Original Communication

Journal of Parenteral and Enteral Nutrition
Volume XX Number X
Month XXXX 1-8

10.1177/0148607110374477
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Nutrition Status and Risk Factors Associated With Length of Hospital Stay for Surgical Patients

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Financial disclosure: Sponsored by Research Support Fund of the Pontifícia Universidade Católica de Campinas.

Objective: To diagnose the nutrition status of hospitalized patients and identify the risk factors associated with hospital length of stay (LOS). *Methods:* The subjective approach and the body mass index (BMI) were used to classify the nutrition status, and other indicators (anthropometry, biochemistry, and energy intake) were analyzed regarding their association with length of hospital stay of 350 patients. The chi-square test was used to compare proportions, and the Mann-Whitney or Kruskal-Wallis test was used to compare continuous measures. Linear association was verified using Spearman's rank correlation coefficient. Cox's regression model was used to investigate factors associated with LOS. *Results:* Disease was the factor that influenced LOS the most in the studied population. Longer LOS prevailed in males ($P < .0001$), patients aged ≥60 years ($P = .0008$), patients with neoplasms ($P < .0001$), patients who lost weight during their hospital stay ($P < .0001$), and malnourished patients ($P = .0034$). There was a negative and significant, but weak, correlation between LOS and nutrition indicators (calf circumference, arm circumference, triceps skinfold thickness, subscapular skinfold thickness, arm fat area, lymphocyte count, and hemoglobin). Among adults, well-nourished patients were 3 times more likely to be discharged sooner ($P = .0002$, RR = 3.3 [1.7–6.2]) than those who had some degree of malnutrition. Well-nourished patients with digestive tract diseases (DTD) were also discharged sooner than malnourished patients with the same condition ($P = .02$, RR = 2.5 [1.1–5.8]). In patients with neoplasms, arm circumference was an independent risk factor to assess LOS ($P = .009$, RR = 1.1 [1.0–1.1]). *Conclusions:* LOS was associated with disease and nutrition status. Among the more common diseases, nutrition status according to the subjective approach determined the LOS for patients with DTD and nutrition status according to arm circumference determined the LOS for patients with neoplasms. (*JPEN J Parenter Enteral Nutr*. XXXX;xx:xx-xx)

Keywords: nutrition status; malnutrition; length of hospital stay; surgical patients; risk factors; multiple regression model

The nutrition status of hospitalized patients reflects directly on their clinical course, given that there are greater rates of hospital-acquired diseases and deaths and greater risk of clinical complications among malnourished patients, increasing the hospital length of stay (LOS) and reducing quality of life. This leads to high hospital costs because these patients have a greater need for intensive care or specialized services.[1-4]

Malnutrition is a notorious problem among hospitalized patients in developed countries.[5] In the hospital environment, malnutrition is already a well-known problem, the estimated prevalence of which ranges from 28% to 50%.[6-8] Contemporary clinical practices allow only about 50% of these malnourished patients to be identified.[8]

Malnutrition is considered an important problem in hospitalized patients and is generally related to increased morbidity and mortality, contributing to increased length of stay and hospital costs.[7,9,10] A multicentric epidemiological study[11] done in Brazil used the subjective global assessment (SGA) to investigate the prevalence of malnutrition in 4000 hospitalized patients and found that 48% were malnourished, of which 12.6% were severely malnourished. When the LOS was >15 days, malnutrition affected as many as 61% of the hospitalized patients. The prevalence of malnutrition within the first 48 hours of hospital stay was found to be 33.2%, indicating that some patients are already malnourished on hospital admission.

In a recent study in Sweden,[12] the prevalence of moderate and severe malnutrition varied from 22% to 34% in small, medium, and large hospitals.

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Received for publication February 23, 2010; accepted for publication April 17, 2010.

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A study done in hospitals in the Netherlands found that 12% of the patients were malnourished and 13% were at nutrition risk.[13] A prevalence of malnutrition of 51.4% was found by a study done in Brazil in an economically developed region[14]; however, both studies used the SGA to assess nutrition status.

Regarding surgical patients in particular, many studies have documented the nutrition risk that these patients present in the postoperative period when they have a poor nutrition prognosis in the preoperative period, especially patients who started losing weight before surgery. Literature has clearly shown that malnutrition in these patients is a significant risk factor for postoperative complications, especially in cases of abdominal surgery.[15,16]

However, differing data exist regarding the presence or absence of malnutrition in surgical and nonsurgical patients.[4,16,17] In a recent study, Pacelli et al[18] assessed the incidence of mortality, postoperative complications, and nutrition status using routine indicators and found that weight loss and hypoalbuminemia were not associated with increased risk of morbidity and mortality in gastric surgery patients. Pacelli et al did not take into account the hospital LOS or nutrition status.

Given these considerations, the first objective of this study was to diagnose and describe the nutrition status of the surgical inpatient in the preoperative period; the second objective was to identify the risk factors associated with LOS.

Methods

This study included adult and elderly inpatients of the general and digestive tract surgery unit of the Hospital e Maternidade Celso Pierro, of the Pontifical Catholic University of Campinas, located in the state of São Paulo, Brazil. The study began after it was approved by the hospital's administration and Research Ethics Committee (Protocol 925/08). The inclusion criteria were as follows: age >20 years; having undergone a nutrition assessment within the first 48 hours of admission; and data regarding nutrition status, disease, and hospital LOS recorded in the medical records of the institution. The exclusion criteria were patients whose nutrition status data were incomplete, patients who had not been subjected to a nutrition assessment within the first 48 hours of admission, and those admitted only for clinical investigation and tests.

This cross-sectional study was carried out in 2009, with an initial population of 350 patients. Data collection was done in the preoperative period using a nutrition protocol that had been previously defined. Diagnosis and personal information of the patients were obtained from their medical records. In addition to personal data, data about anthropometric factors, laboratory results, energy intake, and LOS were included in the protocol. All data were recorded in the medical records for subsequent assessment.

Nutrition Status Assessment and Classification of Malnutrition

The nutrition status of the patients was assessed right after admission, through the use of different criteria such as anthropometric indicators, laboratory tests, SGA for adults, mini nutrition assessment (MNA) for the elderly subjects, and assessment of habitual energy intake (HEI). The SGA for adults and MNA for the elderly subjects were used as a subjective approach to classify the nutrition status, and body mass index (BMI) was used as the objective assessment. Cutoffs were not used for the other indicators; only the association was established.

Anthropometric Indicators

The following anthropometric indicators were measured: current weight (CW), height (H), arm circumference (AC), triceps skinfold thickness (TST), subscapular skinfold thickness (SST), and calf circumference (CC). These measures allowed us to calculate the BMI, mid-arm muscle circumference (MAMC), arm muscle area (AMA), and arm fat area (AFA) to be calculated. Weight was determined with an electronic scale (Marte, model PP180) with a maximum capacity of 180 kg and accuracy of 0.1 kg. The skinfold caliper (Lange Skinfold Caliper; TBW), with a measuring range of 0–60 mm and accuracy of ±1.0 mm, was used to determine skinfold thicknesses, and an inelastic tape measure (TBW) measuring 150 cm with an accuracy of 0.1 cm was used for the other measures.

BMI was calculated by dividing the weight by the square of the height and classified according to the World Health Organization[19] criteria for adults up to 60 years old, which are as follows: underweight, $BMI \leq 18.4$; normal weight, $18.5 \leq BMI \leq 24.9$; pre-obese, $25.0 \leq BMI \leq 29.9$; obese, $BMI \geq 30.0$. The BMI of the elderly subjects (≥60 years) was classified according to Lipschitz20: underweight, $BMI \leq 22$; normal weight, $22 < BMI < 27$; and overweight, $BMI \geq 27$.

Recent weight loss was classified as *yes* for those patients who reported losing weight before admission and *no* for those who did not lose weight before admission.

Meanwhile, weight variation during hospital stay was classified as *unchanged* for those whose weight did not vary during their stay, *weight loss* for those who lost weight, and *weight gain* for those who gained weight. The considered value of weight change was 1 kg positive or negative.

Subjective Assessment

SGA. The SGA was administered only for the adult population of the study as recommended by Detsky et al.[21] The

SGA allows one to make a subjective assessment of the nutrition status of diseased individuals, based on scores given for weight loss, food intake, and clinical and physical signs of malnutrition. The patients were classified as well-nourished (WN), slightly malnourished (SM), and moderately malnourished (MM).

MNA. The MNA was administered only for the elderly patients of the study as recommended by Guigoz and Garry.[22] This instrument is a variation of the SGA and includes aspects that are specific for older individuals. The patients were classified as properly nourished, malnourished (MN), and at risk of malnutrition (RM).

The 2 approaches were used separately (the SGA for adults and the MNA for elderly).

Investigation of HEI

HEI was assessed based on the habitual food intake when the patient was admitted (method used to determine the habitual diet of the individual, which consists of a description of his or her typical diet, representing the food intake of the individual). It includes meal and snack times and type and quantity of foods that individuals normally consume. Next, the centesimal composition of the foods present in the dietary recalls was calculated by the software NutWin[23] version 1.5. The energy adequacy of the habitual energy intake in relation to the energy needs was then calculated (%HEI/EN). The energy need represents the total energy expenditure of the individual and was calculated by the Harris-Benedict equation, adding the activity factor and stress factor.

Assessment of Risk Factors Associated With LOS

Gender, disease, and age; anthropometric indicators such as BMI, calf circumference, arm circumference, triceps skinfold thickness, subscapular skinfold thickness, and arm muscle area; and HEI and %HEI/energy need were investigated as possible risk factors associated with LOS. The SGA and MNA were used together (subjective approach).

Other data such as laboratory tests, including lymphocyte count, hemoglobin, and LOS, were collected from the medical records.

Statistical Analysis

Initially, a descriptive analysis of the patients was done, calculating mean, standard deviation, and proportion of the studied variables. The chi-square test was used to compare the proportions. The Mann-Whitney test was used to compare the continuous or ordinal measures between 2 groups, and the Kruskal-Wallis test was used for ≥3 groups. Spearman's correlation coefficient was used to verify the linear association between 2 measures. This coefficient varied from −1 to 1. Values near the extremes indicated negative or positive correlation respectively, and values close to zero indicated no correlation.

Later, an investigation was done to verify whether risk factors, such as nutrition indicators, influenced LOS. To identify the risk factors associated with LOS, we used Cox's regression model, calculating the relative risk (RR) and the respective 95% confidence interval (CI).[24,25] The stepwise process was used to select the variables, and the level of significance for all the statistical tests was set at 5% ($P < .05$). The software SAS[26] (SAS Institute, Cary, NC) was used to analyze the data.

Results

A total of 350 patients were studied: 52.57% (n = 184) were females and 47.43% (n = 166) were males; 65.71% (n = 230) of the patients were adults <60 years of age and 34.29% (n = 120) were aged ≥60 years. The most common causes for hospitalization were digestive tract diseases (DTDs, 31.43%, n = 110), gynecological diseases (23.14%, n = 81), vascular diseases (12%, n = 42), malignant neoplasms (12.57%, n = 44), and traumas (10.57%, n = 37). Other causes accounted for 10.29% (n = 36) of the hospitalizations.

Regarding the variables studied in the entire population (adults and elderly), the mean age was 52.0 ± 18.2 years; BMI was 25.3 ± 5.5 kg/m^2; CC was 34.3 ± 4.5 cm; AC was 29.5 ± 4.9 cm; TST was 19.6 ± 10.7 mm; SST was 19.0 ± 8.6 mm; MAMC was 233.1 ± 34.1 mm; AMA was 44.2 ± 12.8cm^2; AFA was 26.8 ± 17.2cm^2; lymphocyte count was 1615.6 ± 771.8 mm^3; hemoglobin was 12.4 ± 2.3 mg/dL; HEI was 1498.0 ± 625.6 kcal; and energy need was 2022.3 ± 379.5 kcal. The mean LOS was 5.7 ± 5.9 days.

When the BMI of the entire population was stratified according to the cutoff points adopted, 42.9% were overweight or obese, 42.9% were normal weight, and 14.2% were underweight or malnourished. When only adults were stratified, 47.5% were normal weight, 49.5% were overweight or obese, and only 2.9% were underweight or malnourished. The elderly subjects were distributed as follows: 33.7% were normal weight, 29.7% were overweight or obese, and 36.6% were underweight or malnourished.

According to the SGA administered only to patients younger than 60 years, 79.8% of the patients were classified as well nourished, 19.3% were slightly malnourished, and 0.8% were moderately malnourished. According to the MNA administered only to patients 60 years or older, 56.2% were well nourished, 32.9% were at risk of malnourishment, and 11.0% were malnourished.

Most (62.6%) of the patients presented no weight variation during their hospital stay; 11.9% gained weight and 25.6% lost weight.

Table 1. Characteristics of the Population According to the Studied Variables and Disease Type*

	DTD	Gynecological Diseases	Vascular Diseases	Neoplasms	Trauma	Other
Gender, n F/M	56/54	81/0	10/32	9/35	12/25	16/20
Age, y	54.4 ± 17.8	43.0 ± 14.7	58.4 ± 16.3	61.7 ± 13.1	44.0 ± 19.5	53.9 ± 21.2
LOS	5.6 ± 5.3	3.0 ± 3.0	8.1 ± 8.6	9.4 ± 7.2	4.9 ± 3.1	5.5 ± 5.7
BMI	25.6 ± 5.7	26.3 ± 5.4	25.2 ± 5.3	22.7 ± 5.6	24.4 ± 4.8	26.1 ± 5.1
CC	34.0 ± 4.7	35.8 ± 3.8	33.5 ± 5.2	32.5 ± 3.5	33.5 ± 4.4	35.2 ± 4.0
AC	29.7 ± 5.4	30.7 ± 4.7	28.6 ± 4.3	27.3 ± 5.0	29.0 ± 3.3	29.7 ± 4.9
TST	19.7 ± 11.0	25.9 ± 9.4	17.0 ± 9.7	12.8 ± 8.7	16.3 ± 7.2	19.7 ± 11.0
SST	18.7 ± 9.0	23.0 ± 8.2	16.5 ± 7.4	15.3 ± 7.4	17.7 ± 8.3	18.6 ± 7.8
MAMC	235.7 ± 35.0	225.6 ± 27.5	233.2 ± 36.7	233.4 ± 38.7	238.8 ± 29.1	235.2 ± 39.5
AMA	45.0 ± 13.5	41.1 ± 10.0	44.4 ± 13.3	44.5 ± 14.5	46.0 ± 11.0	45.8 ± 14.9
AFA	27.3 ± 18.3	35.7 ± 17.0	22.6 ± 14.0	17.0 ± 14.0	23.3 ± 13.0	26.1 ± 15.7
LC	1448.0 ± 785.5	2066.5 ± 683.9	1852.2 ± 675.8	1338.3 ± 834.6	1747.0 ± 497.4	1227.0 ± 558.5
HB	12.6 ± 2.4	12.4 ± 1.8	11.7 ± 2.3	12.3 ± 2.8	13.0 ± 1.8	12.0 ± 2.7
HEI	1568.3 ± 745.5	1376.1 ± 485.2	1510.4 ± 617.3	1404.0 ± 506.9	1663.1 ± 624.7	1478.4 ± 609.9
Energy need	1978.5 ± 376.3	1886.6 ± 291.8	2038.0 ± 428.1	2183.1 ± 397.8	2120.6 ± 432.3	2140.1 ± 311.3
%HEI/EN	79.9 ± 38.7	75.3 ± 32.5	78.6 ± 41.1	67.4 ± 28.9	81.5 ± 30.9	68.5 ± 23.5

AC, arm circumference (cm); AFA, arm fat area (cm^2); AMA, arm muscle area (cm^2); BMI, body mass index (kg/m^2); CC, calf circumference (cm); DTD, digestive tract diseases; HB, hemoglobin (mg/dl); HEI, habitual energy intake (kcal); %HEI/EN, % adequacy of the HEI in relation to the total energy need (TEN); LC, lymphocyte count (cel/mm^3); LOS, length of hospital stay in days; MAMC, mid-arm muscle circumference (mm); SST, subscapular skinfold thickness (mm); TST, triceps skinfold thickness (mm). *Values (except for gender) given as mean ± SD.

Table 2. Nutrition Status of the Population Classified by Body Mass Index, According to Type of Disease, no.(%)

Disease	Overweight (Obese)	Normal Weight	Underweight (Malnutrition)
Digestive tract diseases	41 (43.6)	38 (40.4)	15 (15.9)
Gynecological	41 (55.4)[a]	30 (40.5)	3 (4.0)
Vascular	13 (36.1)	17 (47.2)	6 (16.6)
Neoplasms	10 (25.6)	17 (43.5)	12 (30.7)[a]
Trauma	8 (29.6)	17 (62.9)	2 (7.4)
Other	17 (51.5)	11 (33.3)	5 (15.1)
Total	130 (42.9)	130 (42.9)	43 (14.1)

[a]p = .0048, according to the chi-square test.

The number of patients, age, gender, LOS, anthropometric indicators, laboratory indicators, and energy intake according to type of disease are shown in Table 1.

The nutrition status of the population classified by BMI is shown in Table 2. A greater prevalence of obesity among patients with gynecological diseases was found compared with patients who had malignant neoplasms, who were more likely to be malnourished or underweight (P = .0048).

Table 3 shows the descriptive and comparative analysis of the studied variables compared with LOS. LOS was greater for males ($P < .0001$), those aged ≥60 years (P = .0008), those with neoplasms ($P < .0001$), those who lost weight during their stay ($P < .0001$), and those who were underweight (P = .0034). When the LOS and nutrition status according to the subjective assessment were analyzed, it was shown that those who had been classified as malnourished also remained in the hospital for longer periods. There was a statistically significant difference between the groups (10.1 ± 8.7 days, P = .0005) (Table 3).

Spearman's linear correlation coefficient was used to study the relationship between LOS and anthropometric and laboratory indicators and energy intake. A positive correlation was found for age (r = 0.263, $P < .0001$) and a negative correlation was found for CC (r = −0.182, P = .0010), AC (r = −0.138, P = .0114), TST (r = −0.228, $P < .0001$), SST (r = −0.169, P = .0058), AFA (r = −0.213, $P < .0001$), lymphocyte count (r = −0.234, P = .0058), and hemoglobin (r = −0.286, $P < .0001$). No correlation was found for the other indicators (BMI, MAMC, AMA, HEI, and energy need).

Table 3. Comparison of the Length of Hospital Stay in Relation to Gender, Age, Disease, Recent Weight Change, Weight Variation During Hospital Stay, Body Mass Index, and Subjective Assessment

	Length of Hospital Stay in Days			
Variables	n	Mean ± Standard Deviation	Median	*P*
Gender				
Female	184	4.6 ± 5.0	3.0	
Male	166	7.0 ± 6.6	5.0	<.0001[a]
Age				
<60 y	230	5.1 ± 5.4	3.0	
≥60 y	120	6.9 ± 6.7	4.0	.0008[a]
Disease				
Digestive tract diseases	110	5.6 ± 5.4	4.0	
Gynecological diseases	81	3.0 ± 3.1	2.0	
Vascular diseases	42	8.2 ± 8.7	5.0	
Neoplasms	44	9.4 ± 7.2	7.5	
Trauma	37	4.9 ± 3.1	5.0	
Other	36	5.6 ± 5.7	4.0	<.0001[b]
Recent weight change				
Yes	189	5.9 ± 6.1	4.0	
No	157	5.4 ± 5.7	4.0	.2710[a]
Weight variation during stay				
Unchanged	169	3.9 ± 2.6	3.0	
Weight gain	32	7.5 ± 6.6	5.0	
Weight loss	69	10.1 ± 8.8	8.0	<.0001[b]
Body mass index				
Overweight	130	5.0 ± 4.5	4.0	
Normal weight	130	5.6 ± 6.8	3.0	
Underweight	43	7.6 ± 5.6	6.0	.0034[b]
Subjective assessment				
Malnourished	32	10.1 ± 8.7	7.0	
At risk of malnourishment	24	7.5 ± 6.5	5.0	
Well nourished	136	5.7 ± 5.8	4.0	.0005[b]

[a]Mann-Whitney test.
[b]Kruskal-Wallis test.

Table 4. Risk Factors Associated With Hospital Length of Stay, Analyzed by Cox's Regression Model in the Total Population

Disease	*P* Value	Relative risk	95% Confidence Interval
Digestive tract disease vs neoplasm	.0002	2.360	1.505–3.701
Gynecological disease vs neoplasm	<.0001	3.834	2.385–6.163
Vascular disease vs neoplasm	.6554	1.134	0.652–1.972
Trauma vs neoplasm	.0679	1.754	0.960–3.205
Other vs neoplasm	.0287	1.813	1.064–3.091

The risk factors for longer hospital stays were assessed and are shown in Tables 4, 5, and 6. The relation of the risk factors associated with LOS according to Cox's regression model can be seen in Table 4. The following risk factors were investigated to see whether they influenced LOS: gender, disease, age, anthropometric indicators (BMI, CC, AC, TST, SST, AMA), HEI, and %HEI/energy need. Cox's model showed that only disease was a significant factor; that is, disease was the factor that had the greatest influence on the LOS for the entire population (adults and elderly) (Table 4).

Cox's regression model was also used to assess LOS in the population aged <60 years and revealed that both disease status and nutrition status according to the SGA were associated with LOS (Table 5).

Because disease was the factor that had the greatest influence on LOS, the different risk factors that increase

Table 5. Risk Factors Associated With Hospital Length of Stay, Analyzed by Cox's Regression Model in the Population Aged <60 Years

Disease	*P* Value	Relative risk	95% Confidence Interval
Digestive tract disease vs neoplasm	.0648	1.921	0.961–3.840
Gynecological disease vs neoplasm	.0331	2.366	1.072–5.222
Vascular disease vs neoplasm	.7298	0.859	0.363–2.032
Trauma vs neoplasm	.6098	0.789	0.318–1.957
Other vs neoplasm	.5291	0.739	0.288–1.896
SGA (WN vs SM or MM)	.0002	3.287	1.741–6.206

SGA, subjective global assessment; SM, slightly malnourished; MM, moderately malnourished; WN, well nourished.

Table 6. Risk Factors Associated With Length of Hospital Stay, Analyzed by Cox's Regression Model in the Population With Digestive Tract Disease

Nutrition status[a]	*P* Value	Relative Risk	95% Confidence Interval
At risk of malnutrition vs malnourished	.7710	1.171	0.405–3.387
Well nourished vs malnourished	.0233	2.557	1.136–5.755

[a]Nutrition status assessed by the subjective global assessment in adults and mini nutrition assessment in the elderly subjects.

LOS were investigated for the most common diseases (DTD) and diseases that had the greatest impact on nutrition status and LOS (malignant neoplasms) (Tables 6).

Thus, Cox's regression model showed that for patients with DTD, the nutrition status according to the subjective assessment was the risk factor that most influenced LOS (Table 6). Among patients with neoplasms, the factor that had the greatest influence on LOS was AC ($P = .0097$; RR = 1.101; 95% CI, 1024–1185).

Discussion

Hospital malnutrition has been the target of many studies in the last years, and prevalence ranging from 15% to 50% has been found among hospitalized patients.[1,3,6,16] This shows that BMI is an indicator of little sensitivity when used to detect hospital malnutrition, because it is not sensitive to acute malnutrition processes such as unintentional weight loss by patients with fat reserves, which happened in many of the patients of this study.

In this study, the preoperative nutrition status of 350 patients with various diseases was assessed as they were admitted to the surgery unit of a large university hospital. Malnutrition was diagnosed in 14.1% of patients according to their BMI. When analyzed separately, malnutrition was found in only 2.97% of the adult patients (aged ≤59 years) and in 36.6% of the elderly patients (aged ≥60 years). SGA and MNA revealed a malnutrition rate of 0.84% among adults and 10.96% among elderly subjects, respectively. Therefore, it was possible to verify that this study did not find a high prevalence of malnutrition among adult patients, given that most of them were normal weight or overweight, contrary to other studies done in Brazil that found high indices of hospital malnutrition.[11] However, as reported by other studies, a high prevalence of malnutrition was found among the elderly subjects[16]: the risk of malnutrition increases with age.

This study also found that the nutrition diagnosis given by BMI, SGA, or MNA assessment did not coincide in this population. The SGA can also be used in elderly people, but in this study we chose to implement the MNA, because this is a more specific method for use in elderly people. There are studies that show differences in the interpretation of nutrition status between these 2 criteria.[27] It is known that the prevalence of malnutrition can vary according to the type of population or institution studied or the diagnostic criteria used.[17]

Studies in European hospitals have shown a prevalence of malnutrition of 10%–50%, depending on the group of patients studied.[2] In a British study, Stratton et al[5] revealed that the risk of malnutrition among inpatients ranged from 19% to 60%, and a study done in German hospitals that used the SGA to assess malnutrition found a prevalence of 27.4%.[28] Recently, a study of hospitalized patients done in Turkey found 15% of them to be at nutrition risk.[16] Other recent studies found prevalences of 30% and 50%.[29,30]

This study found that 25.56% of the patients lost weight during their hospital stay. This is a worrisome fact, because literature shows that isolated weight loss or weight loss combined with other assessment parameters is considered the main indicator of a poor nutrition status.[31]

It is important to point out that the studied population included patients with malignant neoplasms. These patients are usually at some risk of malnutrition, are malnourished, or are losing weight.[16,32]

When the nutrition indicators were descriptively analyzed for the entire studied population (mean and standard deviation, Table 1), nutrition status was not largely compromised but the same did not hold true for patients with neoplasms. When nutrition status was assessed separately by each studied criterion, 14.1% of the patients were underweight or malnourished and those with neoplasms were at greater risk of malnourishment. Another study reported a similar finding.[16]

The %HEI/energy need revealed that energy intake was inadequate, especially among patients with neoplasms, who presented the lowest energy intakes. In this case, our data suggest that greater nutrition care regarding energy intake is necessary because some recent studies have shown that low energy intake is a risk factor for hospital mortality in some cases.[33]

The different nutrition diagnoses obtained by the different indicators assessed in this study is something to bear in mind, but all of them showed that elderly people were at greater nutrition risk. Even though normal weight or overweight was more prevalent, disturbing indices of malnutrition were found among the patients and, as shown by Table 3, LOS is always greater among those at some nutrition risk. Yet, the prevalence of malnutrition found by this study was lower than that found by other studies or studies done in other regions.[11,12,28] Many factors can explain these differences, such as the variety of diseases and assessment instruments.[34] If we exclude from this analysis patients with gynecological diseases, the malnutrition rates would likely be higher, because overweight or obesity rates were high in this population.

Our study found that males, patients aged ≥60 years, patients with neoplasms, patients who lost weight during their stay, and malnourished patients according to the subjective assessment (Table 3) had significantly greater LOS. Some recent studies reported a similar finding[9]; malnourished patients had longer hospital stays. When LOS and the studied nutrition indicators were analyzed, there was a significant but weak negative correlation among these parameters. Some studies show that malnutrition can contribute to an increased LOS[9,10] and others show a weak correlation between SGA and LOS,[6] but all of them reinforce the need of nutrition follow-up to prevent malnutrition and decrease LOS.

In our study, many patients presented some degree of malnutrition, and in the investigation of risk factors associated with LOS, Cox's regression model identified disease as being the most influencing factor (Tables 4 and 5). All non–neoplastic diseases were compared with neoplasms, because these patients had the longest LOS. Except for vascular diseases and trauma, non–neoplastic diseases are likely to result in shorter LOS than neoplasms (Table 4). Disease and SGA were the significant variables in the population aged 59 years and younger. In addition to disease (Table 5), SGA was the factor that most associated with LOS. Well-nourished patients are 3 times more likely to stay in the hospital for shorter periods (P = .0002; RR = 3.3 [1.7–6.2]) compared with those having some degree of malnutrition.

Regarding DTDs (because they were the most common), Cox's regression model showed that the well-nourished patients according to the SGA (Table 6) were more likely to remain in the hospital for shorter periods (P = .02, RR = 2.5 [1.1–5.8]). Because neoplasms were the diseases that presented the greatest LOS and compromised nutrition status the most, we investigated which parameter reflected this finding best and found it to be AC: as AC increased, LOS decreased (P = .009, RR = 1.1 [1.0–1.1]). AC was an independent risk factor to assess LOS, and among patients with neoplasms, it is easier to use AC than weight because many of these patients are non-ambulatory and therefore cannot be weighed.

Conclusions

In the conditions of this study and after comparison of the studied variables, LOS was greater among males, those aged ≥60, those with neoplasms, those who lost weight during their stay, and those who had been classified as malnourished according to the SGA or MNA. When the entire population is considered, LOS was associated with disease and nutrition status. When the most common disease, DTD, was studied, the nutrition status according to the SGA (for adults) and MNA (for elderly) determined the LOS, whereas AC determined the LOS for those with malignant neoplasms.

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