RESEARCH ARTICLE

Proportion of malnourished ambulatory hospitalized patients based on international criteria at Cipto Mangunkusumo Hospital, Indonesia

Fiastuti Witjaksono, Wiji Lestari, Krisadelfa Sutanto, Yohannessa Wulandari, Nurul Ratna Mutu Manikam, Lily Indriani Octovia

Abstract

Objective: Malnutrition is quite prevalent in hospitalized patients, and its diagnosis is particularly important for doctors in order to treat it accordingly. This study aims in finding the frequency of malnutrition in ambulatory hospitalized patients based on three international criteria.

Methods: The subjects of this study were hospitalized patients at Cipto Mangunkusumo Hospital, Jakarta, Indonesia. The subjects were investigated for malnutrition using World Health Organization (WHO), American Society for Parenteral and Enteral Nutrition (ASPEN), and the European Society for Clinical Nutrition and Metabolism (ESPEN) criteria for malnutrition. Two hundred and twenty-nine ambulatory hospitalized patients were subject to accurate anthropometry measurements. They were analyzed for their height using Seca-360 and their weight using Seca-869, from which their body mass index could be measured. They were also examined for their handgrip strength using Jamar® Handgrip Dynamometer. The rest of the criteria were fulfilled through subjective history taking.

Results: The proportion of malnutrition at Cipto Mangunkusumo hospital was 20.1% when assessed using WHO malnutrition criteria. Meanwhile, about 48.5% of the subjects had malnutrition when assessed using ASPEN criteria. About 42.8% of subjects were categorized as malnutrition according to ESPEN criteria.

Conclusion: The highest proportion of hospital malnutrition is based on ASPEN, followed by ESPEN, and the latter is WHO. ESPEN is more likely to capture malnutrition in chronic conditions, whereas ASPEN is more suitable in acute conditions rather than in chronic ones. ESPEN data would be more accurate when done appropriately according to its guidelines (with the use of a validated instrument).

Keywords: Malnutrition, World Health Organization, Hospitals, Nutrition Assessment, Ambulatory.

(JPMA 71: S-107 [Suppl. 2]; 2021)

Introduction

Malnutrition is often an unrecognized problem in hospitalized patients,[1] occurring in hospital between 20-50%.[2,3] A study in Australia showed that malnutrition in a tertiary hospital was approximately 23% as assessed by Subjective Global Assessment (SGA), and was related to 4.5 times longer hospital stay than well-nourished patients.[3] One study in Denmark revealed that as many as 40% of hospitalized patients had a risk of malnutrition as assessed by Nutrition Risk Screening (NRS)-2002, where 8% were malnourished.[4] A malnutrition study in the digestive ward of Cipto Mangunkusumo Hospital in Jakarta, Indonesia, found that 37.1% of patients had a malnourished nutritional status.[5]

Malnutrition on hospital admission is associated with poor clinical outcomes, increased risk of infection, impaired wound healing,[6] prolonged length of stay in the hospital, increased hospital costs, as well as increased morbidity and mortality.[7] Therefore, assessment of nutritional status to detect any risk of malnutrition for admitted patients is needed to prevent hospital malnutrition and to determine nutritional therapy.[8]

There are various tools to assess malnutrition, including World Health Organization (WHO), American Society for Parenteral and Enteral Nutrition (ASPEN), and European Society for Clinical Nutrition and Metabolism (ESPEN) criteria. The purpose of this research was to determine the proportion of malnutrition in ambulatory hospitalized patients based on these three tools.

Patients and methods

This is a descriptive and cross-sectional study, and the participants were hospitalized patients at Building A of Cipto Mangunkusumo Hospital, Jakarta, Indonesia, who met inclusion criteria and were willing to participate in this study from October until December 2018.

Inclusion criteria were new patients admitted to building A in the last 24 hours based on Electronic Health Records (EHR), ≥18 years old, had stable haemodynamic status,

Department of Nutrition, Universitas Indonesia, Cipto Mangunkusumo Hospital, Jakarta, Indonesia.

Correspondence: Wiji Lestari. Email: wiji.lestari99@ui.ac.id

could stand, and was willing to sign an informed consent. We excluded patients who had been hospitalized for more than 3 days, who were not in their respective rooms when the data was about to be collected, and who were not suitable for Bioelectrical Impedance Analysis (BIA) examination using Seca medical Body Composition Analyzer (mBCA) 525 (Seca, Hamburg, Germany) due to conditions such as: cramps, tremor, connected to electronic medical devices (electrocardiogram; ECG, infusions pumps), had an electronic implant (pacemaker), had orthopaedic prosthesis, cardiac arrhythmias, was pregnant, or had open wound or skin infections. The final subjects chosen were 109 males and 120 females. This research was approved by the Institutional Review Board (IRB) of Faculty of Medicine Universitas Indonesia, with the number 0668/UN2.F1/ETIK/2018.

Height was measured by Seca 360 (Seca, Hamburg, Germany), which measured the distance from heels to vertex. In this measurement, there were a number of requirements, such as using only minimum light clothing and removal of shoes and socks. The subjects being measured must look straight ahead (Frankfurt plane), arms placed by the side, and shoulders, buttocks, and heels should be touching the wall. During height measurement, the subject was asked to take a breath in order to straighten the spine. The movable part of the equipment was lowered to touch the tip of the head. Height measurement was carried out in a state of maximal inspiration, with the examiner's eye position parallel to the headboard to avoid human measurement errors.[9]

Body weight was measured with Seca 869 (Seca, Hamburg, Germany) with minimum light clothing and no footwear. Subjects were asked to stand up, look straight ahead, and urinate before the measurement.[9]

Body mass index (BMI) is defined as the weight in kilograms divided by height in meters squared (kg/m^2). Free Fat Mass Index (FFMI) was calculated by dividing Free Fat Mass (FFM) in kg with height in meters squared (kg/m^2). FFM was obtained from Seca mBCA 525 (Seca, Hamburg, Germany).

Handgrip Strength (HGS) was measured by Jamar® Handgrip Dynamometer (Sammons Preston, Bolingbrook, IL, USA), using the second handle position since it is considered the most consistent position and could produce maximum handgrip strength. HGS measurement was done as part of the ASPEN criteria in determining malnutrition. It was done with the subject sitting and lying down. In sitting position, the subject was instructed to sit with shoulder adducted, and elbow flexed at 90°. Meanwhile, in supine position, upper extremity remained in the same pose, except that the subject was lying down. The hand used in this examination was non-dominant hand.[10]

WHO criteria for malnutrition is Body Mass Index (BMI) <18.5 kg/m^2.[11] Two alternative ways to diagnose malnutrition based on ESPEN criteria are 1. BMI <18.5 kg/m^2.[2] Unintentional weight loss (>10% indefinite of time, or >5% in the last three months) with either BMI <20 kg/m^2 in <70 years of age, or <22 kg/m^2 in ≥70 years of age) or FFMI (<17 kg/m^2 and <15 kg/m^2 in men and women, respectively).[12] Diagnosis of malnutrition based on ASPEN is carried out with several physical examinations based on the guide.[13]

Descriptive analysis was performed for categorical variables using frequency distributions. The analysis was performed using "IBM SPSS Statistics 20" (IBM Corporation, SPSS, INC., Chicago, IL, USA).

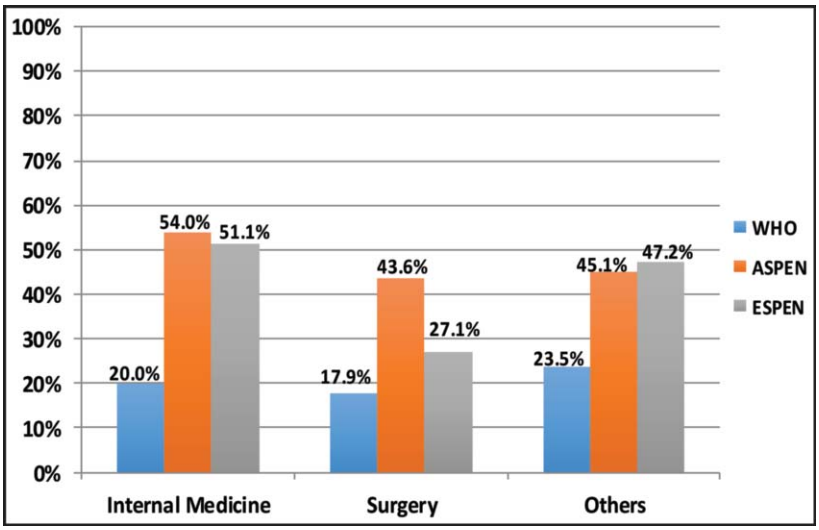
Results

There were 350 subjects recruited, but only 229 subjects were selected because they were ambulatory. Two hundred and twenty-nine subjects (109 males; 47.6% and 120 females; 52.4%) were analyzed to compute for malnutrition based on WHO and ASPEN criteria. Almost all subjects (218 subjects; 95.2%) were 18-64 years old. Subjects who were assessed using ESPEN criteria were

Table-1: Clinical characteristics of participants (n=229).

Clinical Characteristic	n	Proportion (%)
Ward		
Internal Medicine	100	43.7
Surgery	78	34.0
Others	51	22.4
Malnutrition Screening Tool (MST)		
0	84	36.7
1	36	15.7
2	45	19.7
3	37	16.2
4	13	5.7
5	14	6.1
Albumin*		
≤2.49	5	5.8
2.5-2.9	7	8.1
≥3.0	74	86.0
Karnofsky Performance Status (KPS)		
≤60	21	9.2
>60	208	90.8

ENT: Ear, Nose, Throat, KPS: Karnofsky Performance Status, MST: Malnutrition Screening Tool.
*Total sample that had albumin examination was 86 subjects.



ASPEN: American Society for Parenteral and Enteral Nutrition. BMI: body mass index. ESPEN: European Society for Clinical Nutrition and Metabolism.

Figure-1: Proportion of malnutrition in each ward.

Table-2: Proportion of malnutrition based on WHO, ASPEN and ESPEN criteria.

Criteria	Malnutrition Criteria	n	Proportion (%)
WHO	No malnutrition	183	79.9
n: 229	Malnutrition	46	20.1
	Mild malnutrition	19	8.3
	Moderate malnutrition	9	3.9
	Severe malnutrition	18	7.9
ASPEN	Not including malnutrition criteria	118	51.5
n: 229	Moderate malnutrition	62	27.1
	Severe malnutrition	49	21.4
ESPEN	No malnutrition	107	57.2
n: 187	Malnutrition	80	42.8

WHO: World Health Organization.
ASPEN: American Society for Parenteral and Enteral Nutrition.
ESPEN: European Society for Parenteral and Enteral Nutrition.

187 subjects, consisting of 91 males and 96 females. The wards where some of the subjects were collected (51 subjects; 22.4%) consisted of obstetrics and gynaecology (11.4%) patients; neurology (4.4%) patients; ear, nose, and throat (ENT) (5.7%) patients, and dermatology (0.9%) patients. The baseline clinical characteristics of the sample are shown in Table-1.

The proportion of malnutrition at the Cipto Mangunkusumo hospital was 20.1% assessed using WHO criteria, about 48.5% of the subjects were malnourished according to ASPEN criteria, and about 42.8% of subjects were malnutrition according to ESPEN criteria, which was then divided according to the levels of malnutrition as shown in Table-2. Based on these three malnutrition diagnostic tools, the malnutrition proportion in each ward could be seen in Figure-1.

Discussion

The diagnosis of malnutrition by ESPEN emphasized disease-related malnutrition or malnutrition due to inadequate intake of nutrients.[14,15] Therefore, the main objective of determining criteria for malnutrition based on ESPEN is to recognize the presence of energy and protein depletion as a result of illness. The BMI criteria are <18.5 kg/m^2, similar to the recommendations of WHO. Malnutrition criteria by ESPEN also recognize that malnutrition might be different for geriatric patients (malnutrition BMI criteria of 20 kg/m^2 for <70 years old and 22 kg/m^2 for ≥70 years old) since it could be associated with weight loss, underlying chronic disease, or changes in nutritional status.[12]

Our subjects who entered internal medicine ward with malnutrition were 54.0% and 51.1% based on ASPEN and ESPEN criteria respectively. Unlike the subjects who were admitted to surgery ward, malnutrition incidence was 43.6% and 27.1%, presenting quite a high difference between ASPEN and ESPEN criteria. A decrease in body weight seen in subjects assessed by ESPEN criteria showed that there was a significant decrease in food intake, loss of appetite, and imbalance between nutrient requirements and intake. This is defined in ESPEN criteria where malnutrition is also defined as a decrease in 5% body weight within 3 months for acute conditions, and >10% in unlimited time for chronic conditions. Term weight loss would encompass significant reductions in food intake, appetite loss, and any imbalance between nutrient requirements and intake. Criteria of weight loss should be combined with either reduced BMI or with reduced free fat mass.[12] Meanwhile, criteria of reduced BMI or reduced free fat mass might not be seen in surgery cases associated with acute conditions.

The proportion of malnutrition based on ESPEN in this study is quite high. This could be because most subjects (43.7%) allocated from internal medicine department, which presented most patients suffering from chronic diseases. In addition, the hospital used in this study is the highest referral hospital in Jakarta.

The research conducted by Fink et al, showed that using ESPEN criteria alone to determine the risk of malnutrition might not be as accurate compared to the use of

combination of malnutrition criteria and other nutrition screening tools.[16] Malnutrition identified based on ESPEN criteria could predict the risk of infection, primarily when used together with Malnutrition Screening Tools (MST) or when used with Nutrition Risk Screening (NRS-2002), which could also predict mortality. The prevalence of malnutrition in patients assessed using ESPEN criteria alone (step 2) compared to those assessed using a combination with NRS-2002 and MST was 20.5%, 29.3%, and 37.1%, respectively. However, Fink's study did not include FFMI in assessing the risk of malnutrition because it had used secondary data. Research conducted by Guerra et al, showed that as many as 72% of subjects screened using NRS-2002 had a risk of malnutrition, then from these results, as many as 57.1% and 12.1% of subjects had malnutrition based on Patient-Generated criteria of Subjective Global Assessment (PG-SGA) and ESPEN criteria.[17] This data proved that ESPEN might be effective in assessing malnutrition, but it will be more accurate when done appropriately with the use of MST or NRS-2002.

The proportion of malnutrition according to ASPEN in this study was higher compared to ESPEN proportion since ASPEN criteria consider the characteristics that reflect nutritional status or inflammatory response associated with underlying disease.[14] The study by Hudson et al, showed that 66.88% of subjects had malnutrition based on ASPEN criteria.[18] Malnourished subjects were associated with 30-day readmissions, with Odd Ratio (OR) 2.13 and mortality with OR 1.76.[18]

The criteria by ASPEN considered more subjective than objective means in grading malnutrition. Rodriquez et al, showed that ASPEN criteria had high sensitivity but low specificity.[14] It means that ASPEN would be more useful to identify early stages of malnutrition or nutrition-related syndromes. Early stages of malnutrition usually occur in acute conditions. Acute conditions are defined as the presence of an underlying disease, which lasts for 3 months.[15] Acute diseases could cause malnutrition due to hypermetabolism and reduced intake.[20] An increase in metabolism leads to depletion of fat mass and muscle mass, resulting in a decrease in body weight and, consequently, malnutrition.[14]

The ASPEN criteria included all of those listed in ESPEN, except for BMI. ASPEN criteria are much more practical since it only needs two criteria to make a definitive malnutrition diagnosis, yet ESPEN criteria require two stages. The first step is to identify the risk of malnutrition, and the second is to determine diagnosis of malnutrition. In ESPEN, malnutrition is associated with poorer functional capacity.

The proportion of malnutrition based on WHO is 20.1%. However, since WHO assesses malnutrition only using BMI, it would not represent the amount of fat mass (FM) and free fat mass (FFM). Therefore, BMI measurement could not determine the amount of adipose tissue in the body.[21] This is crucial since adipose reserve might lead to co-morbidities such as fatty liver, insulin resistance, and malignancy.

When we combined BMI < 18.5 kg/m^2 and MST $\geq$2, the proportion of malnutrition increased to 30.6%. Hence, malnutrition is not considered only related to BMI <18.5 kg/m^2. Malnutrition parameters in ASPEN and ESPEN criteria indicated that physical and objective examination is related to malnutrition even though BMI >18.5 kg/m^2. ASPEN is more suitable for use in hospitals that do not own complete facilities because most of its nutritional assessment is by anamnesis and physical assessments. ESPEN is more suitable in hospitals that own complete facilities, due to many objective nutritional assessments.

Both ASPEN and ESPEN malnutrition criteria are associated with a longer length of stay in the hospital. Patients' length of stay in the hospital could be influenced by several factors, such as diagnosis, severity of illness, and nutritional status. Pichard et al, and Pirlich et al, showed that malnutrition had a longer hospital stay than who were not.[22,23] Tsaousi, et al, showed that malnourished patients had a higher length of stay than those well-nourished patients (14.1 days compared to 3.7 days).[24] Furthermore, Merhi et al, showed that complications were more common in those staying at the hospital for $\geq$7 days.[25]

This study would be the first to compare the diagnosis of malnutrition with these three tools. We used top referral hospitals with various background diseases and we used a wide age range of subjects that helped the data retrieved more applicable.

Unfortunately, this study is limited by a couple of factors. The first being a high cost for the electrodes used during assessment using ESPEN criteria. This resulted in only 187 subjects to be examined, compared to 229 subjects assessed using WHO and ASPEN criteria. Therefore, a lower amount of malnutrition assessed using ESPEN criteria might be due to lack of subjects to be compared with. The second factor is the diversity of diseases present in subjects. The wide range of diseases found during this study complicated the analysis of how certain diseases could be related to the degree of malnutrition found in general population.

Conclusion

The highest proportion of hospital malnutrition in Cipto Mangunkusumo is based on ASPEN, followed by ESPEN, and the latter is WHO. The different criteria could be used according to patient's condition, whether acute or chronic. ESPEN is more likely to capture malnutrition in chronic conditions, whereas ASPEN is more suitable in acute conditions rather than in chronic ones. Both ESPEN and ASPEN assess nutritional status using subjective and objective means, but ESPEN is more detailed due to the use of high cost facilities. ESPEN data would be more accurate when done appropriately according to its guidelines (with the use of a validated instrument). However, ASPEN criteria is more feasible when used in a low budget setting. ASPEN and ESPEN criteria are better used to determine malnutrition rather than WHO criteria since more factors are considered.

Acknowledgement: We would like to thank all clinical nutrition residents and all the staff members of Cipto Mangunkusumo Hospital, Jakarta, Indonesia, for their support in this study.

Disclaimer: None to declare.

Conflict of Interest: The authors declare no conflicts of interest.

Funding Disclosure: None to declare.

References

1. Konturek PC, Herrmann HJ, Schink K, Neurath MF, Zopf Y. Malnutrition in Hospitals: It Was, Is Now, and Must Not Remain a Problem! Med Sci Monit 2015;21:2969-75. doi: 10.12659/MSM.894238.
2. Barker LA, Gout BS, Crowe TC. Hospital malnutrition: prevalence, identification and impact on patients and the healthcare system. Int J Environ Res Public Health 2011;8:514-27. doi: 10.3390/ijerph8020514.
3. Gout BS, Barker LA, Crowe TC. Malnutrition identification, diagnosis and dietetic referrals: are we doing a good enough job? Nutr Diet 2009;66:206-11. DOI: 10.1111/j.1747-0080.2009.01372.x
4. Rasmussen HH, Kondrup J, Staun M, Ladefoged K, Kristensen H, Wengler A. Prevalence of patients at nutritional risk in Danish hospitals. Clin Nutr 2004;23:1009-15. doi: 10.1016/j.clnu.2004.01.001.
5. Sutanto LB. Malnutrition in an Indonesia hospital. [Online] 2011 [Cited 2020 October 31]. Available from URL: http://www.pensa-online.org/newsletter_detail.php?id=55&page=5
6. Mechanick JI. Practical aspects of nutritional support for wound-healing patients. Am J Surg 2004;188(Suppl 1A):52-6. doi: 10.1016/S0002-9610(03)00291-5.
7. Neumayer LA, Smout RJ, Horn HG, Horn SD. Early and sufficient feeding reduces length of stay and charges in surgical patients. J Surg Res 2001;95:73-7. doi: 10.1006/jsre.2000.6047.
8. Tappenden KA, Quatrara B, Parkhurst ML, Malone AM, Fanjiang G, Ziegler TR. Critical role of nutrition in improving quality of care: an interdisciplinary call to action to address adult hospital malnutrition. JPEN J Parenter Enteral Nutr 2013;37:482-97. doi: 10.1177/0148607113484066.
9. Gibson RS. Principles of nutritional assessment. 2nd ed. New York: Oxford University Press; 2005.
10. El-Sais WM, Mohammad WS. Influence of different testing postures on hand grip strength. Eur Sci J 2014;10:290-301.
11. Meier R, Stratton R. Basic concept in nutrition: epidemiology of malnutrition. E Spen Eur E J Clin Nutr Metab 2008;3:e167-70. doi:10.1016/j.eclnm.2008.04.002
12. Cederholm T, Bosaeus I, Barazzoni R, Bauer J, Van Gossum A, Klek S, et al. Diagnostic criteria for malnutrition - An ESPEN Consensus Statement. Clin Nutr 2015;34:335-40. doi: 10.1016/j.clnu.2015.03.001.
13. White JV, Guenter P, Jensen G, Malone A, Schofield M. Consensus statement: Academy of Nutrition and Dietetics and American Society for Parenteral and Enteral Nutrition: characteristics recommended for the identification and documentation of adult malnutrition (undernutrition). JPEN J Parenter Enteral Nutr 2012;36:275-83. doi: 10.1177/0148607112440285.
14. Sánchez-Rodríguez D, Marco E, Schott AM, Rolland Y, Blain H, Vázquez-Ibar O, et al. Malnutrition according to ESPEN definition predicts long-term mortality in general older population: Findings from the EPIDOS study-Toulouse cohort. Clin Nutr 2019;38:2652-8. doi: 10.1016/j.clnu.2018.11.016.
15. Cederholm T, Jensen GL. To create a consensus on malnutrition diagnostic criteria: A report from the Global Leadership Initiative on Malnutrition (GLIM) meeting at the ESPEN Congress 2016. Clin Nutr 2017;36:7-10. doi: 10.1016/j.clnu.2016.12.001.
16. da Silva Fink J, Marcadenti A, Rabito EI, Silva FM. The New European Society for Clinical Nutrition and Metabolism Definition of Malnutrition: Application for Nutrition Assessment and Prediction of Morbimortality in an Emergency Service. JPEN J Parenter Enteral Nutr 2018;42:550-6. doi: 10.1177/0148607117695248.
17. Guerra RS, Fonseca I, Sousa AS, Jesus A, Pichel F, Amaral TF. ESPEN diagnostic criteria for malnutrition — A validation study in hospitalized patients. Clin Nutr 2017;36:1326-32. doi: 10.1016/j.clnu.2016.08.022.
18. Hudson L, Chittams J, Griffith C, Compher C. Malnutrition Identified by Academy of Nutrition and Dietetics/American Society for Parenteral and Enteral Nutrition Is Associated With More 30-Day Readmissions, Greater Hospital Mortality, and Longer Hospital Stays: A Retrospective Analysis of Nutrition Assessment Data in a Major Medical Center. JPEN J Parenter Enteral Nutr 2018;42:892-7. doi: 10.1002/jpen.1021.
19. Saunders J, Smith T. Malnutrition: causes and consequences. Clin Med (Lond) 2010;10:624-7. doi: 10.7861/clinmedicine.10-6-624.
20. Thibault R, Pichard C. The evaluation of body composition: a useful tool for clinical practice. Ann Nutr Metab 2012;60:6-16. doi: 10.1159/000334879.
21. Amirabdollahian F, Haghighatdoost F. Anthropometric Indicators of Adiposity Related to Body Weight and Body Shape as Cardiometabolic Risk Predictors in British Young Adults: Superiority of Waist-to-Height Ratio. J Obes 2018;2018:e8370304. doi: 10.1155/2018/8370304.
22. Pichard C, Kyle UG, Morabia A, Perrier A, Vermeulen B, Unger P. Nutritional assessment: lean body mass depletion at hospital admission is associated with an increased length of stay. Am J Clin Nutr 2004;79:613-8. doi: 10.1093/ajcn/79.4.613.
23. Pirlich M, Schütz T, Norman K, Gastell S, Lübke HJ, Bischoff SC, et al. The German hospital malnutrition study. Clin Nutr 2006;25:563-72. doi: 10.1016/j.clnu.2006.03.005.
24. Tsaousi G, Panidis S, Stavrou G, Tsouskas J, Panagiotou D, Kotzampassi K. Prognostic indices of poor nutritional status and their impact on prolonged hospital stay in a Greek university hospital. Biomed Res Int 2014;2014:e924270. doi: 10.1155/2014/924270.
25. Leandro-Merhi VA, de Aquino JL. Determinants of malnutrition and post-operative complications in hospitalized surgical patients. J Health Popul Nutr 2014;32:400-10.