

## ORIGINAL ARTICLE

## Prevalence of Malnutrition and Its Association with Clinical Complications in Hospitalized Cardiac Patients: Retrospective Cohort Study

Natally Gonçalves de Ávila,<sup>1</sup> Juliana Umbelino Carneiro,<sup>1</sup> Fernanda Donner Alves,<sup>1</sup> Izabele Vian da Silveira Corrêa,<sup>2</sup> Juliana Paludo Vallandro<sup>1</sup>

Centro Universitário Ritter dos Reis – Uniritter,<sup>1</sup> Porto Alegre, RS – Brazil

Instituto de Cardiologia – Fundação Universitária de Cardiologia (IC-FUC),<sup>2</sup> Porto Alegre, RS – Brazil

### Abstract

**Background:** Malnutrition can affect the clinical course of hospitalized patients, increasing hospital stay, infections, mortality, and hospital costs. Among heart disease patients, the malnutrition prevalence ranges from 25 to 51.9%.

**Objective:** To assess the prevalence of malnutrition and its association with clinical complications in cardiac patients admitted to a cardiology hospital.

**Method:** Retrospective cohort study with patients evaluated within 48 hours of admission to the ward of a referral center for cardiology in Porto Alegre, Brazil. Patients were aged 18 years or older. Malnutrition was assessed by Subjective Global Assessment. Length of hospital stay, transfer to the intensive care unit (ICU), hospital discharge and in-hospital death were collected from medical records. Statistical analysis was performed using the SPSS 22.0 program. Comparisons between groups with and without malnutrition were made by unpaired Student's t-test and chi-square test with adjusted residuals, and multivariate Poisson regression used for analysis of outcomes. The significance level considered was 5%.

**Results:** We evaluated 130 patients aged  $63 \pm 13$  years, 63% were male, and the most frequent cause of hospitalization was angina (25%). The prevalence of malnutrition was 27% and, after statistical adjustment for age, malnutrition was positively associated with ICU transfer and length of hospital stay longer than seven days.

**Conclusion:** The prevalence of malnutrition found in this sample was 27% and this nutritional diagnosis was positively associated with ICU transfer and length of hospital stay longer than seven days. (Int J Cardiovasc Sci. 2020; [online].ahead print, PP.0-0)

**Keywords:** Cardiovascular Diseases/complications; Malnutrition; Patient Care; Mortality; Hospitalization; Cohort Studies.

### Introduction

Annually, approximately 17.9 million people die from cardiovascular disease worldwide, representing nearly 31% of global deaths.<sup>1</sup> In cardiac patients, the prevalence of malnutrition varies according to the cause of the disease and the malnutrition screening tool, ranging from 25 to 51.9%.<sup>2</sup> However, no study has been found in the literature over the past 10 years investigating the prevalence of malnutrition and its association with clinical outcomes in stable ischemic heart disease patients.

In hospital practice, impaired nutritional status and malnutrition are possible complications among cardiac patients<sup>3,4</sup> leading to increased morbidity and mortality rates and impact on clinical outcomes.<sup>4,5</sup> Studies have shown that cardiac patients with moderate or severe energy-protein malnutrition have higher mortality risks,<sup>3,6,7</sup> and hospitalization, per se, is an important predictor of nutritional risk.<sup>8</sup>

The assessment of nutritional status of hospitalized cardiac patients is essential to diagnose nutritional

**Mailing Address:** Juliana Paludo Vallandro

Rua Fernando Abbott, 455/901. Postal Code: 91040-360, Bairro Cristo Redentor, Porto Alegre, RS - Brazil

E-mail: jujupaludo@hotmail.com

disorders that may be additional risk factors for heart disease.<sup>3,5</sup> Different parameters, such as dietary history, anthropometric measures, biochemical data, clinical history and physical examination, have been used in the nutritional assessment of hospitalized patients,<sup>9,10</sup> and the Subjective Global Assessment (SGA) has been a widely used tool due to its practicality<sup>3,11</sup> and sensitivity in detecting impaired nutritional status.<sup>3,7</sup>

Identifying the nutritional profile of hospitalized cardiac patients is essential to determine the most appropriate dietary treatment and to optimize health professionals' and institutional managers' planning. As malnutrition is an important risk factor for clinical complications, the aim of the present study was to identify the prevalence of malnutrition and its association with the need for intensive care, with death and longer hospital stay in cardiac patients admitted to a referral center for cardiology.

## Materials and methods

### Study design

It was a retrospective cohort study performed at the Institute of Cardiology - University Foundation of Cardiology (IC - FUC) of Porto Alegre - RS, Brazil. Collection of data referring to the period from May 2016 to September 2017 was made in June and July 2018, following the *Strengthening the Reporting of Observational Studies in Epidemiology* (STROBE)<sup>12</sup> recommendations. The IC-FUC is a tertiary level hospital specialized in cardiac diseases, that provides emergency, outpatient and inpatient care, with approximately 300 beds, 60% of which for users of the Brazilian Unified Health System and 40% for patients covered by private health insurance and private patients.

### Population

The study included hospitalized patients aged 18 years or older, of both genders, whose underlying disease was ischemic heart disease. All patients were prescribed oral diets. Patients on enteral or parenteral nutrition were excluded, since the SGA includes parameters for assessment of oral intake only; patients admitted to the emergency room, to the Intensive Care Unit (ICU) or to the operating room were not included.

### Nutritional Status Assessment

Assessment of nutritional status was conducted using the SGA<sup>11</sup> tool, applied by experienced and trained nutritionists of the hospital within 48 hours of admission. The SGA questionnaire contains subjective information obtained by anamnesis and simplified physical examination. The SGA includes taking a history of body weight change (weight loss percentage calculated from patient's usual and current weight), eating habits (changes in food intake in the last two weeks), gastrointestinal symptoms, functional capacity (defined as the ability to walk and perform daily activities) and degree of metabolic stress (classified according to type and stage of the disease).

Subcutaneous tissue loss, muscle mass loss, presence of edema in the ankle, sacral region and ascites were evaluated by physical examination. Then, After the evaluator's subjective evaluation, patients were subjectively classified as being (A) well-nourished, (B) moderately malnourished or (C) severely malnourished.<sup>11</sup>

Variables related to clinical outcomes were obtained from patients' electronic medical records and included length of hospital stay (days), transfer to ICU and in-hospital death.

### Statistical analysis

For statistical analysis purposes, SGA categories B and C were grouped in one category, and analysis was made based on two groups: Group 1: well-nourished and Group 2 (categories B and C): malnourished. Furthermore, multivariate analysis with Poisson regression was performed in an adjusted and unadjusted way for the variable age.

The WINPEPI program (version 11.65) was used for sample calculation, based on the prevalence of malnutrition reported in the systematic review by Correia et al.,<sup>2</sup> of 25-52% in cardiac patients. Therefore, to estimate the prevalence of malnutrition with an acceptable difference of 0.1 and a significance level of 95%, the number of patients for this study would be from 97 (25%) to 105 (52%). To ensure sampling, 130 patients were included.

The variables collected were compiled into an Excel database and analyzed using the Statistical Package for the Social Science 22.0 (SPSS) software. Continuous variables were expressed as means and standard deviations and categorical variables were described in absolute frequencies and percentage. The Kolmogorov-

Smirnov normality test was performed to assess sample distribution. For comparisons between patients with different nutritional status assessed by SGA, continuous variables were compared by unpaired Student's t-test. Multivariate analysis was also performed with age-adjusted Poisson regression for death, length of hospital stay and need for intensive care. Categorical variables were compared with chi-square test and adjusted residual analysis greater than 1.96 indicated statistical difference. The level of significance adopted was 5%.

### Ethical aspects

The research project was submitted and approved by the Research Ethics Committee of the Teaching Unit of IC-FUC (approval number UP 5496.18 and CAAE number 90618818.2.0000.5333). The study was conducted and developed according to the Declaration of Helsinki and CNS Resolution No. 466 of 2012 of the Brazilian Ministry of Health. Considering the retrospective nature of data collection and review of patients' electronic medical records, patient confidentiality was preserved.

### Results

Data of 130 patients were analyzed. Mean age of patients was 63 ± 13 years, most of patients was male (n = 82, 63%), and angina was the main cause of hospitalization (n = 33, 25%). The prevalence of malnutrition according to the SGA was 27% (n = 35). Table 1 describes the characteristics of the sample and SGA classification.

Table 2 describes the frequency of the SGA components, and a low frequency of severe malnutrition was found. Most patients were classified as having low metabolic stress (n = 48, 37%). Weight loss in the last 6 months was identified in 15 patients (11%), and reduced food intake in 20 (15%) patients.

Table 3 shows the comparison of well-nourished patients (SGA group A) with patients grouped as SGA B + C (with some degree of malnutrition) for clinical variables and complications at admission. Patients classified as malnourished by SGA were older and had a higher frequency of hospital stay longer than 7 days.

In table 4 consolidates the multivariate analysis by Poisson regression models, adjusted and unadjusted for age. After this adjustment, statistical significance was observed for the variables ICU stay and hospital stay longer than 7 days.

**Table 1 – Characteristics of the sample**

Variables	N = 130
Age	63 ± 13
- elderly	56 (43.1%)
- adults	74 (56.9%)
Male	82 (63%)
Cause of hospitalization	
- angina	33 (25%)
- AMI	23 (18%)
- surgery	19 (15%)
Length of hospital stay	9 (5 – 14)
Need for intensive care	59 (45%)
In-hospital death	4 (3%)
SGA classification	
- A	95 (73%)
- B	32 (25%)
- C	3 (2%)

*Data described as mean and standard deviation, absolute frequency and percentage. SGA: subjective global assessment; ICU: intensive care center; AMI: acute myocardial infarction;*

### Discussion

The present study found a low prevalence of malnutrition in the sample using SGA. Malnourished patients were older and had longer hospital stays. After age-adjusted multivariate analysis, a positive association of malnutrition with ICU transfer and length of hospital stay was observed.

Corroborating with the present study, findings in the literature indicate that malnutrition is more commonly observed in elderly patients,<sup>8,13,14</sup> where the more advanced the age, the greater the risk of malnutrition. Therefore, for assessment of malnutrition using clinical outcomes, age adjustment was necessary in the multivariate analysis. This research also revealed that 73% of the sample was well-nourished, which can be justified by the fact that most patients with ischemic heart disease are overweight or obese.<sup>15,16</sup> More severe patients and hemodynamically unstable patients were excluded to add data in the literature regarding the prevalence of malnutrition and associated clinical outcomes in patients with stable ischemic heart disease.

**Table 2 – Frequency of patients by Subjective Global Assessment (SGA) components presence (n = 130)**

SGA Variables	Frequency
Weight loss in the last 6 months	15 (11%)
Weight loss in the last 2 weeks	8 (6%)
Dietary intake change	20 (15%)
Presence of gastrointestinal symptoms	10 (7%)
Functional capacity dysfunction	12 (9%)
Underlying disease:	
- heart disease	67 (51%)
- two or more	22 (17%)
Metabolic stress:	
- low	48 (37%)
- moderate	2 (16%)
- high	5 (4%)
Slight fat loss	12 (9%)
Mild muscle loss	12 (9%)
Mild ankle edema	3 (2%)
Mild sacral edema	2 (1.5%)
Ascites	0 (0%)

*SGA: subjective global assessment.*

Malnourished patients in this study showed a higher percentage of hospitalization longer than 7 days. In the study of Karst et al.,<sup>17</sup> which evaluated 83 cardiac patients admitted to the ICU, mean hospital stay of malnourished patients was longer than that of well-nourished patients. Kang et al.,<sup>18</sup> evaluated 300 hospitalized patients with different diseases and identified a longer hospitalization time in the malnourished group. In contrast, the study by Veras et al.,<sup>19</sup> performed with 45 surgical patients with various diseases, found no significant difference in the length of hospital stay between well-nourished and malnourished groups according to SGA.

In addition, in-hospital mortality was not associated with malnutrition. However, a positive association of malnutrition with in-hospital mortality in heart failure has already been demonstrated,<sup>20</sup> which is expected for this patient's profile and which differs from ischemic heart disease. In the study by Yamauti et al.,<sup>7</sup> with two groups of cardiac patients, one consisting of several etiologies and the other only with decompensated congestive heart failure, malnutrition prevalence was significantly higher in the heart failure group.

To overcome the limitation that SGA is a method originally validated for surgical patients, we used the scored version of the instrument,<sup>11</sup> which is also validated and allows minimizing possible measurement biases, inherent to any subjective assessment methods. The evaluators were previously trained for its application; however, as it was a retrospective study,

**Table 1 – Comparison between well-nourished and malnourished patients according to Subjective Global Assessment**

	Well-nourished SGA A (n = 95)	Malnourished SGA B e C (n = 35)	<i>P value</i>
Age	60 ± 12	70 ± 13	< 0,001
Male	60 (63%)	22 (63%)	0.975
ICU admission	38 (40%)	21 (60%)	0.115
In-hospital death	1 (1%)	3 (8%)	0.075
Hospital stay > 7 days	50 (53%)	27 (77%)	0.012

*Continuous data with normal distribution compared by Student's t-test and described as mean and standard deviation. Categorical data were described as absolute and percentage frequency and compared by chi-square test. SGA: global subjective assessment; ICU: intensive care unit*

**Table 4 – Multivariate analysis to assess the effect of malnutrition detected by Subjective Global Assessment (B / C classifications) on the study outcomes**

Variables	PR (95% CI)	P	Adjusted PR* (95% CI)	p-value
ICU stay	1.48 (1.03 – 2.14)	0.034	1.55 (1.05 – 2.27)	0.026
In-hospital death	8.06 (0.87 – 74.9)	0.067	7.41 (0.49 - 112.4)	0.149
Hospital stay > 7 days	1.47 (1.13 – 1.91)	0.004	1.35 (1.01 – 1.79)	0.040

\* Adjusted for age. SGA: subjective global assessment; ICU: intensive care unit; BMI: body mass index; PR: prevalence ratio; CI: confidence interval.

intra-observer analysis was not possible. In addition, the exclusion of patients using enteral nutritional therapy may have underestimated the prevalence of malnutrition in our sample.

On the other hand, SGA allows for a consistent assessment of hospitalized patients, especially when objective measurements cannot be performed, which justifies its wide use in clinical practice.

## Conclusion

The prevalence of malnutrition according to the SGA was 27% in hospitalized ischemic heart disease patients. There was a positive association of malnutrition with hospitalization stay longer than 7 days and referral to the intensive care unit. Studies evaluating body composition in cardiac patients can better elucidate the association of nutritional diagnosis with clinical complications and length of hospital stay.

## Author contributions

Conception and design of the research: Ávila NG, Alves FD, Corrêa IVS, Vallandro JP. Acquisition of data: Ávila NG, Carneiro JU, Corrêa IVS, Vallandro JP. Analysis and interpretation of the data: Ávila NG, Alves FD, Corrêa

IVS, Vallandro JP. Statistical analysis: Ávila NG, Alves FD, Corrêa IVS, Vallandro JP. Writing of the manuscript: Ávila NG, Carneiro JU, Alves FD, Corrêa IVS, Vallandro JP. Critical revision of the manuscript for intellectual content: Ávila NG, Carneiro JU, Alves FD, Corrêa IVS, Vallandro JP.

## Potential Conflict of Interest

No potential conflict of interest relevant to this article was reported.

## Sources of Funding

There were no external funding sources for this study.

## Study Association

This study is not associated with any thesis or dissertation work.

## Ethics approval and consent to participate

This study was approved by the Ethics Committee of the *Instituto de Cardiologia - Fundação Universitária de Cardiologia* (IC-FUC) under the protocol number 5496.18. All the procedures in this study were in accordance with the 1975 Helsinki Declaration, updated in 2013. Informed consent was obtained from all participants included in the study.

## References

1. World Health Organization - WHO. Cardiovascular diseases (CVDs). Geneva; 2016. [Cited in 2019 May 12] Available from: <http://www.who.int/mediacentre/factsheets/fs317/en/index.html>.
2. Correia MITD, Perman MI, Waitzberg DL. Hospital malnutrition in Latin America: A systematic review. *Clin Nutr*. 2017;36(Suppl 4):958-67.
3. Pathirana AK, Lokunarangoda N, Ranathunga I, Santharaj WS, Ekanayake R, Jayawardena R. Prevalence of hospital malnutrition among cardiac patients: results from six nutrition screening tools. *Springerplus*. 2014 Aug 2014;3:412.
4. Raslan M, Gonzalez MC, Dias MCG, Paes-Barbosa FC, Ceconello I, Waitzberg DL. Aplicabilidade dos métodos de triagem nutricional no paciente hospitalizado. *Rev Nutr* 2008;21(5):553-61.
5. Sampaio RMM, Vasconcelos CMCS, Pinto FJM. Prevalência de desnutrição segundo a avaliação nutricional subjetiva global em pacientes

- internados em um hospital público de Fortaleza (CE). *Rev Baiana Saúde Públ.* 2010;34(2):311-20.
6. Dutra OP, Sociedade Brasileira de Cardiologia. II Diretriz Brasileira de Cardiopatia Grave. *Arq Bras Cardiol.*2006;8&(6):544-50.
  7. Yamauti AK, Ochiai MF, Bifulco PS, Araújo MA, Alonso RR, Ribeiro RHC et al. Avaliação nutricional subjetiva global em pacientes cardiopatas. *Arq Bras Cardiol* 2006;87(6):772-7.
  8. Correia MITD, Hegazi RA, Higashiguchi T, Michel JP, Reddy BR, Tappenden KA et al. Evidence-Based Recommendations for Addressing Malnutrition in Health Care: An Updated Strategy From the feed M.E. Global Study Group. *J Am Med Dir Assoc.* 20115(8):544-50.
  9. Jensen GL, Mirtallo J, Compher C, Dhaliwal R, Forbes A, Grijalba RF et al. Adult starvation and disease related malnutrition: a proposal for etiology-based diagnosis in the clinical practice setting from the International Consensus Guideline Committee. *JPEN J Parenter Enteral Nutr.* 2010;34(2):156-9.
  10. Valente KP, Silva NMF, Faiol AB, Barreto MA, Moraes RAG, Guandalini VR. Espessura do músculo adutor do polegar na avaliação nutricional de pacientes cirúrgicos. *Einstein.* 2016;14(1):18-24.
  11. Garavel M, Hagaman A, Morelli D, Rosenstock BD, Zagaja J. Determining nutritional risk: assessment, implementation and evaluation. *Nutrition Support Services.* 1988;18:19.
  12. Malta M, Cardoso LO, Bastos FI, Magnanini MMF, Silva CMFP. Iniciativa STROBE: subsídios para a comunicação de estudos observacionais. *Rev Saude Publica.* 2010;44(3):559-65.
  13. Kellett J, Kyle G, Itsiopoulos C, Naunton M, Luft N. Malnutrition: The Importance of Identification, Documentation, and Coding in the Acute Care Setting. *J Nutr Metabol.* 2016 Sep 28; 2016.
  14. Crestani N, Bieger P, Kik RME, Dias RL, Alscher S, Lienert RS. Perfil nutricional de pacientes adultos e idosos admitidos em um hospital universitário. *Rev Ciência & Saúde.* 2011;4(2):45-9.
  15. Simão AF, Precoma DB, Andrade JP, Correa Filho H, Saraiva JFK, Oliveira GMN, et al. I Diretriz Brasileira de Prevenção Cardiovascular. *Arq Bras Cardiol.* 2013;101(6 supl 2):1-63.
  16. Quirino CSP, Maranhão RVA, Giannini DT. Síndrome metabólica em pacientes atendidos em programa de reabilitação cardíaca. *Rev Bras Cardiol.* 2014;27(3):180-8.
  17. Karst FP, Vieira RM, Barbiero S. Relação da espessura do músculo adutor do polegar e avaliação subjetiva global em unidade de terapia intensiva cardiológica. *Rev Bras Ter Intensiva.* 2015;27(4):369-75.
  18. Kang MC, Kim JH, Ryu SW, Moon JY, Park JH, Park JK, et al. Prevalence of Malnutrition in Hospitalized Patients: a Multicenter Cross-sectional Study. *J Korean Med Sci.* 2018 Jan;33(2):e10.
  19. Veras VS, Oliveira TR, Fortes RC., Salomon AL. Prevalência de desnutrição ou risco nutricional em pacientes cirúrgicos hospitalizados e correlação entre os métodos subjetivos e objetivos de avaliação do estado nutricional. *Rev Bras Nutr Clin.* 2016;31(2):101-7.
  20. Bonilla-Palomas JL, Gamez-Lopez AL, Castillo-Dominguez JC, Moreno-Conde M, Lopez-Ibanez M, Exposito RA, et al. Nutritional Intervention in Malnourished Hospitalized Patients with Heart Failure. *Arch Med Res.* 2016;47(7):535-40.

