BRIEF COMMUNICATION

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Nutritional indicators of malnutrition in hospitalized patients

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ABSTRACT – **Background** – Malnutrition is associated with clinical factors, including longer hospital stay, increased morbidity and mortality and hospital costs. **Objective** – To investigate the prevalence of malnutrition using different nutritional indicators and to identify factors that contribute to malnutrition in hospitalized patients. **Methods** – We investigated anthropometric, laboratory standards, nutritional risk screening (NRS), subjective global assessment (SGA), mini nutritional assessment and habitual energy consumption (HEC). Chi-square, Fisher's exact test, Mann-Whitney test and univariate and multiple Cox regression analysis were used, at 5% significance level. **Results** – It was found 21.01% of malnourished individuals by ASG; a total of 34.78% with nutritional risk according to NRS and 11.59% with low weight (BMI). There was no statistically significant difference in the prevalence of malnutrition by ASG (*P*=0.3344) and nutritional risk by NRS (*P*=0.2286), among the types of disorders. Patients with nutritional risk were of higher median age (64.5 vs 58.0 years; *P*=0.0246) and had lower median values of HEC (1362.1 kcal vs 1525 kcal, *P*=0.0030), of calf circumference (32.0 cm vs 33.5 cm, *P*=0.0405) of lymphocyte count (1176.5 cell/mm^3 vs 1760.5 cell/ mm^3, *P*=0.0095); and higher percentage of low body weight according to the BMI (22.9% vs 5.6%; *P*=0.0096). Lymphocyte count was associated with nutritional risk (*P*=0.0414; HR= 1.000; IC95%= 0.999; 1.000). **Conclusion** – NRS was more sensitive than other indicators in the diagnosis of malnutrition. Patients at risk were older and had lower HEC values, calf circumference, BMI and lymphocyte count. Low lymphocyte count was considered a factor associated with nutritional risk by the NRS.

HEADINGS – Health status indicators. Malnutrition. Nutrition assessment. Nutritional status.

INTRODUCTION

Malnutrition is associated with clinical factors, including longer hospital stay[1-4], increased morbidity and mortality[1,5] and hospital costs[4].

A recent systematic review, developed by Correia et al., 2017[4], indicated a high prevalence of malnutrition in Latin American countries[4]. Tangvik et al., 2015[6] determined the nutritional risk profile in a hospital population and showed that diseases of higher prevalence were infections, cancer and lung diseases[6].

Martin-Palmero et al., 2017[3], investigated the prevalence of malnutrition in inpatients in Spain and showed that approximately half of the patients in medical and surgical wards were malnourished; and this was associated with longer hospital stay, medication and mortality[3].

This preliminary study aimed to investigate the prevalence of malnutrition by different nutritional indicators and type of disease, and to identify factors that contribute to malnutrition in hospitalized patients.

METHODS

Study characteristics

A cross-sectional study, with 138 (n=138) adult and elderly inpatients. Inclusion criteria included, age ≥20 years; complete entries of clinical and nutritional data in medical records and assessment of nutritional status during the first 24 hours of hospitalization. Patients with incomplete entries for such information in the medical records and those hospitalized only for diagnostic investigation and exams were excluded. This study is part of a larger project that is investigating the presence of malnutrition in patients hospitalized for different kinds of diseases and indicators, previously approved by the institution's ethics and research committee (opinion no. 2,312,714). We investigated variables such as age, sex, type of disease, hospitalization time, anthropometric and laboratory standards, nutritional screening tools, energy consumption and the kind of diet prescribed during hospitalization.

Anthropometric and laboratory indicators

According to standardized procedures and cutoff points defined in the literature, the body mass index (BMI) grading was used both for adults and the elderly[7,8]. According to Frisancho (1990)[9] and Burr & Phillips (1984)[10], arm circumference (AC), triceps skinfold (TSF) and arm muscle circumference (AMC) were classified by percentiles grades. Calf circumference (CC) was classified according to WHO definition[11].

Laboratory tests for lymphocyte count (LC) (cell/mm^3), white blood cells (cell/mm^3), erythrocytes (cm^3), hematocrit (%), hemoglobin (g/dL) and MCV (fL) were classified according to standardized cut-off points[12].

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Nutritional screening tools (nutritional risk screening-NRS, subjective global assessment-SGA and mini nutritional assessment -MNA)

For nutritional risk detection, NRS was applied[13,14]. This method takes into account BMI, weight loss, decreased food intake and disease severity, classifying the risk by numerical score ≥3 (at risk) and <3 (no risk)[13,14].

Based on weight loss, food consumption and clinical and physical signs of malnutrition, SGA subjectively assessed the patient's nutritional status, being classified as: well-nourished-WN, slightly malnourished-SM, moderately malnourished-MM and gravely malnourished-GM[15]. In this study, patients classified as SM, MM and GM, were considered as malnourished.

MNA classifies the elderly as malnourished, risk of malnutrition and eutrophic, considering dietary and weight changes, physical evaluation, functional capacity, AC, CC, nutritional problems and disease[16].

Percentage of adequacy of habitual energy consumption in relation to individual energy needs (% HEC/EN)

The % HEC/EN was classified as <75% and ≥75%[2,17,18]. This assessment was obtained through the investigation of habitual energy consumption (HEC). The energy requirements were estimated from the Harris & Benedict equation[19].

Statistical analysis

A descriptive analysis was performed with frequencies for categorical variables and position and dispersion measurements for continuous variables. To compare proportions, the chi-square or Fisher's exact test was used when necessary. For the comparison of continuous or orderly measurements between two groups, the Mann-Whitney test was applied. Subsequently, univariate and multiple Cox regression analysis was used to identify the risk factors associated with SGA malnutrition and NRS nutritional risk. The variable selection process was performed stepwise. The level of significance adopted for the statistical tests was 5%[20-22].

Ethical approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national Research Committee (CNS resolution nº. 466/12).

RESULTS

This investigation included a sample of 138 inpatients, the majority being male (n=82; 59.42%). The most frequent diagnoses were: 29.71% of the patients with digestive neoplasia; 24.64% with digestive tract disorders (DTD); 20.29% with vascular diseases; 13.04% with head and neck neoplasia and 12.32% with trauma. The majority (57.25%) had been hospitalized for more than seven days. Regarding nutritional screening instruments, 21.01% patients were found as malnourished by SGA and 34.78% with nutritional risk by NRS. It was observed that 64.49% were classified as malnourished by MNA among the elderly. Using the anthropometric indicators, 11.59% of the patients were rated as low weight by BMI. And in the anthropometric indicators of body composition, we found 32.61%; 16.67% and 47.83% of patients classified ≤ to the 15th percentile (≤ P15), for AC, TSF and AMC, respectively. It was verified that 68.84% of the patients showed a HEC lower than 75% of their estimated energy needs. In the dietary prescription, at the time of hospitalization, 27.54% were fed a general diet; 21.01% a soft diet; 17.39% liquid diet; 7.97% enteral/parenteral diet and 26.09% were prescribed oral fasting. The mean age was 55.67±17.15 years, and the mean length of hospital stay was 10.88±9.04 days. There was no statistically significant difference in the prevalence of malnutrition by SGA (P=0.3344) and nutritional risk by NRS (P=0.2286), among the types of diseases.

A comparison of all variables studied (sex, age, diagnosis, length of stay, fasting time, anthropometric standards, laboratory tests, HEC, type of diet prescribed upon admission) and nutritional status by SGA and nutritional risk by NRS were analyzed by the Mann-Whitney, chi-square and Fischer tests. In this analysis, it was verified that only the TSF class presented a significant difference, when we compared malnourished and well-nourished by SGA, with the percentage of patients with TSF ≤ to the percentile 15; it was higher in the malnourished, according to the SGA (37.9%, P=0.0022).

In the comparison between the studied variables and the NRS, it was verified that the variables age, HEC, CC, LC and low weight (BMI), showed a significant difference when we compared patients with risk and without nutritional risk by NRS. Patients with nutritional risk were characterized by a higher median age (64.5 vs 58.0 years; P=0.0246) and lower mean values in the other numerical variables (HEC: -1362.1 kcal vs 1525 kcal, P=0.0030; CC: -32.0 cm vs 33.5 cm, P=0.0405; LC: -1176.5 cell/mm^3 vs 1760.5 cell/mm^3, P=0.0095), and with a higher percentage of low weight according to the BMI (22.9% vs 5.6%; P=0.0096).

TABLE 1 shows the study of the risk factors associated with malnutrition (SGA), assessed by the Cox regression analysis. It was observed that no variable presented a statistically significant difference at the 5% level, as a factor associated with the risk of malnutrition by SGA.

TABLE 1. Study of the risk factors associated with malnutrition (SGA), assessed by the Cox regression analysis.

Variables	Categories	*P*-value	HR	CI 95%
Age		0.8740	1.002	0.981; 1.023
Gender	Female vs male	0.4006	1.367	0.660; 2.831
Diseases	Digestive tract disorder vs trauma	0.1536	4.500	0.570; 35.518
	Vascular disease	0.4274	2.429	0.271; 21.728
	Head and neck neoplasia	0.2345	3.778	0.422; 33.799
	Digestive neoplasia	0.1462	4.561	0.589; 35.326
Lymphocytes		0.6587	1.000	0.999; 1.000
Leukocytes		0.2586	1.000	1.000; 1.000
Erythrocytes		0.1517	1.100	0.966; 1.254
Hematocrit		0.0890	0.956	0.907; 1.007
Hemoglobin		0.9367	1.006	0.870; 1.163
MCV		0.5588	0.992	0.966; 1.019
HEC	<75% vs ≥75%	0.6995	0.860	0.400; 1.849

MCV: mean corpuscular volume, HEC: habitual energy consumption; HR: hazard ratio.

TABLE 2 shows the risk factors associated with nutritional risk by NRS, assessed by the COX regression analysis. Only the LC variable revealed to be a factor associated with nutritional risk; This risk was associated with lower LC values (P=0.0414, HR=1,000, 95% CI=0.999, 1,000). In other words, every 100 units less lymphocytes, increases the nutritional risk by 4.6%, by NRS.

TABLE 2. Study of risk factors associated with nutritional risk by NRS, assessed by the Cox regression analysis.

Variables	Categories	*P*-value	HR	CI 95%
Age		0.1116	1.014	0.977; 1.032
Gender	Female vs male	0.6641	0.879	0.490; 1.576
Diseases	Digestive tract disorder vs trauma	0.8446	1.125	0.346; 3.653
	Vascular disease	0.6037	1.366	0.421; 4.436
	Head and neck neoplasia	0.5895	1.417	0.400; 5.020
	Digestive neoplasia	0.1832	2.073	0.709; 6.065
Lymphocytes		**0.0414**	**1.000**	**0.999; 1.000**
Lymphocytes	**100 units**		0.956	0.915; 0.998
Leukocytes		0.9461	1.000	1.000; 1.000
Erythrocytes		0.8421	1.015	0.879; 1.171
Hematocrit		0.1900	0.972	0.932; 1.014
Hemoglobin		0.9943	1.000	0.892; 1.122
MCV		0.4931	1.010	0.981; 1.041
HEC	<75% vs ≥75%	0.2213	1.522	0.776; 2.983

MCV: mean corpuscular volume, HEC: habitual energy consumption; HR: hazard ratio.

DISCUSSION

This is a preliminary investigation study of nutritional indicators that are routinely used in hospitalized patients to identify malnutrition. The data found here, perhaps because it was a small sample, did not show any association of SGA and NRS, with the different types of diseases.

Recently, Borek et al., 2017[23], pointed out that malnutrition was highly prevalent among hospitalized patients with kidney diseases, influencing hospitalization length of stay. The authors also showed that the identification of this malnutrition and of the nutritional risk, could help in the implementation of nutritional intervention actions.

In the study by Martín-Palmero, 2017[3], almost half of the patients were considered malnourished, regardless of the nutritional tool used. A high consistency between the NRS and SGA methods was found. In the population in this study, our data indicated 21.01% of malnourished patients by SGA and 34.78% with nutritional risk by NRS. Possibly, in our study, the NRS was more sensitive in the diagnosis of nutritional risk, when compared to malnutrition by the SGA. In the present study, approximately 65% of malnourished patients (MNA) were found among the elderly. Comparisons with other studies have revealed a higher prevalence of nutritional risk in older patients[1,2,4,6]. Patients aged ≥70 years may present a 2.4-fold increased risk of malnutrition[1].

Another study conducted by Wang et al., 2016[24], found that the risk of malnutrition among patients was high, and that NRS and SGA had similar capacity to predict length of stay, costs, infectious complications, and mortality. However, the NRS proved to be a better predictor for noninfectious complications[24].

Our study pointed out that regarding the anthropometric standards, a low percentage of patients with low weight by BMI was found (11.59%); while (21%), and even more was found based on the NRS (almost 35%). A deterioration of nutritional status has been observed in the literature in hospitalized patients, which may occur both at the beginning or during the hospitalization period. Tangvik, et al., 2015[6], investigated the nutritional risk of inpatients (NRS) and found a 29% nutritional risk, with different prevalence in different clinical situations and at more advanced age; besides a prevalence of malnutrition also in those patients with higher morbidity and infections. However, attention was drawn to the fact that nutritional risk was evidenced in patients with normal BMI or overweight[6].

In the present study, those patients with nutritional risk by NRS were significantly associated with older age and lower energy consumption, in addition to presenting lower values of CC, LC and with a higher percentage of low weight by BMI. Finally, this study showed that the LC indicator was associated with nutritional risk by the NRS, when assessed by the Cox regression analysis. A study conducted in Turkey investigated the use of NRS-2002, indicating sensitivity of 88% and specificity of 92%, showing that this is a valid method for assessing nutritional risk in hospitalized adult patients[25]. Another recent study[26] that also used anthropometric, laboratory, NRS and SGA indicators in the first 24 hours hospitalization showed poor clinical outcomes in patients at nutritional risk, indicating further that the prevalence of malnutrition and nutritional risk on discharge was higher than that observed at hospital admission[26].

It is possible to consider as limiting factors of this study, principally the sample size, and as a consequence, the reduced number of patients in each disease category. More research should be conducted with a larger population, which could contribute to more consistent results, evidencing malnutrition and its associated factors in hospitalized patients. Such results may contribute to more effective nutritional interventions in the hospital setting.

CONCLUSION

NRS was more sensitive than other indicators in the diagnosis of malnutrition prevalence. Patients at risk were older and had lower HEC, CC, BMI and LC. Low LC was considered a factor associated with nutritional risk by NRS.

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Authors' contribution

All authors contributed equally to data collection and analysis, and manuscript writing and review.

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RESUMO – **Contexto** – A desnutrição está associada a fatores clínicos, incluindo maior tempo de internação, aumento da morbimortalidade e custos hospitalares. **Objetivo** – Investigar a prevalência de desnutrição por diferentes indicadores nutricionais e identificar fatores que contribuem para a desnutrição em pacientes hospitalizados. **Métodos** – Investigou-se indicadores antropométricos, laboratoriais, *nutritional risk screening*, avaliação subjetiva global (ASG), mini avaliação nutricional e consumo energético habitual (CEH). Utilizou-se os testes qui-quadrado, exato de Fisher, Mann-Whitney e análise de regressão de Cox univariada e múltipla, com nível de significância de 5%. **Resultados** – Verificou-se 21,01% de desnutridos pela ASG; 34,78% com risco nutricional pelo NRS e 11,59% com baixo peso pelo índice de massa corporal (IMC). Não houve diferença estatisticamente significante da prevalência de desnutrição pela ASG (P=0,3344) e de risco nutricional pelo NRS (P=0,2286), entre os tipos de doenças. Os pacientes com risco nutricional apresentaram maior mediana de idade (64,5 vs 58,0 anos; P=0,0246) e menores valores medianos no CEH (1362,1 kcal vs 1525 kcal, P=0,0030); na circunferência de panturrilha (CP) (32,0 cm vs 33,5 cm, P=0,0405); na contagem de linfócitos (CL) (1176,5 cel/mm^3 vs 1760,5 cel/mm^3, P=0,0095); e maior percentual de baixo peso pelo IMC (22,9% vs 5,6%; P=0,0096). A CL foi associada ao risco nutricional (P=0,0414; HR=1,000; IC95%= 0,999; 1,000). **Conclusão** – O NRS foi mais sensível que outros indicadores no diagnóstico de desnutrição. Pacientes com risco apresentaram mais idade e valores menores de CEH, CP, IMC e CL. A baixa CL foi considerada fator associado ao risco nutricional pelo NRS.

DESCRITORES – Indicadores básicos de saúde. Desnutrição. Avaliação nutricional. Estado nutricional.

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