

# Integrative review: Subjective and objective methods for assessing nutritional status of elderly patients with heart failure

*Revisão integrativa: Métodos subjetivos e objetivos para avaliação do estado nutricional de pacientes idosos com insuficiência cardíaca*

DOI: 10.37111/braspenj.2021.36.1.13

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**Unitermos:**

Idoso. Avaliação Nutricional. Estado Nutricional. Insuficiência Cardíaca.

**Keywords:**

Aged. Nutrition Assessment. Nutritional Status. Heart Failure.

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**Submission:**

June 7<sup>th</sup>, 2020

**Accepted for publication:**

February 10<sup>th</sup>, 2021

**ABSTRACT**

**Introduction:** There is a high prevalence of chronic noncommunicable diseases when age advances, highlighting the heart disease. The objectives of this study was to investigate the aging process, the cardiovascular disease and the main subjective and objectives evaluation methods of nutritional status of elderly patients with heart disease. **Methods:** It is an integrative review through articles indexed in Lilacs, Medline, PubMed, SciELO, NCBI, Capes, Bireme, published between 2014 and 2018. **Results:** Studies show that the elderly are frequently affected by malnutrition during hospitalization, which represents about 77% of the cases. In pre-surgical patients, the prevalence of malnutrition ranges from 25.5% to 51%. There are several types of subjective methods and objectives for assessing the nutritional status of hospitalized elderly people, such as: Nutritional Risk Screening (NRS-2002), Mini Nutritional Assessment Short-Form (MNA-SF) and Malnutrition Universal Screening Tool (MUST), body mass index (BMI), arm circumference, calf circumference, hand grip strength and biochemical tests. **Conclusions:** The various researches investigated reveal that the subjective and objective evaluations of the nutritional status of the elderly with cardiovascular diseases are essential tools for early detection of malnutrition and nutritional risk and of nutritional changes, which contribute to the appropriate and timely nutritional intervention.

**RESUMO**

**Introdução:** Observa-se uma elevada prevalência de doenças crônicas não transmissíveis com o avançar da idade, destacando-se a doença cardíaca. O objetivo deste estudo foi investigar o processo de envelhecimento, a doença cardiovascular e os principais métodos subjetivos e objetivos de avaliação do estado nutricional em pacientes idosos cardiopatas. **Método:** Trata-se de uma revisão integrativa por meio de artigos indexados em Lilacs, Medline, PubMed, SciELO, NCBI, Capes, Bireme, nos idiomas inglês, espanhol e português, publicados entre 2014 e 2018. **Resultados:** Estudos demonstram que os idosos são frequentemente acometidos pela desnutrição durante a internação hospitalar, o que representa cerca de 77% dos casos. Nos pacientes pré-cirúrgico, a prevalência da desnutrição varia de 25,5% a 51%. Existem diversos tipos de métodos subjetivos e objetivos de avaliação do estado nutricional de idosos hospitalizados, tais como: Triagem de Risco Nutricional (NRS-2002), Mini Avaliação Nutricional Simplificada – (MNA-SF) e Instrumento Universal de Triagem de Má-Nutrição (MUST), peso, estatura, índice de massa corporal (IMC), circunferência do braço (CB), circunferência da panturrilha (CP), força de preensão palmar (FPP) e exames bioquímicos. **Conclusão:** As diversas pesquisas investigadas revelam que as avaliações subjetivas e objetivas do estado nutricional do idoso com doença cardiovascular são instrumentos essenciais para detecção precoce da desnutrição e/ou do risco nutricional, das alterações nutricionais, o que contribui para a adequada e oportuna intervenção nutricional.

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## INTRODUCTION

According to the World Health Organization (WHO), in developing countries such as Brazil, individuals aged 60 or older are considered elderly, while in developed countries it is considered to be 65 years or older<sup>1,2</sup>.

The Brazilian population is aging rapidly due to the decrease of fertility rate and the increase of life expectancy. A significant increase in the proportion of the elderly in Brazilian population is expected on the coming decades, as well as the speed in which this change will occur in the age structure of the population. The proportion of the elderly in the Brazilian population was 14.3%, in 2015<sup>3</sup>.

In 2015, the estimated life expectancy for individuals reaching 60 years old was that they had, on average, additional 22.1 years of life. According to data from the Mortality Information System (MIS) of 2014, the mortality of the elderly, when considering the proportion of deaths by sets of defined causes, was more grouped in diseases of the circulatory system (36.3%), followed by neoplasms (18.6%) and diseases of the respiratory system (15.5%)<sup>4</sup>.

As aging is increasing, along with the increase of chronic noncommunicable diseases (NCD's), adequate clinical care is necessary to minimize the potential effects and to improve the quality of life of the elderly. With this, the demand for hospitalizations for cardiovascular surgery has expanded<sup>5</sup>.

Elderly surgical patients are classified as an audience with a wide variety of diseases, metabolic responses and treatments, in which there is increased nutritional needs. Nutritional risk and/or malnutrition may be expressed by hospitalization or thrive due to hypercatabolic and hypermetabolic status. In view of these changes, the elderly has greater possibility of presenting complications during hospitalization and a high morbidity and mortality rate<sup>6</sup>.

Thus, it is essential to monitor the nutritional status of hospitalized elderly people through subjective and objective methods of nutritional status, assessment with the aim of early identification of nutritional risk and the possibility of aggravating an existing malnutrition. Thus, the prognosis and clinical outcomes associated with nutritional status can be improved by appropriate nutritional intervention in a timely manner through the most appropriate care therapy to the patient<sup>6</sup>.

The objective of this study was to investigate the aging process, heart failure and the main subjective and objective methods of assessment of nutritional status in elderly patients with heart disease.

## METHODS

This is an integrative review through articles indexed in Lilacs, Medline, PubMed, SciELO, NCBI, Capes and Bireme. The following inclusion criteria were used: articles in the

English, Spanish and Portuguese languages; published between 2014 and 2018, however, publications prior to this period were considered due to the relevance of the theme; which had at least one of the descriptors. Articles that were not related to the research topic were excluded. Guidelines, synthesis indicators and sites with data updates on the subject were used.

A combination of the following index terms was used: in Portuguese: "Cirurgia Torácica", "Insuficiência Cardíaca", "Avaliação Nutricional", "Estado Nutricional", "Idoso", "Envelhecimento Populacional", "Transição Demográfica", "Força Muscular", "Dinamômetro de Força Muscular" and "Desnutrição".

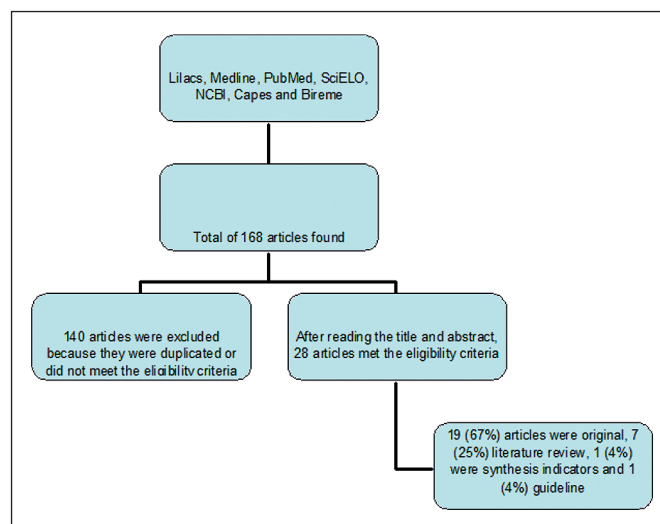
In English: "Thoracic Surgery", "Heart Failure", "Nutrition Assessment", "Nutritional Status", "Aged", "Demographic Aging", "Demographic Transition", "Muscle Strength", "Muscle Strength Dynamometer" and "Malnutrition".

In Spanish: "Cirugía Torácica", "Insuficiencia Cardíaca", "Evaluación Nutricional", "Estado Nutricional", "Anciano", "Envejecimiento de la Población", "Transición Demográfica", "Fuerza Muscular", "Dinamómetro de Fuerza Muscular" and "Desnutrición".

## RESULTS

A total of 168 articles were found, but only 28 met the eligibility criteria. Of these, 19 (67%) articles were original, 7 (25%) literature review, 1 (4%) were synthesis indicators and 1 (4%) guideline (Figure 1).

After the analytical reading of these articles, 28 were selected as the object of study because they presented aspects that answered the guiding question of this integrative review (Table 1).



**Figure 1** - Structuring the number of articles on heart failure and the main subjective and objective methods of assessing nutritional status in elderly patients with heart disease from 2014 to 2018, available at Lilacs, Medline, PubMed, SciELO, NCBI, Capes and Bireme.

**Table 1-** Main characteristics of the articles included.

Author / Date of publication	Kind of study	Objective	Methodology	Results
WHO <sup>1</sup> , 1984	Indicator of synthesis	Discussion centers on the implications for health services of the changing patterns of morbidity and disability among those over 65 years of age	An expert report on the age structure of populations in countries at different stages of the epidemiological transition	The report concludes with a number of proposals for the use of epidemiological research as a tool for acquiring the knowledge needed to improve the health and well-being of the elderly
Paz et al. <sup>2</sup> , 2011	Review	To investigate the process of aging and cancer and main methods of subjective evaluation of nutritional status in elderly cancer	This is a review of the literature using articles indexed in the LILACS, MEDLINE, SciELO, NCBI, Capes, Bireme, PubMed, Cochrane, in English, Spanish and Portuguese, with an emphasis in the last five years, following certain selection criteria	We found that individuals with malignancies are affected by changes in the metabolism of carbohydrates, proteins, lipids and, consequently, in energy metabolism. The anorexia-cachexia syndrome has a high incidence among cases of malignancy, being related to increased mortality and lower tolerance to treatment. The main methods of subjective evaluation of the nutritional status of elderly cancer are: AMS, MAN, SGA, ASG-PPP and determines
Silveira et al. <sup>5</sup> , 2016	Original	To analyze the clinical outcomes of patients undergoing cardiac surgery in a high complexity hospital	Descriptive historical longitudinal study, in which records of patients undergoing cardiac surgery within the period of one year were analyzed	Among the 137 patients records analyzed, coronary artery bypass (CABG) surgery was the most prevalent 85 (62%). The average length of stay in the intensive care unit (ICU) was $2.93 \pm 4.53$ days, and clinical / surgical units, was $3.77 \pm 3.53$ days. The most prevalent complications in the postoperative period were hypotension 50 (36.6%), bleeding 17 (12.4%) and hyperglycemia 10 (7.3%)
Nunes e Marshall <sup>6</sup> , 2014	Review	To identify, through literature review, the effectiveness of NRS 2002 screening method for predicting clinical outcomes in surgical patients	A search was conducted for articles published in the period 2003-2013, using keywords in accordance to Health Sciences Descriptors, in English, Portuguese and Spanish languages. The selection was based on the titles, abstracts and keywords	A high prevalence of malnutrition in hospitals is associated with a worse prognosis, longer hospitalization, higher rates of infectious and non-infectious complications, and mortality. Thus, it is imperative that this condition is detected early in order to avoid such negative outcomes, particularly in surgical patients
Miranda et al. <sup>7</sup> , 2016	Original	To analyze the current and future challenges related to the planning of public policies and population aging	A case study was conducted using quantitative and qualitative data from secondary data information systems and interviews with actors of social policy and the country's health	In 2010, there were 39 elderly persons for every 100 young people, while in 2040 there will be an estimated 153 elderly persons for every 100 young people. For those interviewed, Brazil is not prepared for the needs generated by such population aging, due to challenges such as the adequacy of the social security and health system. The present study identified a reduction of beds and hospitalizations, which may reflect the improvement of primary care and quality of life, with a complexification of hospitalizations
Cunha et al. <sup>8</sup> , 2016	Original	To describe the profile of medical schools that introduced courses on Geriatrics and Elderly Health or Aging in their curriculum, and compare such information with the age distribution and health epidemiological data of the Brazilian population, using data until the year of 2013	180 universities offering medical undergraduate courses and registered with the Ministry of Education and Culture of Brazil (MEC) were found, as seen on the MEC website ( <a href="http://www.emec.mec.gov.br">www.emec.mec.gov.br</a> ) in February 2013. Based on the list of institutions, the authors created a database	Brazil's Southeast region is the one presenting most of the courses, both offered as core or elective subjects, in the area of Geriatrics. The Midwest region had the least offer of Geriatrics and Elderly Health and Care courses. The Southeast region presents the greater absolute number of institutions with elective subjects, followed by the South and Northeast regions, each with a single institution. The Southeast region was at the same time the one that presented the biggest absolute number of institutions offering core subjects in the area of Geriatrics, being followed by the Northeast, South, North, and Midwest regions

Continuation Table 1 - Main characteristics of the articles included.

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Myrrha et al. <sup>9</sup> , 2014	Review	To apply such methodology to the Brazilian population, discussing major demographic changes from current function of population growth in Brazil, observed in the periods between 1970 and 1980, 1980 and 1990, 1990 and 2000, 2000 and 2010	From the patterns of the specific growth rates, simulated by Horiuchi and Preston (1988) to describe the structure of specific growth rates for each demographic change regime, possible marks of the demographic history present in the current cohorts were evaluated by Brazilian companies	The results show that the information contained in the specific rates growth rates are quite illuminating in relation to the effects of variations in demographic, being of great use in populations whose vital rates are not reliable or are unavailable
Silva e Paiva <sup>10</sup> , 2010	Original	To trace the nutritional and food profile of the elderly participants of the UNIPAM Senior Program, at the University Center of Patos de Minas	Cross-sectional study conducted with students over the age of 60 years periodically attending the UNIPAM Senior program, at the University Center de Patos de Minas - UNIPAM, from September 2008 to September 2009	The population was made up of 56 elderly men and women, the majority of whom were female (91.1%). It was diagnosed that 3.6% of the elderly were underweight, 57.1% eutrophic, and 39.3% were overweight, with a higher proportion in males. The average caloric intake daily rate was only 1246.50 ± 421.68 kcal. However, they reported consuming healthy foods daily, like fruits, vegetables, milk
Taffet <sup>11</sup> , 2017	Review	To evaluate the effects of aging on the endocrine and immune systems are discussed in more detail separately	Review	Time modifies many biologic processes. Aging is characterized by progressive and broadly predictable changes that are associated with increased susceptibility to many diseases. Aging is not a homogenous process. Rather, organs in the same person age at different rates influenced by multiple factors, including genetic makeup, lifestyle choices, and environmental exposures
Wysokinski et al. <sup>12</sup> , 2015	Review	To present a summary of current knowledge on the physiological, pathological, and social mechanisms of the anorexia of aging	Searched the EBSCO Medline and PubMed databases using the keywords anorexia and aging/ageing. No time limits were used. Two hundred seventy three articles were identified. included articles on people above 65 years of age that assessed physiopathology, epidemiology, mortality, and treatment of the anorexia of aging. Also, articles on pathological causes of anorexia in the elderly and social causes of the anorexia of aging were included. As regards physiopathology. Studies on anorexia nervosa were excluded	The etiology of the anorexia of aging is multifactorial and includes a combination of physiological changes associated with aging (decline in smell and taste, reduced central and peripheral drive to eat, delayed gastric emptying), pathological conditions (depression, dementia, somatic diseases, medications and iatrogenic interventions, oral-health status), and social factors (poverty, loneliness). However, exact mechanisms of the anorexia of aging remain to be elucidated
Leandro-Merhi et al. <sup>13</sup> , 2017	Original	To investigate whether total lymphocyte count is related to other nutritional markers in hospitalized older adults	Hospitalized older adults (N=131) were recruited for a cross-sectional study. Their nutritional status was assessed by the Nutritional Risk Screening (NRS), anthropometry, and total lymphocyte count. The statistical analyses included the chi-square test, Fisher's exact test, and Mann-Whitney test. Spearman's linear correlation coefficient determined whether total lymphocyte count was correlated with the nutritional markers. Multiple linear regression determined the parameters associated with lymphocyte count. The significance level was set at 5%	According to the NRS, 41.2% of the patients were at nutritional risk, and 36% had mild or moderate depletion according to total lymphocyte count. Total lymphocyte count was weakly correlated with mid-upper arm circumference (r=0.20507); triceps skinfold thickness (r=0.29036), and length of hospital stay (r= -0.21518). Total lymphocyte count in different NRS categories differed significantly: older adults who were not at nutritional risk had higher mean and median total lymphocyte count (p=0.0245). Multiple regression analysis showed that higher lymphocyte counts were associated with higher triceps skinfold thicknesses and no nutritional risk according to the NRS

Continuation Table 1 - Main characteristics of the articles included.

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Calvo et al. <sup>14</sup> , 2012	Original	To evaluate the use of the MNA® Mini Nutritional Assessment in hospitalized older adults for rapid evaluation of nutritional risk	A prospective cohort study was made of 106 patients 65 years old or older admitted to an internal medicine ward of a tertiary-care teaching hospital to evaluate the use of the short form, or screening phase, of the MNA-SF. In the first 48 hours of admission, the full MNA questionnaire was administered and laboratory tests and a dermatologic evaluation were made	The MNA score showed that 77% of the patients were at risk of malnutrition or were frankly malnourished. Low blood levels of albumin, cholesterol and vitamins A and D showed a statistically significant association with malnutrition or risk of malnutrition. Separate evaluation of the MNA-SF showed that it was accurate, sensitive and had predictive value for the screening process. Routine use of the MNA-SF questionnaire by admission nurses to screen patients is recommended. Patients with MNA-SF scores of 11 or lower should be specifically
Leite et al. <sup>15</sup> , 2016	Original	To identify nutritional risk according to a nutritional screening method, of patients admitted to surgical ward in the preoperative period, in a general hospital in the city of Salvador, BA	This is a cross-sectional study. Data were collected from patients admitted, during the period from March to July 2013, on gender, age, surgical diagnosis, anthropometric measures (weight and height) and classification Nutritional Risk Screening - 2002. Body mass index was used to determine the prevalence of malnutrition as stratification proposed by the World Health Organization for adults and the proposal by Lipschitz for the elderly. Statistics analyses were performed with the aid of the software Statistical Package for Social Sciences (SPSS), version 17.0, using the Chi Square test. Statistical significance is reported for $p < 0.05$	The study included 180 patients, with a mean age of $53.0 \pm 16.0$ years, the majority (58.9%) was female and 28.9% malnourished. The general prevalence of nutritional risk was 46.1%. Males had greater prevalence of nutritional risk (62.2%), as well as elderly (50.8%) and cancer patients (71.3%) ( $p < 0.001$ among groups)
Gonçalves et al. <sup>16</sup> , 2016	Original	To assess the preoperative nutritional status of patients and the role it plays in the occurrence of clinical complications in the postoperative period of major elective cardiac surgeries	Cross-sectional study comprising 72 patients aged 20 years or older, who underwent elective cardiac surgery. The preoperative nutritional assessment consisted of nutritional screening, anthropometry (including the measurement of the adductor pollicis muscle thickness) and biochemical tests. The patients were monitored for up to 10 days after the surgery in order to control the occurrence of postoperative complications. The R software, version 3.0.2, was used to statistically analyze the data	Clinical complications were found in 62.5% ( $n=42$ ) of the studied samples and complications of non-infectious nature were most often found. Serum albumin appeared to be associated with renal complications ( $p=0.026$ ) in the nutritional status indicators analyzed herein. The adductor pollicis muscle thickness was associated with infectious complications and presented mean of $9.39 \pm 2.32$ mm in the non-dominant hand ( $p=0.030$ ). No significant correlation was found between the other indicators and the clinical complications
Santos e Araújo <sup>17</sup> , 2014	Original	To investigate the association between preoperative nutritional status, the incidence of surgical complications and length of hospitalization of elderly patients undergoing gastrointestinal surgeries	51 elderly patients (> 60 years) were evaluated within 48 hours in the preoperative gastrointestinal surgeries through nutritional evaluation, of anthropometric parameters: weight, height estimated from knee height, brachial circumference, calf circumference, weight loss in the last 6 months, body mass index and of biochemical parameters. The clinical diagnosis, comorbidities, the incidence of postoperative complications and length of hospital stay were also investigated	The diagnosis of malnutrition varied from 25.5 to 51%, the nutritional miniavaliação significantly associated with brachial circumference ( $p = 0.025$ ) and calf circumference ( $p = 0.021$ ). Patients with malignant disease had a higher percentage of malnutrition by nutritional miniavaliação ( $p = 0.025$ ) and brachial circumference ( $p = 0.029$ ). The nutritional miniavaliação ( $p = 0.005$ ), the percentage of weight loss ( $p = 0.014$ ), anemia ( $p = 0.012$ ), malignancy ( $p = 0.003$ ) and the presence of postoperative complications ( $p < 0.001$ ) were associated with length of hospitalization



Continuation Table 1 - Main characteristics of the articles included.

Author / Date of publication	Kind of study	Objective	Methodology	Results
Guerra-Sanchez et al. <sup>18</sup> , 2014	Original	To determine a fast and reliable method that doesn't require prior training, for the screening and nutritional assessment of heart failure's patients	Observational study. The nutritional status has been evaluated by Subjective global assessment (SGA), Mini nutritional assessment (MNA) in its short form (MNA-SF) and in its evaluation form (MNA-LF), the nutritional Risk Screening (NRS 2002), the controlling nutritional status or method Ulibarri's method (CONUT), the Cardona's method and the Malnutrition Universal Screening Tool (MUST) the nutritional status of 242 patients joined in a high complexity hospital with decompensation of chronic heart failure. There were analyzed the sensibility, specificity, the predictive values, the reasons of verisimilitude, the odds ratio diagnoses and the Kappa correlation index of the different methods compared with the subjective global valuation, which was considered like gold standard	The mean age was 75±9. The 50,8%(n=123) were men. The Kappa index was MNA-LF= 0,637; MNASF= 0,556; NRS= 0,483; MUST= 0,197; Cardona= 0,188; CONUT= 0,076.75
Hsu et al. <sup>19</sup> , 2016	Original	To compare the abilities of two anthropometrics parameters (calf circumference and body mass index) in predicting emerging care-need in older adults	The authors analyzed the 1999 (baseline) and 2003 (end-point) datasets of the Taiwan Longitudinal Survey on Aging. Participants were 2521 ≥ 65-year old adults without care at baseline. To derive proper cut-offs of body mass index (BMI) and calf circumference (CC), we first drew a plot to show the relationship between the risk of care-need and the cumulative distribution of BMI or CC. We then divided the risk into three levels and calculated the corresponding percentiles of BMI and CC. Multivariable logistic regression was used to build up predictive models. Akaike Information Criterion (AIC) and net reclassification improvement (NRI) were performed to compare the models as well as the predictive abilities of BMI and CC	After controlled other independent variables, CC was significantly associated with emerging care-need in the subsequent 4 years, but BMI was not. The Akaike Information Criterion (AIC) value of the model with CC (1956.3) was remarkably lower than BMI (1968.7). The net reclassification improvement (NRI) was 4.8% (p = 0.007) which quantified the improvement of the model with inclusion of CC instead of BMI to predict emerging care-need
Veras e Fortes <sup>20</sup> , 2014	Review	To investigate in literature the prevalence of malnutrition and/or nutritional risk in surgical inpatients	Randomized clinical trials, observational studies and literature review articles published in journals indexed at Pubmed/ Medline, Lilacs/ Bireme, SciELO and ProQuest have been selected, mostly those between 2003 and 2014. Articles in Portuguese, English and Spanish have been drawn on	Deterioration in the nutritional state affects a large part of surgical inpatients, which ends up by bringing a negative impact on a prognosis for the sick patient, mostly in the post-operative phase. Studies have found that prevalence in nutritional risk or malnutrition in surgical inpatients ranges between 6% and 87%. The nutritional screening tools renders possible a more reliable evaluation of a nutritional state, which in turn leads to an early identification of malnutrition or nutritional risks
Kondrup et al. <sup>21</sup> , 2003	Guideline	To give simple guidelines as to how undernutrition, or risk for development of undernutrition, can be detected, by proposing a set of standards which are practicable for general use in patients and clients within present healthcare resources	To provide guidelines for nutrition risk screening applicable to deferent settings (community, hospital, elderly) based on published and validated evidence available until June 2002	A nutritional care plan in most cases will involve food, oral supplements, tube feeding and parenteral nutrition, often used interchangeably in the same patient, whereas the majority of randomized trials, and meta-analyses, have dealt with studies of single modality treatments. The predictive validity of a screening tool therefore cannot be directly based on meta-analyses available at present

Continuation Table 1 - Main characteristics of the articles included.

Author / Date of publication	Kind of study	Objective	Methodology	Results
Duarte et al. <sup>22</sup> , 2014	Original	To assess the prevalence of nutritional risk in hospitalized subjects and the agreement in nutritional diagnosis between five nutritional screening protocols	A cross-sectional study included patients of both genders, aged 18, admitted to hospital from January to March 2013 within the first 48 hours of admission, the following nutritional screening protocols were applied: Mini Nutrition Assessment (MNA); Mini Nutrition Assessment Short Form (MNA-S); Subjective Global Assessment (ASG); Nutritional Risk Screening (NRS 2002); and Malnutrition Universal Screening Tool (MUST). The protocols consist of questions related to weight loss, body mass index, functional capacity, food appetite and gastrointestinal disturbances. Subjects were classified into two levels: well-nourished and malnourished	A sample of 100 patients were evaluated, which showed 49 (49%) individuals at nutritional risk by the MNA protocol; 53 (53%) by MNA-SF; 23 (23%) by MUST; 7 (7%) by NRS; and 4 (4%) by ASG. The female and aged over 60 years prevailed in the sample. Three protocols, MNA-SF, MUST and NRS, showed a higher nutritional risk in patients over 60 years ( $p \leq 0.05$ ). It was observed that MNA and MNA-SF protocols obtained better agreement (Kappa coefficient = 0.760, $p < 0.001$ )
Nunes e Marshall <sup>23</sup> , 2015	Original	To determine the value of nutritional screening Nutritional Risk Screening 2002 (NRS-2002) to predict postoperative outcomes in patients undergoing surgery of the gastrointestinal tract	This was a cohort study conducted in the surgical clinic of one Distrito Federal public hospital from November 2013 to July 2014. The outcome measures were: length of stay, death and presence of complications post infectious and non-infectious operative. Statistical analysis was performed using the Statistical Analysis System (SAS) Enterprise Guide 4.3, with 5% significance level	The sample comprised 100 patients of both sexes, with a higher prevalence of females (61%) and mean age of $56.1 \pm 15.5$ years. The overall average length of stay was $15.01 \pm 12.6$ days and 67% of the sample was classified as nutritional risk. Patients with nutritional risk had longer hospital stays and complications in the postoperative period, but was statistically significant only in the elderly and in cancer surgical patients ( $p = 0.001$ )
Sorensen et al. <sup>24</sup> , 2008	Original	To implement nutritional risk screening (NRS-2002) and to assess the association between nutritional risk and clinical outcome	NRS-2002 was implemented in 26 hospital departments (surgery, internal medicine, oncology, intensive care, gastroenterology and geriatrics) in Austria, the Czech Republic, Egypt, Germany, Hungary, Lebanon, Libya, Poland, Romania, Slovakia, Spain and Switzerland. Being a prospective cohort study, randomly selected adult patients were included at admission and followed during their hospitalization. Data were collected on the nutritional risk screening, complications, mortality, length of stay and discharge. The correlation between risk status and clinical outcome was assessed and adjusted for confounders (age, specialty, diagnoses, comorbidity, surgery, cancer and region) by multivariate regression analysis	Of the 5051 study patients, 32.6% were defined as 'at-risk' by NRS-2002. 'At-risk' patients had more complications, higher mortality and longer lengths of stay than 'not at-risk' patients and these variables were significantly related to components of NRS-2002, also when adjusted for confounders
Rubenstein et al. <sup>25</sup> , 2001	Original	To develop a screening version of this instrument, the MNA-SF, that retains good diagnostic accuracy	The authors reanalyzed data from France that were used to develop the original MNA and combined these with data collected in Spain and New Mexico. Of the 881 subjects with complete MNA data, 151 were from France, 400 were from Spain, and 330 were from New Mexico. Independent ratings of clinical nutritional status were available for 142 of the French subjects. Overall, 73.8% were community dwelling, and mean age was 76.4 years. Items were chosen for the MNA-SF on the basis of item correlation with the total MNA score and with clinical nutritional status, internal consistency, reliability, completeness, and ease of administration	After testing multiple versions, we identified an optimal six-item MNA-SF total score ranging from 0 to 14. The cut-point score for MNA-SF was calculated using clinical nutritional status as the gold standard ( $n = 142$ ) and using the total MNA score ( $n = 881$ ). The MNA-SF was strongly correlated with the total MNA score ( $r = 0.945$ ). Using an MNA-SF score of $\geq 11$ as normal, sensitivity was 97.9%, specificity was 100%, and diagnostic accuracy was 98.7% for predicting undernutrition

Continuation Table 1 - Main characteristics of the articles included.

Author / Date of publication	Kind of study	Objective	Methodology	Results
Kaiser et al. <sup>26</sup> , 2009	Original	To validate a revision of the Mini Nutritional Assessment short-form (MNA®-SF) against the full MNA, a standard tool for nutritional evaluation	A literature search identified studies that used the MNA for nutritional screening in geriatric patients. The contacted authors submitted original datasets that were merged into a single database. Various combinations of the questions on the current MNA-SF were tested using this database through combination analysis and ROC based derivation of classification thresholds	Twenty-seven datasets (n=6257 participants) were initially processed from which twelve were used in the current analysis on a sample of 2032 study participants (mean age 82.3y) with complete information on all MNA items. The original MNA-SF was a combination of six questions from the full MNA. A revised MNA-SF included calf circumference (CC) substituted for BMI performed equally well. A revised three-category scoring classification for this revised MNA-SF, using BMI and/or CC, had good sensitivity compared to the full MNA
Sousa et al. <sup>27</sup> , 2015	Original	To evaluate the nutritional risk in elderly hospitalized patients using the mini nutritional assessment short form and to check its applicability in the hospital routine	Cross-sectional study conducted with 253 elderly patients, both genders, aged ≥ 65 years, admitted to the Hospital of the University of São Paulo. Parameters assessed: demographics (age and sex), calf circumference, clinical profile (admission diagnosis, comorbidities and clinical outcome) and the nutritional risk using the Mini Nutritional Assessment short form. Statistical analysis was performed using analysis of variance (ANOVA), 2 test and Spearman's rank correlation coefficient	68% of subjects were classified as malnourished or on nutritional risk. Negative and weak correlation was found between calf circumference and length of hospital stay (r = -0.198; p = 0.002). When stratified by gender, calf circumference was positively correlated with body mass index (r = 0.698; p < 0.001) and negatively with age (r = -0.271; p < 0.001) and length of hospital stay (r = -0.454; p < 0.001) among women
Kruizenga et al. <sup>28</sup> , 2016	Original	To determine the prevalence of the screening score "undernourished" with use of the Short Nutritional Assessment Questionnaire (SNAQ) or Malnutrition Universal Screening Tool (MUST) and its relation to length of hospital stay (LOS) in the general hospital population and per medical specialty	The authors conducted an observational cross-sectional study at 2 university, 3 teaching, and 8 general hospitals. All adult inpatients aged >18 years with an LOS of at least 1 day were included. Between 2007 and 2014, the SNAQ/MUST score, admitting medical specialty, LOS, age, and sex of each patient were extracted from the digital hospital chart system. Linear regression analysis with ln (LOS) as an outcome measure and SNAQ ≥ 3 points/MUST ≥ 2 points, sex, and age as determinant variables were used to test the relation between SNAQ/MUST score and LOS	In total, 564,063 patients were included (48% males and 52% females aged 62 ± 18 years). Of those, 74% (419,086) were screened with SNAQ and 26% (144,977) with MUST, and 13.7% (SNAQ) and 14.9% (MUST) of the patients were defined as being undernourished. Medical specialties with the highest percentage of the screening score of undernourished were geriatrics (38%), oncology (33%), gastroenterology (27%), and internal medicine (27%). Patients who had an undernourished screening score had a higher LOS than did patients who did not (median 6.8 compared with 4.0 days; p < 0.001). Regression analysis showed that a positive SNAQ/MUST score was significantly associated with LOS [SNAQ: +1.43 days (95% CI: 1.42, 1.44 days), p < 0.001; MUST: +1.47 days (95% CI: 1.45, 1.49 days), p < 0.001]
Martinez et al. <sup>29</sup> , 2016	Original	To evaluate the association between strength and skeletal muscle mass in hospitalized elderly persons	A cross-sectional study was carried out in a private hospital in the city of Salvador in Bahia. The study included individuals ≥60 years during their first and fifth day of hospitalization and who were neither sedated nor had taken vasoactive drugs. Muscle mass was calculated using an anthropometric equation and force was measured through handgrip strength. Muscle weakness was identified as <20 kgf for women and <30 kgf for men, and reduced muscle mass was when the muscle mass index was ≤8.9 kg/m <sup>2</sup> for men and ≤6.37 kg/m <sup>2</sup> for women. The Pearson correlation was used to evaluate the relationship between mass and strength and the accuracy of using mass to predict strength	In 110 patients included, there was a moderate correlation between mass and strength (R=0.691; p=0.001). However, the accuracy of using mass to predict muscle strength was low (accuracy=0.30; CI 95% = 0.19-0.41; p=0.001). The elderly patients with muscle weakness were older than those without muscle weakness, with no differences between the other variables



Continuation Table 1 - Main characteristics of the articles included.

Author / Date of publication	Kind of study	Objective	Methodology	Results
Paz et al. <sup>30</sup> , 2018	Review	To suggest a protocol for the early detection of nutritional risk and / or malnutrition of hospitalized elderly patients by means of the association of parameters consolidated by the literature	As search strategies for this protocol, scientific articles published in magazines indexed in Lilacs, Medline, PubMed, SciELO, NCBI, Capes, Bireme, in English, Spanish and Portuguese, with emphasis on the last five years, were used, however works used in publication prior to that period due to the relevance of the topic for this research. The combination of the following indexing terms was used. Clinical, observational, epidemiological studies, among others, were selected, followed by statistical treatment with a probability of significance of 5%, in addition to the Project Guidelines of the Brazilian Medical Association and the Federal Council of Medicine	The MNA-SF is a validated instrument, through large representative samples of the elderly population worldwide. Measurement of calf circumference (CP) has been used as a predictor of the functionality and quantity of muscle tissue. It is verified that the greater the measured value of CP, the better the performance of functional activity and the lower risk of frailty of the elderly. The benefit of the clinical protocol is early detection of nutritional risk or malnutrition, promoting recovery, minimizing changes in nutritional status and, consequently, providing better quality of life for individuals

## DISCUSSION

### Epidemiology and Aging Process

In Brazil and in other developing countries, one can observe the phenomenon of the demographic transition, where there is an increase in the number of elderly people due to the decrease of young people. In this way, aging has become a global reality, with growth rates of more than 4% per year in the period 2012-2022<sup>7</sup>.

From 2000 to 2010, the Brazilian population aged 60 or older went from 14.2 to 19.6 million. According to projections for 2030 and 2060, it should reach 41.5 and 73.5 million, respectively. For the next 10 years, an average increase of more than 1 million elderly people per year is believed. It is observed, in this sense, that Brazil has undergone a demographic and epidemiological transition<sup>31</sup>.

In 1940, life expectancy increased from 45.5 years to 72.7 years in 2008. According to IBGE (Brazilian Institute of Geography and Statistics), the projection for 2050 is 81.29 years. And for every 100 children aged 0-14, there will be 172.7 elderly in 2050<sup>8</sup>.

Brazilian population is experiencing one of the most pronounced aging processes due to the decrease in fertility and mortality rates, where it began to change the age structure, gradually narrowing the base of the population pyramid, due to the increase in life expectancy and consequent increase in the elderly<sup>8</sup>.

The change of the age structure of the population due to the decrease in fertility and mortality rate is called demographic transition. In 1940, fertility in Brazil went through the first decline, but at a slow pace. Soon after, there was a period of stability until the late 1960s, in which fertility levels began to decline rapidly<sup>31</sup>.

From 1940 there was a marked decrease in the raw mortality rate. Although both tendencies led to changes in the age structure of the Brazilian population, the decrease in fecundity is considered essential for highlighted changes, followed by a decrease in mortality<sup>9</sup>.

Simultaneously with the demographic transition, the epidemiological transition of the Brazilian population has been observed in the last decades. In the 1950s, about 40% of deaths were caused by infectious diseases, and in 2009, they accounted for less than 10%. On the other hand, NCDs and chronic degenerative diseases had an expressive increase, such as cardiovascular diseases, hypertension, cancer, diabetes mellitus, among others<sup>8</sup>.

Aging is an individual phenomenon, gradual and natural. Individuals age differently even at the same chronological age. These individual differences are dependent on factors such as: diseases, education, genetic differences, physiological and biological system, lifestyle, sex, environmental factors, culture and socioeconomic condition<sup>1</sup>.

Aging causes a series of physiological and metabolic changes in the body, which results in repercussions on the nutritional and health status of the elderly. These nutritional alterations may favor or even exacerbate chronic and acute diseases, in which they anticipate the development of diseases and aggravate the prognosis of this age group<sup>6,10</sup>.

The physiological changes that can occur due to aging are such as: body temperature oscillation, hormonal changes causing desynchronization; emergence of depression; decrease of homeostasis that leads to vulnerability to diseases (delirium, cardiorespiratory arrest, hydro electrolytic alterations, among others). However, vulnerability to disease occurs with advancing age due to the

exacerbated use of physiological reserves to compensate for the changes of aging<sup>11</sup>.

In the hematopoietic system, changes such as decrease in the lifetime of red blood cells, iron content and bone marrow production occur. One study suggests that the inability to produce stimulatory hormones is the main factor responsible for the functional difference between bone marrow of the elderly and the young. Thus, functional reserves for the compensatory hematopoietic response are reduced<sup>11</sup>.

In the gastrointestinal system, alterations in the oral cavity may occur, which hinders the chewing process and reduces saliva production. Also the following changes are observed, hypertrophy of the skeletal muscle of the esophagus; esophagitis; decreased absorption of nutrients by the small intestine; reduction of colon motility caused by decreased sensory loss of the intrinsic neuron, which can lead to constipation and intestinal cancer; reduction of nitric oxide leading to altered compliance of gastric fundus and changes in antral stretch may lead of gastroparesis and anorexia. These changes facilitate and accentuate the process of malnutrition in the elderly<sup>11,12</sup>.

In the renal system, reduction of functional renal mass with renal fibrosis, and diffuse sclerosis of the glomeruli may occur. Decreased creatinine production and increased tubular secretion; increased rate of urine excretion that can lead to dehydration and urinary incontinence are also observed<sup>11</sup>.

Changes in the cardiovascular and pulmonary systems, such as the development of arterial hypertension and atherosclerotic disease. The left atrium increases and the left ventricle hypertrophies; implying on decreased heart rate; impairment of early filling of the left ventricle with a greater compensatory contribution of atrial systole. Greater probability of developing acute infarction and increased chest wall stiffness that predominates over an increase in lung parenchyma compliance also happens. The diaphragm flattens and becomes less efficient, which may contribute to increased breathing work during physical activity<sup>11</sup>.

Normal aging of the skin leads to atrophy, decreased elasticity, impaired metabolic and skin repair response. These changes are intensified due to the "photo aging" which is the result of chronic sun exposure and recurring damages by ultraviolet light from the sun<sup>11</sup>.

Changes in the sensory system, such as low visual acuity due to changes in the cornea and iris and decreases in high frequency auditory acuity impair speech recognition in noisy environments. Loss of taste and/or dysgeusia due to decreased smell, favors the appearance of nutritional deficiencies due to low food intake. Decreased immune functions are among the most serious changes, contributing to the rise of infections, malignancies and autoimmune disorders<sup>11</sup>.

However, the advancement of the age has positive consequences, such as the increase in the life expectancy of the population, but, consequently, there is an increase in morbidity and mortality characterized by an increase in NCDs and chronic degenerative diseases. Cardiovascular disease has become an important cause of morbidity and mortality in the elderly on the different countries of the world, since it represents one of the main diseases responsible for the increase of the number of deaths in individuals over 60 years old<sup>2,5</sup>.

### **Hospital Malnutrition Associated with Cardiovascular Surgery in the Elderly**

WHO<sup>32</sup> estimates that 17.7 million people died of cardiovascular disease in 2015, accounting for 31% of all deaths worldwide. Of these, about 7.4 million were due to coronary heart disease and 6.7 million to stroke.

The elderly is often affected by malnutrition during hospital stay. A high prevalence, about 77% of malnutrition, is observed in hospitalized patients over 65 years old<sup>13,14</sup>.

With the increasing population-ageing, cardiovascular diseases and, consequently, cardiac surgeries have increased<sup>4</sup>. The performance of a surgical procedure in the elderly is accompanied by metabolic and physiological alterations, in which nutritional needs are elevated, that, when not supplied, may compromise nutritional status, with consequent malnutrition<sup>15,16</sup>.

The previous nutritional status contributes to the recovery and/or postoperative complications, which includes the favoring of extubation, the response to catabolic reversion proper from surgical stress, appearance of infections, among others. In pre-surgical patients, the prevalence of malnutrition ranges from 25.5% to 51%, depending on the nutritional evaluation parameter used. Previous malnutrition is associated with a greater number of postoperative complications, length of hospital stay, mortality, and higher hospital costs<sup>15,17</sup>.

In heart failure, it is known that at least one third of the patients may lose weight unvolitionally, which means worse clinical and nutritional prognosis. There is still no "gold standard" method for assessing nutritional status; however, the literature suggests an association between subjective and objective methods of nutritional status assessment. Most patients with cardiac involvement have retained body fluids, which often masks weight loss<sup>13,18</sup>.

Some elderly patients with heart disease present anorexia due to inflammation associated with heart failure, which contributes negatively to clinical therapy. Nutritional risk or malnutrition can be minimized when detected early and adequate nutritional therapy established. Thus, the evaluation of nutritional status, early intervention and adequate nutritional support are able to improve the clinical outcome of this patient<sup>15,16</sup>.

In the study by Calvo et al.<sup>14</sup> carried out in Spain, with a sample of 106 elderly that were hospitalized, 55% were at risk of malnutrition and 22% were malnourished according to the Mini Nutrition Assessment (MNA) screening tool. In Hsu's et al.<sup>19</sup> research, it was verified that the predictive capacity of the calf circumference greater when compared to the body mass index (BMI) in the prediction of malnutrition. Thus, it is observed that nutritional risk increases progressively in the elderly compared to younger people<sup>13</sup>.

### Subjective Methods for Nutritional Status Assessment

The many different subjective assessment of nutritional status in the elderly with cardiovascular disease are important for the definition of adequate nutritional strategies and intervention, as well as the correct monitoring and interpretation of the various signs and symptoms of complete nutritional assessment<sup>2</sup>.

The purpose of subjective assessment methods is to detect early nutritional risk or malnutrition, promote an early intervention that may lead to recovery, minimize changes in nutritional status and consequently provide better quality of life for individuals. Subjective protocols should be applied within the first 72 hours of hospital stay<sup>20</sup>.

### Nutritional Risk Screening 2002 (NRS-2002)

The Nutrition Risk Screening (NRS-2002) was created by Kondrup et al.<sup>21</sup>, in 2002, with the objective to early identify nutritional risk in hospitalized patients. It is used as a predictive tool for morbidity and mortality, providing the nutrition therapy to be optimized early. The NRS-2002 is indicated as a nutritional risk assessment protocol by ESPEN (European Society for Clinical Nutrition and Metabolism)<sup>21</sup>, by the Guidelines of the Brazilian Medical Association and Federal Council of Medicine<sup>33</sup>.

NRS-2002 defines the diagnosis of nutritional risk by reduced food intake and the severity of the disease. Nutritional status is assessed by three related factors: BMI, recent unvolitional weight loss and altered food consumption. The severity of the disease is verified as a factor of metabolic stress due to the increase of energy demand. The patient aged 70 years or older is also scored. The individual who receives 3 or more points is classified into nutritional risk<sup>22</sup>. It is a tool that is easy to apply in routine clinical practice, with high reliability and reproducibility, of low cost and can be performed with hospitalized patients of any age, regardless of clinical diagnosis<sup>15,20</sup>.

In the study of Nunes e Marshall<sup>23</sup>, with a sample of 45 elderly patients hospitalized for elective gastrointestinal surgery, NRS-2002 was used as nutritional screening. It was verified that 32% of the elderly were classified as nutritional

risk. The authors emphasized that the NRS-2002 is an adequate predictor of outcomes in surgical patients related to postoperative complications. Thus, it is recommended to use this screening to diagnose the nutritional status early.

The research of Guerra-Sanchez et al.<sup>18</sup>, when using NRS-2002 in elderly patients with heart failure, verified that 28.9% did not present nutritional risk and 71.1% presented a risk of malnutrition. The authors also found that the NRS-2002 obtained sensitivity of 95.8%, specificity of 52.8%, positive predictive value of 66.3% and negative predictive value of 92.8%, with subjective global assessment (SGA) as "gold standard".

In a multicenter study conducted in 26 clinics in Austria, the Czech Republic, Egypt, Germany, Hungary, Lebanon, Libya, Poland, Romania, Slovakia, Spain and Switzerland, applying NRS-2002 to 5,051 patients, it was verified that 32,6% of the sample was classified as risk of malnutrition. The NRS-2002 results were significantly related to complications, like hospitalization time, morbidity and mortality<sup>24</sup>.

### Mini Nutritional Assessment Short-Form (MNA-SF)

The nutritional screening of MNA-SF was developed through the Mini Nutritional Assessment (MNA), in order to minimize the time of application. The MNA is a validated instrument, through large representative samples of the elderly population worldwide. The MNA-SF was translated into different languages, including Brazilian Portuguese, which reduced the difficulties of interpretation and use of the tool<sup>25</sup>.

The MNA-SF protocol is composed of six questions, using only the first part of the original protocol, thus justifying the similarity and agreement between the two protocols. The authors emphasize the good agreement and correlation between both protocols (MNA and MNA-SF)<sup>25</sup>.

In order to reduce MNA's application time, Rubenstein et al.<sup>25</sup> developed a six-question protocol, identifying a subset of complete MNA questions that had high sensitivity, specificity, and correlation with the complete MNA. The MNA-SF identifies well-fed or malnourished seniors so that the complete MNA is only needed if a patient is classified as at risk. The diagnostic accuracy of the original MNA-SF in the identification of well-nourished elderly is comparable to the complete MNA and may be a valid time-saving alternative.

The MNA-SF comprises six questions that encompass aspects such as: reduced food intake due to decreased appetite, difficulty chewing or swallowing, weight loss, mobility, acute illness, neuropsychological problems, BMI or calf circumference. Each item of the question has a score, having the maximum score of 14 points. Values equal or greater than 12 indicate a satisfactory nutritional status. Values lower or equal to 11 suggest a risk of malnutrition and values lower or equal to 7 indicate malnutrition<sup>22,26</sup>.

In elderly patients with heart failure, Guerra-Sanchez et al.<sup>18</sup> found through the MNA-SF, a sensitivity of 96.6%, specificity of 59.3%, positive predictive value of 69.7%, and negative predictive value of 94.8%, using SGA as the reference standard. Regarding nutritional status, it was verified that 31.8% of the sample had adequate nutritional status and 68.2% were at risk of malnutrition.

Sousa et al.<sup>27</sup> study shows that, from all elderly patients admitted to the University Hospital of the University of São Paulo, 68% of the patients presented nutritional risk or malnutrition through MNA-SF, being significantly more common in medical clinic, with a prevalence of 89%.

### Malnutrition Universal Screening Tool (MUST)

MUST is an internationally validated nutritional screening tool developed in 2003 by the Malnutrition Advisory Group (MAG), an integrated committee of the British Association for Parenteral and Enteral Nutrition (BAPEN), to detect malnutrition or nutritional risk as well as overweight and obesity. MUST is a simple, practical and quick method to be applied in different life cycles (adults, the elderly, infants and pregnant women)<sup>21,34</sup>.

ESPEN<sup>21</sup> recommends the use of its screening tool primarily in the community as well as outpatients. The tool was recently extended to other health settings, including hospitals and households where it was confirmed to have excellent interrater reliability, concurrent validity with other screening tools, and predictive validity<sup>21</sup>.

The MUST screening tool consists of three categories: BMI, unintentional weight loss and the presence of acute illness or fasting for more than five days. The cut-off points are: score 0, ranks low nutritional risk, 1 point ranks medium nutritional risk and  $\geq 2$  points ranks high nutritional risk. For each score, MUST suggests action plans, according to the type of patient. MUST also aims to identify obesity (BMI > 30 kg/m<sup>2</sup>)<sup>22</sup>.

In a study conducted by Kruienga et al.<sup>28</sup>, carried out in 13 Dutch hospitals, two nutritional status screening tools were used, one of them being MUST. A total of 564,063 patients were selected by the inclusion criteria. Of these, 144,977 (26%) were screened with MUST, and 14.9% of the patients were classified as malnourished, with scores equal or greater than two. Regarding the percentage of patients selected by medical specialty, the geriatric was the one with the highest percentage of malnourished patients (31%). When comparing malnutrition with length of hospital stay, an average of 9.5 days was reported for malnourished and an average of 6.3 days for those without malnutrition.

### Hand Grip Strength

Muscle tissue is essential for the performance of activities of daily living (ADLs). The gradual and global reduction of

skeletal muscle mass and strength is related to negative outcomes such as higher mortality, increased risk of hospital infections, difficult weaning from mechanical ventilation, physical incapacity, lower quality of life and, consequently, longer hospital stay<sup>29</sup>.

Muscle mass can be determined as the amount of skeletal muscle, distinct from the strength that is related to the capacity of muscle contraction. This muscle strength can be verified from the Hand Grip Strength (HGS) measured with a portable dynamometer, which is an easy-to-use tool. For cutoff points, in the identification of muscle weakness, reference values below 20 kgf are used for females and less than 30 kgf for males<sup>29</sup>.

Martinez et al.<sup>29</sup>, observed that from the 110 hospitalized elderly, 36.4% presented muscular weakness by the HGS test, with an average of 27.9 kgf of HGS. There was also a moderate correlation between strength and skeletal muscle mass, as well as poor muscle mass accuracy. Although the muscular mass is considered an essential variable for the diagnosis of sarcopenia, some elderly may have dynapenia, that is, the reduction of muscle strength and may not be related to the diminished muscular mass.

### Suggested Protocol for Nutritional Risk Screening in Heart Disease Patients

In order to identify the nutritional risk and/or worsening of the nutritional status of hospitalized elderly patients, Paz et al.<sup>30</sup> elaborated a screening protocol through association of parameters consolidated by the literature as a suggestion for implementation in the Brazilian Public Health System (SUS) which can be expanded to several private institutions.

The protocol consists in the application of the Nutritional Screening questionnaire through MNA-SF and CC (calf circumference) for elderly patients assisted by SUS. This should be used in the first 72 hours of hospitalization of the heart disease elderly, since the purpose is to identify the nutritional risk as early as possible<sup>30</sup>.

The first step includes applying the MNA-SF questionnaire. If the result is without nutritional risk, the elderly will be reevaluated every 7 to 10 days, but if the result presents nutritional risk or malnutrition, the protocol should be continued and the second step that is gauging the CC has to be done<sup>30</sup>.

If CC presents an adequate result, this elderly person will be reevaluated every 7 to 10 days using the MNA-SF questionnaire and CC assessment. However, if classified as malnourished (values equal to or less than 34 cm for males and equal to or less than 33 cm for females), a nutritional therapy should be instituted (oral supplement, enteral or parenteral diet) or a combination of these and reevaluate every 7 to 10 days using the MNA-SF questionnaire and CC assessment<sup>30</sup>.



The authors emphasize that the greatest benefit of the clinical protocol is the early detection of nutritional risk or malnutrition itself, with the aim of promoting patient recovery, minimizing changes in nutritional status and, consequently, providing a better quality of life, having in mind that it will be possible to have a timely and adequate nutritional intervention, as well as the effective performance of the multiprofessional team of nutritional therapy<sup>30</sup>.

### Limitations of the Study

The methodological differences of the analyzed studies compose one of the limitations found in the present research, as well as the lack of a statistical method to compare the results found and the heterogeneity of the sample in the several studies analyzed. Therefore, further studies about the subjective methods of evaluation of nutritional status in patients with heart disease are necessary.

### CONCLUSION

The installation of malnutrition in patients with cardiovascular disease compromises the prognosis of these patients, as well as the length of hospitalization, favours the increase of hospital infections and the worsening of clinical outcomes, with consequent increase in the risk of morbidity and mortality and generating debts to the hospital.

The various researches investigated reveal that the subjective and objective evaluations of the nutritional status of the elderly with cardiovascular disease are essential tools for the early detection of malnutrition and nutritional risk, nutritional changes and nutritional intervention, in order to improve the prognosis of this patient at the right time.

Although there is no gold standard for the nutritional diagnosis of heart disease patients, nutritional screening provides the following benefits: early detection of nutritional risk or malnutrition, low cost and easy application, promotes recovery, minimizes changes in nutritional status, facilitates the proper choice of nutritional management, since it directs to the best alternative of nutritional therapy (oral supplementation, enteral or parenteral diet) or the combination of these therapeutic modalities in an opportune moment and, consequently, providing the best quality of life to the individuals.

In this way, we must associate several methods of evaluating the nutritional status or elaborate a protocol, in which it adapts to the target public and type of service. As a suggestion for nutritional risk screening, the protocol was published associating both the application of the MNA-SF questionnaire and the CC assessment.

### ACKNOWLEDGEMENTS

I thank the elderly patients with heart disease and the Instituto de Cardiologia do DF.

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**Institution where the study was developed:** Postgraduate Program in Health Sciences, Health Science Teaching and Research Foundation (FEPECS), Superior School of Health Sciences, State Secretary of Health of Federal District, Brasília, DF, Brazil.

**Conflict of interest:** The authors declare not to have.