1}) Median (IQR)	3.3	2.9-3.8
SNAQ score		
1	450	45
2	236	23.6
$\geq$3	314	31.4
Hospital stay (HS) median (IQR)	5	4-7
Prolonged HS$\geq$9days	159	15.9
Non-prolonged HS<9days	841	84.1

IQR: Interquartile range, BMI: Body mass index, SNAQ: Short nutritional assessment questionnaire, ∞ Comorbidities include infection, bed sores, delayed wound healing

The predictors of prolonged hospital stay were examined using a generalized linear model with a gamma test, which revealed that neither the SNAQ nor albumin levels could predict a long hospital stay, as shown in Table 4; however, the model revealed that a low BMI is a significant risk factor for a long hospital stay.

DISCUSSION

The aim of the present study was to describe the nutritional status of patients with different chronic illnesses admitted to the internal medicine wards of Kasr Alainy Hospital and to identify the risk factors for malnutrition using the validated SNAQ screening tool.

Here, we observed poor nutritional status, defined as a SNAQ score $\geq$2, in more than half of the enrolled participants (55%). Malnutrition is a common complication among hospitalized patients and the prevalence of malnutrition in hospitals is approximately 20-40%. Malnutrition may be attributable to poor overall health, psychological depression and poor appetite, or it may be closely linked to inadequate nutritional intake and absorption, increased nutritional requirements as a result of the underlying disease state[12] or an interplay among the aforementioned factors[13]. The

Table 2: Association between the presence of high nutrition risk and the characteristics of the studied patients

Variables	Malnourished according to SNAQ: With nutritional risk SNAQ≥2	Malnourished according to SNAQ: Without nutritional risk SNAQ<2	p-value
Sex			0.032
Male (N, %)	304 (55.3)	218 (48.4)	
Female (N, %)	246 (44.7)	232 (51.6)	
Comorbidities (N, %)			<0.001
Diabetes mellitus	46 (8.4)	95 (21.1)	
Hypertension	63 (11.5)	79 (17.6)	
Renal	223 (40.5)	98 (21.8)	
Hepatic	183 (33.3)	31 (6.9)	
Cardiac	7 (1.3)	54 (12)	
Respiratory	8 (1.5)	36 (8)	
Neoplasm	91 (6.5)	4 (0.9)	
Other comorbidities∞	22 (4)	122 (27.1)	
BMI (kg m^{-2})			<0.001
Underweight (BMI<18.5)	24 (4.4)	17 (3.8)	
Normal weight (BMI = 18.5-24.9)	204 (37.1)	117(26)	
Overweight (BMI>25)	322 (58.5)	216 (70.2)	
Anaemia*	428 (77.8)	304 (67.6)	<0.001
Hypoalbuminemia (g dL^{-1})	379 (68.9)	208 (46.2)	<0.001
Age (years)	48.8±12.9	49.2±14.6	0.721
Weight (kg)	71.9±11.7	75.8±15.7	<0.001
Height (cm)	167.6±9.6	166.2±9.4	0.019
BMI (kg m^{-2})	25.7±4.6	27.5±5.6	<0.001
Haemoglobin (g dL^{-1})	9.9±2.1	10.3±2	0.001
Albumin (mg dL^{-1})	3.2±0.7	3.5±0.7	<0.001
Hospital stay (days)	6.7±3.4	6.2±4.3	<0.001

BMI: Body mass index SNAQ: Short Nutritional Assessment Questionnaire, ∞ Comorbidities include infection, bedsores, delayed wound healing, *Anaemia is defined as Hb% less than 11 g dL^{-1}

Table 3: Correlation of hospital stay and different background characteristics using Spearman's rho test

Variables	Hospital stay: R-value∞	Hospital stay: p-value*
Age	-0.017	0.590
BMI	-0.252	<0.001
Haemoglobin (%)	-0.018	0.565
Albumin	-0.166	<0.001
SNAQ	0.318	<0.001

BMI: Body mass index SNAQ: Short nutritional assessment questionnaire. ∞ r = Spearman's correlation coefficient

Table 4: Generalized linear model (GLM) with gamma test to explore predictors of length of hospital stay

Variables	p-value	β∞	95% CI for β
BMI	<0.001	-0.015	-0.021–-0.009
Albumin	0.193	0.035	-0.018– 0.088
SNAQ	0.958	0.001	-0.027– 0.028

BMI: Body mass index SNAQ: Short Nutritional assessment questionnaire, CI: Confidence interval, ∞ β: Beta coefficient

malnutrition rate found in the current study, which shows that the prevalence of malnutrition among Australian patients (36%), is higher than that reported in a previous study[14]. A lower prevalence of malnutrition among hospitalized patients was also reported by Olivares *et al.*[15], who investigated the nutritional status of Spanish patients using different tools and estimated the prevalence of undernutrition to be 47.3%. Additionally, result of the present study is higher than that reported by Rabito *et al.*[7] who used the Malnutrition Universal Screening Tool (MUST) (37.1%) and the Nutritional Risk Screening 2002 (NRS-2002) (29.4%) and identified prevalence among patients at nutritional risk. Kami *et al.*[16] reported that 48.7% of Brazilian emergency patients were at nutritional risk. A recent multicentre study conducted in Korea among hospitalized patients assessed by Subjective Global Assessment (SGA) to screen for malnutrition found a prevalence of 22.0% and an adverse impact on hospital stay and survival rate[17].

This variation may be due to differences in patient ethnicities, illness type and severity, hospital settings and nutrition assessment tools used in the studies. In addition, other possible factors that may explain the variation in the reported prevalence of malnutrition are low socioeconomic status, poor awareness of the importance of adequate nutrition and the lack of nutritional care strategies in our selected population[18].

Malnutrition is known to be associated with a prolonged hospital stay[19]. In the present study, the median (IQR) length of hospital stay was 5 (4-9) days and approximately 159 (15.9%) patients had a prolonged stay (LOS) of 9 days or longer.

Although the SNAQ was used to estimate the proportion of hospitalized patients at a high nutritional risk and showed good performance for patient assessments[5], a limitation should be noted as its score weightings rely mostly on weight loss, which reflects only the undernourished population.

Regarding BMI, the median BMI of the enrolled study participants was 25.9 kg m^{-2} (22.8-29.4). An unexpected finding was that most of the study participants were overweight, which is consistent with a recent study conducted by Rabito et al.[7], in which the mean BMI of the study population was 28.13±6.39 kg m^{-2}. However, although many previous studies have linked malnutrition to low BMI[3,6,14], overweight patients are also at high risk for poor outcomes[4]. The body weights of our participants were affected by volume overload, as the most frequently occurring diseases in the study population were renal and hepatic diseases and diabetes mellitus, which lead to increased weight via water and salt retention[20].

The objective determinant of malnutrition is current weight status based on BMI; however, laboratory markers, including Hb%[21] and serum albumin levels, are more reliable[22]. Hypoalbuminemia in adults is defined as albumin levels less than 3.5 g dL^{-1} and is a reliable indicator of protein-energy malnutrition[23]. Regarding albumin levels, in the current study, the median albumin level was 3.3 mg dL^{-1} (2.9-3.8), which could be attributed to renal loss, hepatic disease or a negative phase reaction of the illness. Therefore, ascertaining whether hypoalbuminemia is due to the disease itself or to malnutrition is difficult.

Haemoglobin was used as a nutritional index. The current study showed low Hb levels among the participants, with a mean value of 10.1±2 g dL^{-1}. The most common cause of anaemia in chronic disease is defective erythropoiesis and iron malutilization[24]. As the study showed, albumin and haemoglobin levels differ significantly between patients with and without severe malnourishment. This finding is similar to the observations reported by Kruizenga *et al.*[25]

To identify the association of SNAQ scores with other risk parameters of malnutrition, the present study demonstrated significant negative correlations between SNAQ scores and Hb%, albumin and BMI. Surprisingly, no association was found between age and SNAQ scores, which contrasts with other studies reporting that older patients were more likely to be malnourished than younger patients[26,27]. This finding may be explained by the age heterogeneity (range of 18-97 years) of the study population; unlike in previous studies, our study did not include only elderly patients.

LOS was significantly associated with SNAQ scores ($r = 0.318$, $p \leq 0.001$) and was inversely correlated with BMI and albumin levels. These data corroborate the findings of other studies that affirm the potential risks of complications, mortality and prolonged LOS in malnourished patients[28-31].

Regarding predictors of a prolonged hospital stay, the study revealed that low BMI was an independent potential variable related to long hospital stays. This finding is somewhat in accordance with a study by Gomes *et al.*[32], which suggested that undernourished patients had longer hospital stays.

The limitations of this study should be mentioned. The study is cross-sectional and descriptive and does not prospectively investigate weight loss, morbidity and mortality outcomes. Despite these shortcomings, the study addresses a poorly explored area of Egypt, especially in tertiary health care hospitals. Proper attention should be directed towards nutritional assessment and nutritional management should be an integral part of treatment plans.

CONCLUSION

SNAQ is a simple and quick tool to screen for malnutrition risks among hospitalized patients. However, the SNAQ is not a valuable predictor of long hospital stays.

SIGNIFICANCE STATEMENT

This study discovered that the SNAQ is a simple, quick tool to screen for malnutrition risks among hospitalized patients, which can be beneficial for the early detection of malnutrition and for predicting patient outcomes. This study will help researchers determine the critical impact of nutrition on hospital inpatient morbidity and mortality and may lead to a new theory of screening tools and a possible combination with other questionnaires.

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