Identification of malnutrition risk factors in hospitalized patients

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Summary

Objective: To identify factors associated with the risk of malnutrition in hospitalized patients. **Methods:** Cross-sectional study, performed in a general hospital located in São Paulo, in a convenience sample of 300 adult individuals, aged 18 to 64 years. A structured questionnaire was applied consisting of anthropometric, clinical and dietary data, and the patients were evaluated and dichotomized into malnourished and non-malnourished. A multiple logistic regression was performed to identify the factors associated with malnutrition. The variables were organized according to the values of odds ratio (OR), confidence interval (95% CI), regression coefficient (β) and descriptive level of significance (p). **Results:** The malnutrition occurred in 60.7% and the variables associated with malnutrition were: recent and involuntary weight loss, apparent bony structure, decreased appetite, diarrhea, inadequate energy intake and male sex. **Conclusion:** The factors associated with malnutrition can be identified at hospital admission and lead to a nutritional evaluation that will allow adequate intervention and nutritional therapy.

Keywords: Nutrition assessment; inpatients; malnutrition.

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Introduction

The high global prevalence of malnutrition in hospitalized patients has been widely documented over the past four decades[1-6]. Several studies analyzing hospital malnutrition have correlated its presence and consequences, such as increased frequency of clinical complications and mortality, impact on costs and hospital length of stay; the longer the patient stays in the hospital, the greater the risk of malnutrition worsening[7].

Malnutrition in hospitalized individuals is the result of a number of factors and may be associated with the disease and/or its treatment[7]. One major cause is inadequate dietary intake and there are several clinical situations that can cause loss of appetite or impaired food intake, as well as examinations and procedures that require fasting and changes in diet composition[8]. Moreover, inadequate detection and intervention can lead to the worsening of nutritional status during hospitalization[9].

The evaluation of a patient's nutritional status is obtained through the nutritional assessment, consisting of methods based on anthropometric measurements, observation of clinical signs of malnutrition, altered biochemical test results detecting low levels of plasma proteins and immunity-mediating cells, as well as evaluation of dietary intake[10,11].

Nutritional status assessment may be preceded by the identification of risks for malnutrition by nutrition screening tools. Although there is no consensus on definition and procedures, some institutions have published guidelines on the subject. In 1994, the ADA (American Dietetic Association)[12] defined nutritional risk as the "presence of factors that may cause and/or aggravate malnutrition in patients" and the ESPEN (European Society of Parenteral and Enteral Nutrition)[13,14] as the "risk of nutritional status impairment due to current medical conditions." The ASPEN (American Society of Parenteral and Enteral Nutrition)[15] considers that the risk factors that can compromise the nutritional status of patients are: weight loss, chronic diseases, increased nutritional needs, dietary changes and the need for enteral and/or parenteral nutrition.

Nutritional risk is associated with variables related to the patient's general status and history of present illness, and may also include physical, social and psychological factors. In order to provide an adequate nutritional therapy, identifying patients at risk is crucial to treatment[15,16].

The identification of malnutrition is an important goal in the global attention to the hospitalized patient. A proper diagnosis is essential for an individualized nutrition therapy to be started as soon as possible. The identification of risk factors is essential for the work of the healthcare team to benefit the patient.

Within this context, the objective of this study was to identify factors associated with risk of malnutrition in hospitalized patients.

Methods

This was a cross-sectional observational study, carried out in a general hospital in São Paulo between January and December 2005. It included individuals that had been hospitalized for a day or two, of both sexes, aged between 18 and 64 years. The exclusion criteria were: patients unable to communicate, to be assessed by anthropometric parameters and admitted for obstetric or psychiatric reasons.

Patients were informed about the study objectives and signed a free and informed consent form if they agreed to participate. The study was approved by the Ethics Research Committee of Faculdade de Saúde Pública, Universidade de São Paulo, protocol No. 828.

Considering the prevalence of malnutrition as about 50%[4,5], a convenience sample of 300 patients was statistically estimated.

Patient nutritional assessment

A structured questionnaire was prepared based on the criteria recommended by ADA[12,17], consisting of six sets of data related to: patient identification (personal and sociodemographic data), medical information (reason for hospital admission and diagnosis); nutritional data (appetite assessment and changes in the digestive tract), data on food consumption (recent dietary changes and description of present diet); observation of clinical signs of nutritional deficiencies (observation of hair, skin, nails, eyes, mouth, bones, muscles and presence of edema) and evaluation of anthropometric data (measurement and evaluation of weight, circumferences and skinfolds).

Anthropometric measurements were carried out during the interview and collected by a single examiner (study author) to avoid biases in data collection and interpretation. Weight and height were measured with a portable scale and stadiometer. Measures of body circumferences (arm and calf) and triceps and subscapular skinfold were taken with the patient in the standing position and carried out three times to obtain a mean value. We employed the techniques adopted by Frisancho[18] and the analysis was performed based on percentile tables.

Weight was measured in kilograms using a Plenna® scale, model MEA 07400. Individuals were weighed barefoot wearing light clothes. Height was obtained using a SOEHNLE® electronic stadiometer, model 5001, with subjects standing barefoot in the standing position. To calculate the body mass index (BMI), weight (kg) was divided by height (m) squared. The arm and calf circumferences were obtained with an inelastic measuring tape and skinfold thickness were measured using a Holtain Skinfold Caliper adipometer (0 to 40 mm x 0.2 mm). Evaluations of anthropometric measurements were performed using the software NUTWIN - Nutrition Support Program, Universidade Federal de São Paulo (UNIFESP–EPM)[19].

Regarding the data on consumption, a regular diet was investigated in the last week before hospital admission and analyzed using VIRTUAL NUTRI[20], resulting in total energy value (TEV). The TEV was compared to patient needs, estimated from the formula for basal metabolic rate, adopting a multiple of very light physical activity (1.3) or bedridden (1.2) and the injury factor of the disease[21]. The criterion for inadequate intake was ≤ 75% of the estimated energy needs[22].

The criterion adopted for the diagnosis of malnutrition was the presence of at least one of the following anthropometric parameters: BMI < 18.5 kg/m^2, with no recent history of weight loss, BMI < 20.0 kg/m^2, with a history of recent and unintentional weight loss, triceps (TSF) and subscapular (SSSF) skinfold thickness or the sum of both ≤ 5th percentile, triceps (TSF) and subscapular skinfold thickness (SSSF) or sum of both ≤ 15th percentile, when associated with recent and unintentional weight loss; recent and unintentional weight loss ≥ 3% within a month or similar or ≥ 5% in the last six months or any period that the patient could not specify, but reported as recent.

Statistical analysis

For statistical analysis of data, we chose the logistic regression method, recommended by Jones[23], with the objective of evaluating the effect of each variable on the risk of malnutrition. Malnutrition was established as the dependent variable and forty-five independent variables were selected, organized from the general questionnaire. Malnutrition was considered a binary variable (presence or absence) and the strength of association between variables was expressed as odds ratios (OR) with 95% confidence interval (95% CI) and statistical significance level of 5%.

The analysis of variables that could be associated with malnutrition was initially performed using the Chi-square test, followed by single and multiple analysis, using the stepwise backward model. The program used for data analysis was Statistical Package for Social Science (SPSS), version 10.0 for Windows.

Results

The population consisted of 300 subjects, 52.7% female and 47.3% male. The most frequent age range was 30 to 49 years and the mean age was 45.2 years (SD = 11.8 years). Malnutrition occurred in 60.7% of the sample and the majority of the individuals were males (73.2%). At the univariate regression analysis, fifteen variables were associated with malnutrition ($p < 0.05$) and were organized starting with the most frequently observed (Table 1).

Considering the variables related to body weight assessment, recent and involuntary weight loss was the most frequent (64% of the sample) (Table 1) and 91.2% were malnourished (Figure 1). The highest frequency in the percentage of loss in relation to the usual weight was between 10 to 20% (29.3%), in a period of 1 to 3 months (43.2%) and the mean loss was 15.8 kg (SD = 8.6 kg). At the assessment of clinical signs of malnutrition, the apparent bony structure was observed in 37.7% of the population (Table 1) and 98.2% were malnourished (Figure 1).

Regarding the type of hospital treatment, it was observed that most were admitted for clinical treatment (63.3%) and diagnosis of cancer was the cause of hospitalization in nearly half the sample (43.3%) (Table 1) and most were malnourished (69.2%) (Figure 1).

Concerning the variables associated with the current food intake, recent changes in eating habits were reported by 40.7% of the population (Table 1) and the most frequent change was a reduction in the amount of food consumed (96.4%). When assessing the adequacy of energy intake, we observed that 48.0% of the population did not have individual needs met (Table 1) and of these, 81.9% were malnourished (Figure 1). The average energy consumption observed was 1507.0 kcal/day (SD = 763.8 kcal) and the mean among malnourished individuals (1241.7 kcal, SD = 711.5 kcal) was lower ($p < 0.05$) than among non-malnourished ones (1916.1 kcal, SD = 655.5 kcal).

In the assessment of clinical variables, most did not have recent hospitalizations (58.0%) or weakness (59.0%) (Table 1). However, when assessing these variables and the presence of malnutrition, frequencies of 70.6% and 82.9% were observed, respectively (Figure 1). Regarding the self-assessment of current health, 47.0% considered it adequate, even considering the presence of disease and hospitalized patients and of these, 71.7% were malnourished.

Among the recent alterations in the digestive tract that were investigated (alterations in dentition and deglutition, nausea and vomiting, changes in gastric digestion, diarrhea, constipation and intolerance) the most frequent ones associated with malnutrition were gastric alterations (36.7%) and nausea and vomiting (23.3%) (Table 1) and the frequency of malnourished individuals between the two variables was 70.9 and 84.8%, respectively (Figure 1). Diarrhea was common in 13.3% of the sample and 82.5% of them were malnourished (Table 1 and Figure 1).

The variables initially associated with malnutrition were used in a multiple logistic regression model, and although age did not show any significant association, it remained as adjustment variable. The variables that maintained the association were: recent weight loss, apparent bony structure, decreased appetite, diarrhea, inadequate energy intake and male sex. It was observed that recent and involuntary weight loss was the most important risk of malnutrition (OR = 58.03, 95% CI = 18.46-182.41, $p < 0.001$) (Table 2).

Table 1 – Frequency of factors associated with malnutrition (p < 0.05) after univariate logistic regression in São Paulo, 2005

Variable	Category	Malnutrition				Total	
		Yes		No			
		n	(%)	n	(%)	n	(%)
Weight loss	Yes	175	(86.3)	17	(14.4)	192	(64.0)
	No	7	(13.7)	101	(85.6)	108	(36.0)
Type of treatment	Clinical	135	(74.2)	55	(46.6)	190	(63.3)
	Surgical	47	(25.8)	63	(53.4)	110	(36.7)
Energetic intake	Inadequate	118	(64.8)	26	(22.0)	144	(48.0)
	Adequate	64	(35.2)	92	(78.0)	156	(52.0)
Health self-assessment	Inadequate	114	(62.6)	45	(38.1)	159	(53.0)
	Adequate	68	(37.4)	73	(61.9)	141	(47.0)
Change in dietary habits	Yes	113	(62.1)	9	(7.6)	122	(40.7)
	No	69	(37.9)	109	(92.4)	178	(59.3)
Apparent bony structure	Yes	111	(61.0)	2	(1.7)	113	(37.7)
	No	71	(39.0)	116	(98.3)	187	(62.3)
Appetite decrease	Yes	110	(60.4)	9	(7.6)	119	(39.7)
	No	72	(39.6)	109	(92.4)	181	(60.3)
Sex	Male	104	(57.1)	38	(32.2)	142	(46.7)
	Female	78	(42.4)	80	(67.8)	158	(53.3)
Weakness	Yes	102	(56.1)	21	(17.8)	123	(41.0)
	No	80	(43.9)	97	(82.2)	177	(59.0)
Cancer diagnosis	Yes	90	(49.4)	40	(33.9)	130	(43.3)
	No	92	(50.6)	78	(66.1)	170	(56.7)
Previous and recent hospitalizations	Yes	89	(48.9)	37	(31.4)	126	(42.0)
	No	93	(51.1)	81	(68.6)	174	(58.0)
Gastric alterations	Yes	78	(42.9)	32	(21.1)	110	(36.7)
	No	104	(57.1)	86	(72.9)	190	(63.3)
Pain when eating	Yes	77	(42.3)	6	(5.1)	83	(27.7)
	No	105	(57.7)	112	(94.9)	217	(72.3)
Nausea and vomiting	Yes	67	(36.8)	12	(10.2)	79	(26.3)
	No	115	(63.2)	106	(89.8)	221	(73.7)
Diarrhea	Yes	33	(18.1)	7	(5.9)	40	(13.3)
	No	149	(81.8)	111	(94.1)	260	(86.7)

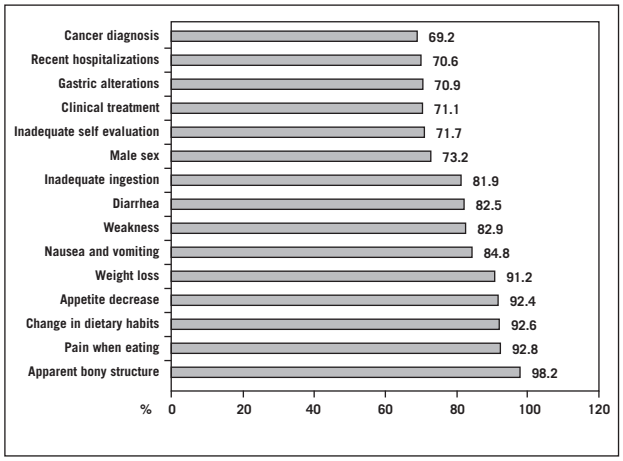

Figure 1 – Frequency of malnutrition among the nutritional risk associated factors (p < 0,05) in São Paulo, 2005.

Discussion

The frequency of malnutrition of 60.7% was very similar to that of other studies carried out in Brazil[4], Latin America[5] and in the world[6], supporting the assertion that over the last four decades, the prevalence of malnutrition has remained high[10] with the consequent increase in hospital length of stay, complications and hospital costs[7].

Within this context, the results of the regression analysis identified predictive variables, i.e., associated with malnutrition in this population. Regarding the variables (recent weight loss, apparent bony structure, decreased appetite, diarrhea and inadequate energy intake), it can be observed that they are often found in similar studies to identify nutritional risk[24-34], methods that are generally subjective and essentially clinical.

Table 2 – Factors associated with malnutrition after multiple logistic regression, according to values of OR (odds ratio), 95% confidence interval (95% CI) and coefficient of regression (β) in São Paulo, 2005

Independent variable	OR	95% IC	β	p
Recent weight loss	58.03	(18.46-182.41)	4.06	< 0.001
Apparent bony structure	47.62	(5.89-384.96)	3.86	< 0.001
Decrease in appetite	10.31	(2.23-47.55)	2.33	0.003
Diarrhea	8.54	(1.32-55.38)	2.14	0.025
Inadequate energetic intake	3.68	(1.03-13.12)	1.30	0.045
Male sex	3.51	(1.17-10.52)	1.26	0.025

Detsky et al.[24,25] validated the Subjective Global Assessment of Nutritional Status (SGA) with variables similar to those in this study. SGA is a commonly used method in clinical practice consisting of an interview about recent changes in body weight, changes in eating habits, gastrointestinal alterations and illness stress assessment.

Weight loss was the main observed variable and the strongest predictor of malnutrition (OR = 58.03, 95% CI: 18.46-182.41, p < 0.001). In a study by Kruizenga et al.[33], weight loss was the main risk factor and the values were similar (OR = 37.7, 95% CI: 10.7-57.3, p < 0.001). Elmore et al.[26] developed a predictive equation based on variables associated with malnutrition, using the percentage of weight loss together with the levels of serum albumin and total lymphocyte count.

The process of weight loss, regardless of the individual's usual weight, is considered a process of malnutrition in itself even if the patient remains within the normal standards after the body alterations[35]. However, weight loss is not an easy variable to quantify, as it depends on the patient's information and constant observation. Several studies have shown that weight loss can be measured indirectly, as in the study by Ward et al.[27], where it was associated with the patient's perception and a significant association with malnutrition was observed.

Unlike the subjective information on body weight reduction, clinical observation of an apparent bony structure was evaluated with the aim of perceiving loss of body fat and muscle mass and identifying visibly emaciated patients. It was a variable associated with malnutrition (OR = 47.62, 95% CI: 5.89-384.96, p < 0.001) and observed in 60.9% of malnourished individuals. Egger et al.[36] studied patients undergoing nutritional therapy and observed anthropometric, biochemical, and clinical parameters and verified that the physical examination was the best method to identify malnutrition.

The apparent bony structure, or any other variable used in order to identify clinical signs of malnutrition, is poorly studied in developed countries. Ward et al.[27] found an association with the question, "has the patient lost weight?" (p < 0.05) and among the studied variables, it was the most strongly associated with malnutrition. However, it is important to consider that about 40% of the sample had malnutrition, but no apparent bony structure. The observation of clinical signs depends on the nutritional status of the individual when the process of malnutrition begins and the current phase in which the individual is when evaluated.

Regarding appetite decrease, it is often observed that it is an important variable associated with malnutrition[24-34]. In the present study, appetite decrease increased the chance of malnutrition in about ten times (OR = 10.31, 95% CI: 2.23-47.55, p = 0.003) and in the study by Ferguson et al.[28] this variable showed the best sensitivity and specificity. Decreased appetite is a variable that depends on information obtained from the patients and may indirectly assess food intake. It should be noted that appetite may be preserved even when reduced food intake is observed[7,9,35].

Alterations in the digestive tract that make nutrient digestion and/or absorption difficult or impossible are often indicated as nutritional risk factors[27,28,30]. In the univariate analysis of the present study, all variables associated with the digestive tract were significant: nausea and vomiting, diarrhea, lip, mouth and throat alterations, presence of pain with food intake impairment (p < 0.05). However, only diarrhea remained in multivariate analysis (OR = 8.54, 95% CI 1.32-55.38, p = 0.025). Changes in the gastrointestinal tract symptoms are usually a result of disease or treatment consequence and may have an important impact on nutritional status of the individual, as they affect food intake.

In this study, inadequate food intake was a factor associated with malnutrition, and the average energy consumption was lower among malnourished individuals than among non-malnourished ones (p < 0.05). However, the evaluation of energy intake adequacy depends on the accuracy with which individual needs and consumption are estimated. The use of predictive equations of basal metabolism, multiple factors of physical activity and injury factors related to the disease are subject to operating errors[21].

Few studies to identify risk factors studied energy assessment and its relation with the needs, as it requires careful data collection and analysis[30,31]. What is most often observed is the variable to be assessed indirectly with questions about the decrease in consumption, changes associated with consistency and reduction in frequency of meals[32,33].

Laporte et al.[31] carried out a study to identify variables predictive of malnutrition, asking the population for information on the current consumption (normal or less than half of what is usually eaten). Ward et al.[36] assessed variables associated with malnutrition and dietary changes, according to changes in consistency (need for a higher amount of fluids in the diet), decrease in the number of meals and recent directions not to consume some types of food. Both studies found an association between malnutrition and dietary variables ($p < 0.05$).

In longitudinal studies, the energy intake evaluation occurs during the hospitalization period. Barton et al.[37] found that 40% of hospitalized patients do not have the energy needs met, as well as what was observed by Depertuis et al.[38] in 57% of their sample.

In the study population, the male sex was a factor associated with malnutrition; the frequency observed among men and women was 73.2% and 49.4%, respectively, and males had an approximately three-fold higher chance of having malnutrition (OR = 3.51 95% CI 1.17 to 10.52, $p = 0.025$). Pirlich et al.[39] studied social factors in hospitalized patients (adult and elderly individuals) and found a positive association with the male sex aged 65 years and older ($p < 0.05$). However, Splett et al.[35] observed that weight loss during hospitalization was higher in women than in men ($p < 0.05$).

To discuss the findings, some considerations are important. In clinical practice, it is observed that men seek healthcare services later than women. This behavior is due to several reasons: men do not have the habit of consulting for preventive measures and are much less attentive to changes in weight and food consumption than women. Thus, the hypothesis is that, when hospitalized, they may have more chances of being malnourished.

Conclusion

After the analysis of variables associated with malnutrition (recent weight loss, apparent bony structure, decreased appetite, diarrhea, inadequate energy intake and male sex), it can be observed that most can be obtained at hospital admission.

The identification of malnutrition risk in patients based on predictive variables is the first step to attain proper nutritional care, in order to reduce the frequency of malnutrition and its consequences. Each institution must identify the most frequent factors in the population, develop their own nutritional screening tools or adopt those among the recommended, developed and adequately validated ones.

Malnutrition prevention and treatment is a major challenge. A proper diagnosis is essential for the nutritional therapy to be started as soon as possible, allowing an efficient dietetic-therapeutic intervention. Diagnosis needs to be achieved early, and nutritional status monitoring is the responsibility of the entire healthcare team that treats inpatients. Nutritional intervention in patients at risk of malnutrition leads to a better prognosis, reducing the morbidity and mortality, improving quality of life.

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