Nutrición Hospitalaria

Trabajo Original

Nutrición en el anciano

Detection of nutritional risk and hospital stay in the hospitalized elderly adult
Detección del riesgo nutricional y estancia hospitalaria en el anciano hospitalizado

Olga Lucía Pinzón-Espitia[1], Juan Mauricio Pardo-Oviedo[2], and Milcíades Ibáñez-Pinilla[2]

[1]Universidad Nacional de Colombia. Facultad de Medicina. Bogotá, Colombia. Universidad del Rosario. Hospital Universitario Mayor Méderi. Colombia. [2]Escuela de Medicina y Ciencias de la Salud. Hospital Universitario Mayor Méderi. Universidad del Rosario. Bogotá, Colombia

Abstract

Background and aims: a high nutritional risk can independently be associated with a longer hospital stay in elderly patients. This study aims to establish the prevalence of the risk of malnutrition and its associated factors in a high-complexity level hospital in Bogotá, Colombia, during 2018.

Methods: a cross-sectional study. The prevalence of the risk of malnutrition was measured using a malnutrition-screening tool (MST), and the association with hospital stage, age, and patient diagnoses was assessed.

Results: a total of 7,192 patients comprised the cohort. Age range was 61 to 108 years, with an average of 77.1 ± 9.2 years, and subjects were mostly female (55.5 %). We identified as main conditions urinary tract infections (8.4 %), congestive heart failure (5.4 %), and chronic obstructive pulmonary disease with an acute exacerbation (4.6 %). The prevalence of the risk of malnutrition was 41.4 %, significantly associated with longer hospital stays (p < 0.001), older age (p < 0.001), and a diagnosis of delirium (OR = 5.98, 95 % CI: 2.78 to 12.86), diarrhea and gastroenteritis (OR = 5.01, 95 % CI: 2.44 to 10.32), gastrointestinal hemorrhage (OR = 4.44, 95 % CI: 2.38 to 8.28), specified pneumonia (OR = 4.43, 95% CI: 2.11 to 9.30), and high blood pressure (3.94, 95 % CI: 2.07 to 7.50). Other diagnoses included abdominal pain (other) (OR = 3.80, 95 % CI: 1.81 to 7.99), urinary tract infections (OR = 3.64, 95 % CI: 2.07 to 6.24), acute bronchitis (OR = 3.22, 95 % CI: 1.56 to 6.65), and bacterial pneumonia (OR = 3.02, 95 % CI: 1.65 to 5.55).

Conclusion: the prevalence of the risk of malnutrition in our institution is approximately one in two patients, with a significant association to increased hospital stay ≥ 8 days, patient age ≥ 80 years, and mainly diagnoses of delirium, diarrhea, and gastroenteritis of suspected infectious etiology.

Resumen

Antecedentes y objetivos: el alto riesgo nutricional puede asociarse independientemente a una estancia hospitalaria más prolongada en los pacientes ancianos. Este estudio tiene por objetivo establecer la prevalencia del riesgo de malnutrición y sus factores asociados en un hospital de alta complejidad de Bogotá (Colombia) durante 2018.

Métodos: este fue un estudio transversal. Se determinó la prevalencia del riesgo de malnutrición mediante la herramienta de detección MST y se evaluó la asociación con la estancia hospitalaria, la edad y el diagnóstico del paciente.

Resultados: en total, 7192 pacientes conformaron la cohorte. El rango de edad era de 61 a 108 años, con un promedio de 77,1 ± 9,2 años, siendo los sujetos en su mayoría de sexo femenino (55,5 %). Se identificaron como condiciones principales las infecciones del tracto urinario (8,4 %), la insuficiencia cardiaca congestiva (5,4 %) y la enfermedad pulmonar obstructiva crónica (4,6 %). La prevalencia del riesgo de desnutrición fue del 41,4 %, asociada a las estancias hospitalarias prolongadas (p < 0,001), la edad avanzada (p < 0,001) y los diagnósticos de delirium (OR = 5,98, IC 95 %: 2,78 a 12,86), diarrea y gastroenteritis (OR = 5,01, IC 95 %: 2,44 a 10,32), hemorragia gastrointestinal (OR = 4,44, IC 95 %: 2.38 a 8.28), neumonía específica (OR = 4,43, IC 95 %: 2.11 a 9.30) e hipertensión arterial (3,94, IC 95 %: 2.07 a 7.50). Otros diagnósticos asociados fueron: dolor abdominal (otros) (OR = 3,80, IC 95 %: 1.81 a 7.99), infecciones del tracto urinario (OR = 3,64, IC 95 %: 2.07 a 6.24), bronquitis aguda (OR = 3,22, IC 95 %: 1.56 a 6.65) y neumonía bacteriana (OR = 3,02, IC 95 %: 1.65 a 5.55).

Conclusión: la prevalencia del riesgo de desnutrición en la institución es aproximadamente de uno de cada dos pacientes, con una asociación significativa al aumento de la estancia hospitalaria superior a 8 días, a la edad del paciente mayor de 80 años y, principalmente, a los diagnósticos de delirium, diarrea y gastroenteritis.

Correspondence:

Olga Lucía Pinzón-Espitia. Edificio 471. Oficina de Nutrición. Bogotá, Colombia
e-mail: olpinzone@unal.edu.co

INTRODUCTION

The identification of nutritional risk in elder patients is becoming more and more important, considering that a high nutritional risk may independently be associated with a longer hospital stay (1).

Since 1999, Ferguson et al. (2) developed a Malnutrition Screening Tool – MST – in acute hospitalized adult patients in order to identify patients at high nutritional risk and requiring nutritional therapy. The assessment of such tool included 408 patients admitted to an Australian hospital, excluding pediatric, maternity, and psychiatric patients. The study's target population was asked two questions related to appetite and recent, involuntary weight loss, showing a reliability between 93 % and 97 % for the high malnutrition-screening tool amongst evaluators.

After the application of nutritional screening tools in hospitalized populations of older adults, a prevalence between 15 % and 60 % (3-5) has been reported in the literature. In a study carried out by Stratton et al. (6), 150 patients of advanced age who were consecutively admitted to a health institution were prospectively evaluated. These patients underwent nutritional screening using the MUST tool, and 58 % of the study's target population was found to be at risk for malnutrition; these individuals showed a greater rate of in-hospital mortality, as well as longer hospital stays when compared to those other patients who were identified as at low risk. A similar finding was reported by Matins et al. (1), whose investigation in older adult patients classified as malnourished using the NRS-2002 screening tool found that their subjects had a greater risk of a longer stay (> 8 days).

Recently, nutritional screening tools have been articulated and added to electronic medical records, showing evidence that implementation of an electronic-format tool for detecting malnutrition improves the knowledge, approachability, and practice of the healthcare staff in hospitals. This creates interactions in multidisciplinary nutritional care and, therefore, results in timely referral to specialized nutritional management (7).

As a result, the use of a nutritional risk detection tool has a short-term, positive effect on the quality of a hospital's nutritional care process, since detection of the risk of malnutrition represents a crucial starting point for the successful management of malnourished patients. Eglseer et al. (8) suggest the importance of joining efforts in order to sustainably maintain the performance of nutritional screening, reinforcing a positive standpoint, designating motivated "key opinion leaders", and ensuring the consented support from the management within the framework of comprehensive healthcare.

Given the importance of the topic and the implications for clinical practice and the health of older adult patients, the objective of our research was to establish the prevalence of the risk of malnutrition in the patient population of a high-complexity level hospital, together with its associated factors.

MATERIALS AND METHODS

STUDY DESIGN AND PARTICIPANTS

This was a cross-sectional study where the prevalence of nutritional risk and associated factors was determined. Patients were included of both sexes, aged ≥ 60 years, hospitalized during the first 24 hours of being admitted to the emergency observation area of a high-complexity level healthcare services provider institution in Colombia from January 1 to December 31, 2018. Patients without a nutritional risk measurement were excluded.

DATA COLLECTION

The nutritional risk calculation tool applied in this investigation was developed by Fergusson et al., and is known by the acronym MST (Table I). For this tool, the authors reported a high reliability (between 93 % and 97 %), this also being a fast, simple-to-apply tool with an application time at the institution averaging five minutes per patient (2).

Nutritional screening was carried out in patients who complied with the inclusion criteria. Two registered dietitians/nutritionists carried out a structured interview and a nutritional risk evaluation.

The information was plotted in an Excel (version 2013) database. Data filtering was carried out using simple frequencies and crossing variables. Information was processed by the SPSS statistical package, version 25.0.

Table I. Malnutrition Screening Tool

Malnutrition Screening Tool (MST)*	
Have you recently lost weight without trying?	
No	0
Yes	1
Unsure	2
If the answer is yes, how much weight (kilograms) have you lost?	
1-5	1
6-10	2
11-15	3
> 15	4
Unsure	2
Have you been eating poorly due to loss of appetite?	
No	0
Yes	1
Total	

*Score ≥ 2 = patients at risk of malnutrition.
Source: Ferguson M, Capra S, Bauer J, Banks M. Development of a valid and reliable malnutrition screening tool for adult acute hospital patients. Nutrition 1999;15(6):458-64.

STATISTICAL ANALYSIS

The descriptive analysis of qualitative variables used absolute and relative frequencies expressed as percentages. For the quantitative variables, measures of central tendency (mean and median) and dispersion (range and standard deviation) were applied.

The prevalence of nutritional risk was measured as a probability expressed as percentage. The association between risk of malnutrition and different factors (sex, age group, pooled stay, and diagnosis) was assessed using Pearson's chi-squared independence test. Odds ratios (OR) and their respective 95 % confidence intervals were also used. For numerical variables (age and hospital stay), the Kolmogorov-Smirnov and Shapiro-Wilk tests were used for the previous testing of normality. In case of normality, Student's t-test was used for the mean differences between two independent groups, with a prior evaluation of the homogeneity of variances (Levene's test), and for distributions other than normal a non-parametrical Mann Whitney-Wilcoxon (M-W) test was used.

A multivariate analysis was performed by means of unconditional logistic regression for risk of malnutrition, estimating the ORs and 95 % confidence intervals. The statistical testing was evaluated at a 5 % significance level ($p < 0.05$).

ETHICAL DISCLAIMER

This study was approved by the Méderi Technical Research Committee (CIMED, for its acronym in Spanish) and the Universidad del Rosario Research Ethics Committee, ensuring respect for patient confidentiality guidelines, and complying with the Declaration of Helsinki and the national regulations intended to guarantee the ethical principles for medical research in humans.

RESULTS

The agreement measurement for the malnutrition risk scale was evaluated by two nutritionists, who found a high level of concordance (kappa = 0.85, $p < 0.001$).

A total of 7192 patients, predominately female, with a minimum age of 61 years and a maximum age of 108 years, comprised the total cohort. Average age was 77.1 ± 9.2 years, and median age was 77 years. The predominant age group was that of 70-79 years (Table II). The five most frequent pathologies for hospital admission were urinary tract infections, congestive heart failure, chronic obstructive pulmonary disease with an acute exacerbation, bacterial pneumonia, and gastrointestinal hemorrhage (Table II). The pathology groups, according to the 10th revision of the International Classification of Diseases and Related Health Problems (ICD-10), reported with the highest frequency were circulatory system diseases (1594; 22.2 %), respiratory system diseases (1105; 15.4 %), and genitourinary tract diseases (794; 11 %).

The prevalence of the risk of malnutrition was 41.4 % (n = 2955), and was significantly higher in women (42.5 % vs 39.9 % in men, p = 0.0028). A significant linear tendency was evidenced in the study population: risk of malnutrition increased with older age ($p < 0.001$, tendency by chi-square test) and with extended hospital stay ($p < 0.001$, tendency by chi-square test) (Table III). The average hospital stay was 7.78 ± 7.36 days

Table II. Demographic and main diagnostic characteristics of the patient cohort screened (n = 7142)

Characteristics	n (%)
Sex	
Female	3,963 (55.5)
Male	3,179 (44.5)
Age (years)	
< 70	1757 (24.6)
70-79.9	2429 (34.0)
80-89.9	2257 (31.6)
≥ 90	699 (9.8)
Main diagnoses	
Unspecified site urinary tract infection	598 (8.4)
Congestive heart failure	380 (5.4)
Chronic obstructive pulmonary disease with exacerbations	326 (4.6)
Non-specified bacterial pneumonia	218 (3.1)
Non-specified gastrointestinal hemorrhage	166 (2.3)
Non-specified chronic obstructive pulmonary disease	143 (2.0)
Acute heart attack, with no other explanation	138 (1.9)
Essential (primary) high blood pressure	133 (1.9)
Non-specified acute bronchitis	107 (1.5)
Syncope and collapse	102 (1.4)

Table III. Relationship between age and length of stay (pooled) with risk of malnutrition, measured with MST

	Malnutrition risk			
	n	%	OR	95 % CI for OR
Age (years)				
< 70	668	38.0	1.000	
70-79.9	979	40.3	1.101	0.970-1.248
80-89.9	993	44.0	1.281	1.128-1.454
≥ 90	315	45.1	1.337	1.120-1.597
Stay (days)				
< 3	512	34.5	1.000	
3-5.9	859	38.1	1.169	1.020-1.340
6- 8.9	618	42.9	1.432	1.233-1.663
≥ 9	964	49.2	1.845	1.606-2.120

(median = 5.79), and was significantly longer in patients at higher nutritional risk (8.64 ± 8.05 days, median = 6.47) than in those classified at low nutritional risk (7.17 ± 6.76 days; median = 6.47; p < 0.001, M-W).

A significant association between diagnosis (ICD-10) and risk of malnutrition was found (p < 0.001, Pearson's chi-square test), with the highest prevalence for the risk of malnutrition being found in the diagnoses of non-specified delirium (56.4 %), specified pneumonia (50.8 %), diarrhea and gastroenteritis of suspected infectious etiology (47.8 %), non-specified gastrointestinal hemorrhage (47.6 %), high blood pressure (44.4 %), non-specified urinary tract infection (43.6 %), non-specified bacterial pneumonia (42.7 %), and other abdominal pain (41.9 %).

MULTIVARIATE ANALYSIS

The factors that together were significantly linked to high risk of malnutrition were increased hospital stay, and increased age (ICD-10). The diagnoses with a stronger association with risk of malnutrition were: non-specified delirium (OR = 5.98, 95 % CI: 2.78 to 12.86), diarrhea and gastroenteritis of suspected infectious etiology (OR = 5.01, 95 % CI: 2.44 to 10.32), non-specified gastrointestinal hemorrhage (OR = 4.44, 95 % CI: 2.38 to 8.28), specified pneumonia (OR = 4.43, 95 % CI: 2.11 to 9.30), high blood pressure (3.94, 95 % CI: 2.07 to 7.50), other abdominal pain (OR = 3.80, 95 % CI: 1.81 to 7.99), non-specified urinary tract infections (OR = 3.64, 95 % CI: 2.07 to 6.24), non-specified acute bronchitis (OR = 3.22, 95 % CI: 1.56 to 6.65), and non-specified bacterial pneumonia (OR = 3.02, 95 % CI: 1.65 to 5.55) (Table IV).

DISCUSSION

Out of the 7192 patients receiving nutritional screening, 2955 cases at risk of malnutrition were detected, i.e., a prevalence of 41.4 % was found, similar to that reported in previous studies carried out in Venezuela (48.4 %) (9), Mexico (40.8 %) (10), Ecuador (37.1 %) (11), and Colombia (60.1 %) (12). The prevalence of malnutrition in studies using the MST tool was equivalent to that reported in this study. For example, a university hospital in southern Brazil reported malnutrition in 33.1 % of the population (13), while in two primary care university hospitals in Porto the estimated prevalence was 55.1 % (1).

According to a systematic review by Correia et al. (14), which included 66 studies involving 29,474 patients from 12 Latin American countries, a prevalence of malnutrition was noted in 40 %-60 % of patients at the time of admission; a prevalence greater than 45 % was specifically reported for Colombia (15,16).

Regarding hospital stay, it is considered that the longer patient stay is, the higher the risk of malnutrition becomes. Martins et al. (1) reported that patients classified as malnourished were at greater risk, regardless of longer stay (8 days). These values were also reported by prevalence studies suggesting that the prevalence of malnutrition increases with stay duration (11,17,18).

The average hospital stay in this study was 7.78 days, with a stay significantly higher in patients at high nutritional risk lasting 8.64 days. Peniche-Herrera et al. (19) evaluated 138 medical files seeking to determine whether the risk of preoperative malnutrition was a causative factor for prolonged hospital stay after gastrointestinal surgery, with evidence that the presence of the risk of preoperative malnutrition is linked to prolonged hospital stay (OR = 1.33, 95 % CI: 1.07-1.64, p = 0.008).

A population study in patients admitted to hospital in two European countries reported that in patients at high risk of malnutrition stay was longer than 11 days (20). A similar report was made by Sorensen et al. (21) in the EuroOOPS study, which affirmed that patients at risk of malnutrition had more complications, greater mortality, and longer stays than patients at no risk. Therefore, hospital stay is a key factor in the administrative management of healthcare institutions, considering that malnutrition is common at hospital admittance and tends to worsen during hospitalization.

Out of the ten pathologies with the largest number of patients based on the ICD-10 diagnosis, there was evidence that circulatory and respiratory system diseases had a prevalence of risk of malnutrition higher than 30 %. Patients with congestive heart failure had a risk of malnutrition of 33.9 %, a value close to that reported by Gomes et al. (22), with high nutritional risk in 44 % of patients with heart failure. A prevalence of 36.5 % and 23.2 % for the risk of malnutrition was reported for pathologies such as chronic obstructive pulmonary disease (COPD) with or without exacerbation, respectively. These figures are similar to those reported in the literature, ranging between 10 % and 60 % (23,24), with the development of nutritional intervention strategies being of paramount importance in clinical practice because malnutrition is common amongst COPD patients (25).

Other relevant pathology in this study was the diagnosis of high blood pressure, where 32.5 % were at risk of malnutrition. This value is lower than that reported in the research carried out in Colombia by Giraldo et al. (26), who found that 62.5 % of older adult patients with high blood pressure presented risk of malnutrition. The differences in cohort conformation, the different screening tools used to establish the risk of malnutrition, and the particularities of each hospital institution may explain the differences found in the studies discussed in this publication.

The present study has various strengths. The size of the sample stands out with a large volume for the study population, an adequate representation of both sexes and age groups, and the inclusion of different health insurers. In addition, information was recorded by nutritionists, thus creating acceptable confidence at the collection of the data defined by the MST tool, established in the electronic medical records.

Finally, with regard to the implications for research and clinical practice, the present research suggests there is a need to carry out additional studies evaluating nutritional risk at different hospitals in the country, given the population's variability. Likewise, the importance of identifying and characterizing the clinical outcomes linked to the risk and cost of malnutrition is highlighted. This is in pursuit of the development of nutritional

Table IV. Multivariate analysis model of unconditional logistic regression
for risk of malnutrition

	ß	OR	95 % CI for OR	Sig.
Sex (ref: male)	0.106	1.111	1.009-1.225	0.033
Age (ref: < 70 years)				
70-79.9	0.093	1.097	0.965-1.248	0.159
80-89.9	0.278	1.321	1.157-1.507	0.000
≥ 90	0.328	1.389	1.155-1.67	0.000
Stay (ref: < 3 days)				
3-5.9	0.2	1.221	1.063-1.403	0.005
6-8.9	0.419	1.52	1.304-1.771	0.000
≥ 9	0.687	1.988	1.723-2.293	0.000
Diagnosis (ref: L031)				
Cystitis, unspecified	1.293	3.644	2.066-6.424	0.000
Congestive heart failure	0.793	2.209	1.233-3.959	0.008
Chronic obstructive pulmonary disease with acute exacerbation, unspecified	0.887	2.427	1.346-4.376	0.003
Bacterial pneumonia, unspecified	1.107	3.024	1.648-5.55	0.000
Gastrointestinal haemorrhage, unspecified	1.49	4.436	2.376-8.282	0.000
Chronic obstructive pulmonary disease, unspecified	0.95	2.587	1.361-4.918	0.004
Acute myocardial infarction, unspecified	0.242	1.274	0.65-2.497	0.481
Essential (primary) hypertension	1.371	3.941	2.071-7.501	0.000
Acute bronchitis, unspecified	0.806	2.239	1.136-4.412	0.020
Syncope and collapse	1.041	2.832	1.438-5.577	0.003
Atrial fibrillation and flutter	0.63	1.878	0.929-3.797	0.079
Cerebrovascular disease, unspecified	1.17	3.221	1.56-6.65	0.002
Other gastroenteritis and colitis of infectious and unspecified origin	1.612	5.014	2.435-10.324	0.000
Chronic kidney disease, unspecified	0.743	2.101	0.985-4.482	0.055
Other and unspecified abdominal pain	1.334	3.798	1.805-7.993	0.000
Pneumonia, unspecified	1.488	4.426	2.107-9.298	0.000
Chest pain, unspecified	0.838	2.311	1.063-5.026	0.034
Diabetes mellitus without complications	0.744	2.104	0.957-4.623	0.064
Delirium, unspecified	1.788	5.978	2.779-12.86	0.000
Angina pectoris, unspecified	1.141	3.13	1.418-6.908	0.005
Pulmonary embolism without mention of acute cor pulmonale	0.685	1.985	0.884-4.456	0.097
Heart failure, unspecified	0.963	2.62	1.181-5.813	0.018
Bile duct stone with cholecystitis	1.02	2.773	1.238-6.214	0.013
Embolism and thrombosis of other specified veins	0.661	1.937	0.835-4.495	0.124
Dyspnea	0.49	1.633	0.691-3.857	0.264
Other diagnoses	1.31	3.705	2.145-6.397	0.000
Constant	-2.08	0.125		0.000

Ref: reference category.

care programs by hospital institutions, taking into account the factors that increase the risk and supported by the available evidence.

One in every two patients admitted to a hospital institution had a high risk of malnutrition linked to hospital stays longer than 8 days, age ≥ 80 years, and the specific diagnoses of delirium, diarrhea and gastroenteritis of suspected infectious etiology, gastrointestinal hemorrhage, specified pneumonia, high blood pressure, other abdominal pain, non-specified urinary tract infections, acute bronchitis, and bacterial pneumonia.

REFERENCES

1. Martins CPAL, Correia JR, do Amaral TF. Undernutrition Risk Screening and Length of Stay of Hospitalized Elderly. Journal of Nutrition For the Elderly 2006;25(2):5-21.

2. Ferguson M, Capra S, Bauer J, Banks M. Development of a valid and reliable malnutrition screening tool for adult acute hospital patients. Nutrition 1999;15(6):458-64.

3. Stratton RJ, Hackston A, Longmore D, Dixon R, Price S, Stroud M, et al. Malnutrition in hospital outpatients and inpatients: prevalence, concurrent validity and ease of use of the 'malnutrition universal screening tool' ('MUST') for adults. Br J Nutr 2004;92(5):799-808.

4. Guigoz Y, Lauque S, Vellas BJ. Identifying the elderly at risk for malnutrition. Clinics in Geriatric Medicine 2002;18(4):737-57.

5. Harris D, Haboubi N. Malnutrition screening in the elderly population. Journal of the Royal Society of Medicine 2005;98(9):411-4.

6. Stratton RJ, King CL, Stroud MA, Jackson AA, Elia M. 'Malnutrition Universal Screening Tool' predicts mortality and length of hospital stay in acutely ill elderly. Br J Nutr 2006;95(2):325-30.

7. Eglseer D, Lohrmann C, Halfens R. Implementation of a malnutrition screening tool improves knowledge, attitudes and practices of health personnel in hospitals. Clinical Nutrition 2018;37:S116-7.

8. Eglseer D, Schoberer D, Halfens R, Lohrmann C. The impact of using a malnutrition screening tool in a hospital setting: a mixed methods study. Eur J Clin Nutr 2019 Feb;73(2):284-92.

9. Rodríguez N, Hernández R, Herrera H, Barbosa J, Hernández-Valera Y. Estado nutricional de adultos mayores institucionalizados venezolanos. Investigación Clínica 2005;46(3):219-28.

10. Jaimes Alpízar E, Zúñiga Torres M, Medina García A, Reyes Barretero D, Cruz Castillo A. Prevalencia de riesgo nutricional en un hospital de segundo nivel en el Estado de México. Nutricion Clinica y Dietetica Hospitalaria 2016;(4):111-6.

11. Gallegos Espinosa S, Nicolalde Cifuentes M, Santana Porbén S. Estado de la desnutrición en los hospitales del Ecuador. Nutrición Hospitalaria 2014;30(2):425-35.

12. Otero MR, Rosas Estrada GM. Valoración nutricional de las personas mayores de 60 años de la ciudad de Pasto, Colombia. Cienc enferm 2017;23(3):23-34.

13. Garcia RS, Tavares LR da C, Pastore CA. Nutritional screening in surgical patients of a teaching hospital from Southern Brazil: the impact of nutritional risk in clinical outcomes. Einstein (São Paulo) 2013;11(2):147-52.

14. Correia MITD, Perman MI, Waitzberg DL. Hospital malnutrition in Latin America: A systematic review. Clinical Nutrition 2017;36(4):958-67.

15. Giraldo Giraldo N, Múnera García N, Espitaleta Marrugo V, Pinerez L. Prevalence of malnutrition and evaluation of dietary treatment for adult hospitalized patients in a public institution of high complexity. Perspect Nut Hum 2007;9(37).

16. Agudelo GM, Giraldo NA, Aguilar NL, Restrepo BE, Vanegas M, Alzate S, et al. Incidence of nutritional support complications in patient hospitalized in wards. multicentric study. Colombia Médica 2012;43(2):147-53.

17. Rezende IFB, Oliveira VS de, Kuwano EA, Leite APB, Rios I, Dórea YSS, et al. Prevalência da desnutrição hospitalar em pacientes internados em um hospital filantrópico em Salvador (BA), Brasil. Revista de Ciências Médicas e Biológicas 2004;3(2):194-200.

18. Gomes Beghetto M, Koglin G, Daniel de Mello E. Influence of the assessment method on the prevalence of hospital malnutrition: a comparison between two periods. Nutrición Hospitalaria 2010;25(5):774-80.

19. Peniche Herrera JR, Cortés Telles A, Lozano Salazar R. Riesgo de desnutricion prequirúrgico como factor de riesgo de estancia hospitalaria prolongada en cirugía gastrointestinal. Revista Biomédica 2018;29(3):45-50.

20. Kyle U, Pirlich M, Schuetz T, Lochs H, Pichard C. Is nutritional depletion by Nutritional Risk Index associated with increased length of hospital stay? A population-based study. JPEN J Parenter Enteral Nutr 2004;28(2):99-104.

21. Sorensen J, Kondrup J, Prokopowicz J, Schiesser M, Krähenbühl L, Meier R, et al. EuroOOPS: An international, multicentre study to implement nutritional risk screening and evaluate clinical outcome. Clinical Nutrition 2008;27(3):340-9.

22. Gomes F, Emery PW, Weekes CE. Risk of Malnutrition Is an Independent Predictor of Mortality, Length of Hospital Stay, and Hospitalization Costs in Stroke Patients. Journal of Stroke and Cerebrovascular Diseases 2016;25(4):799-806.

23. Ingadottir AR, Beck AM, Baldwin C, Weekes CE, Geirsdottir OG, Ramel A, et al. Two components of the new ESPEN diagnostic criteria for malnutrition are independent predictors of lung function in hospitalized patients with chronic obstructive pulmonary disease (COPD). Clinical Nutrition 2018;37(4):1323-31.

24. Akner G, Larsson K. Undernutrition state in patients with chronic obstructive pulmonary disease. A critical appraisal on diagnostics and treatment. Respiratory Medicine 2016;117:81-91.

25. Hoong JM, Ferguson M, Hukins C, Collins PF. Economic and operational burden associated with malnutrition in chronic obstructive pulmonary disease. Clinical Nutrition 2017;36(4):1105-9.

26. Giraldo Giraldo NA, Paredes Arturo YV, Idarraga Idarraga Y, Aguirre Acevedo DC. Factores asociados a la desnutrición o al riesgo de desnutrición en adultos mayores de San Juan de Pasto, Colombia: Un estudio transversal. Rev Esp Nutr Hum Diet 2017;21(1):39-48.