



Evaluation of the nutritional status of hospitalized patients: use of conventional and non-conventional methods

Avaliação do estado nutricional de pacientes hospitalizados: uso de métodos convencionais e não convencionais

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Abstract

The assessment of nutritional status is essential in the follow-up of hospitalized patients, since it aims to check for nutritional changes, allowing an adequate intervention for recovery and / or maintenance of individuals' health. This study is aimed at evaluating the nutritional status of hospitalized patients using adductor pollicis muscle thickness (APMT), handgrip strength (HGS), body mass index (BMI), calf circumference (CC) and arm circumference (AC). It is a cross-sectional study, in which 88 patients of both sexes were evaluated. The results indicate that changes in body composition, physical inactivity, increased inflammatory status, edemas and malnutrition may often be related to differences in nutritional status, as verified from the different parameters observed, with normal weight being more prevalent in all methods, except in the APMT and HGS methods, mainly for the elderly, where the risk of depletion was predominant. It is suggested that both APMT and HGS may be indicators for detection of complications attributed to risks of depletions for both the adult and the elderly populations.

Keywords: Nutritional Assessment. Anthropometry. Inpatients.

Resumo

A avaliação do estado nutricional é essencial no acompanhamento de pacientes internados, pois tem por objetivo verificar as alterações nutricionais, possibilitando uma intervenção adequada para a recuperação e/ou manutenção da saúde dos indivíduos. Este estudo tem por objetivo avaliar o estado nutricional dos pacientes hospitalizados, utilizando os métodos convencionais e não convencionais: espessura do músculo adutor do polegar (EMAP), força da preensão manual (FPM), índice de massa corporal (IMC), perímetro da panturrilha (PP) e perímetro do braço (PB). Trata-se de um estudo transversal, em que foram avaliados 88 pacientes de ambos os sexos. Os resultados apontam que modificação da composição corpórea, a inatividade física, aumento do estado inflamatório, edemas e desnutrição podem estar muitas vezes relacionados com as diferenças dos estados nutricionais verificados a partir dos distintos parâmetros observados, sendo a eutrofia mais prevalente em todos os métodos, exceto nos métodos da EMAP e da FPM principalmente para os idosos, onde predominou o risco de depleção. Sugere-se que tanto a MAP quanto a FPM podem ser indicadores que detectam complicações atribuídas a riscos de depleções tanto para a população adulta quanto para a população idosa.

Palavras-chave: Avaliação Nutricional. Antropometria. Desnutrição.

Introduction

The assessment of nutritional status is essential to monitor hospitalized patients, because it is aimed at evaluating nutritional changes, thus allowing an appropriate intervention for recovery and/or maintenance of individuals' health.¹

Hospitals should standardize techniques for assessment of nutritional status and systematize their application, because they can detect the risk of hospital malnutrition, and assist in nutritional treatment and/or improve the prognosis of hospitalized patients.² Therefore, anthropometry is an important tool for nutritional assessment, because it provides the values of body composition, lean body mass and adipose tissue.

There are different methods to assess body composition, from measurement of fat and protein reserves by means of traditional or conventional anthropometry, to the use of more sophisticated equipment.³ These are the conventional methods most frequently used for assessment of malnutrition among adults and the elderly: weight, height, body mass index (BMI), arm circumference (CC) and calf circumference (CC).⁴

Despite the importance of muscle assessment for characterization of nutritional status, methods for direct measurement remain limited.⁵ Therefore, there are new techniques which are not routinely used in clinical practice; for example, adductor pollicis muscle thickness (APMT) and handgrip strength (HGS). The latter, used as a parameter in clinical practice, plays an important role in the control of rehabilitation processes for assessment and treatment of musculoskeletal disorders of the hand⁶ and for assessment of persons with neurological diseases.⁷

In addition, HGS is understood as an overall indicator of strength and muscle power⁸. As a marker of muscle mass, it is highly valued for assessment of hospitalized patients. One of its main advantages is the fact that it is not influenced by the state of hydration of the patient.⁹

In addition to HGS, adductor pollicis muscle thickness (APMT) is currently applied without limitations, immediately after hospital admission. It can quickly identify patients who are malnourished or at nutritional risk with sensitivity and reliability. With this method, hospitals can devise an early and adequate nutrition plan, as well as adequately monitor the nutritional status of patients, hence it is an important indicator of recovery of hospital patients.¹⁰

The above-mentioned unconventional methods provide benefits in terms of detection of complications and risks arising from muscle mass depletion. For this reason, it is crucial to use them in nutritional assessment. Such detection offers the best understanding of a patient's nutritional status and, consequently, it results in faster and more effective implementation of proposals in the hospital environment.

Therefore, the objective of this study is to assess the nutritional status of hospitalized patients by using different methods and techniques, such as: adductor pollicis muscle thickness (APMT), handgrip strength (HGS), body mass index (BMI), calf circumference (CC) and arm circumference (AC).

Method

Before the study was started, it was submitted to the Research Ethics Committee of *Plataforma Brasil* for approval, registered under protocol number 080376/2013. It complied with the proposed timeframe. The participants were informed about the objectives, risks and procedures involved in the research and those who agreed to participate signed an Informed Consent Form (ICF).

This is a cross-sectional study which evaluated 88 patients, both males and females, currently assisted in a public hospital. The selected patients were analyzed for profile: people above 60 years of age were classified as elderly people, according to the World Health Organization (WHO), and people between 19 and 60 years of age were classified as adults.¹¹ Patients were invited to participate in the research and, after acceptance, the researchers applied the techniques described in the literature for measurement of APMT,¹² HGS,¹³ CC¹⁴ and AC.¹⁵

Patients who were included in the study were those whose limbs injury-free at the time of measurement and who had been hospitalized for at least three days. Patients were excluded if they had been recently admitted to hospital, were younger than 19 years old and were unable to respond to commands. For the objective assessment of nutritional status, a structured questionnaire was applied to collect anthropometric data at the time of admission. After agreeing to participate, they signed an Informed Consent Form.

Measurements of weight and height were collected from patients' medical records. The values for weight and height were used for calculation of body mass index (BMI) in adults, according to the WHO,¹⁶ and BMI in the elderly, according to Lipschitz.¹⁷

The participants were identified with a sequential order number while age-specific indicators were used for classification of nutritional status. The criterion used for classification of adequacy of calf circumference was > 31 cm;¹⁸ for classification of arm circumference, the criteria were: <5 percentile = thin, 5 to 15 = below average, 16 to 85 = average, 86 to 95 = above average, ≥ 95 = excess fat.¹⁹ The classification of APMT was based on the non-dominant hand, with the following criteria: <13.4 mm = malnourished and >13.4 mm = normal weight.²⁰ For classification of handgrip strength (HGS), the criteria in use were: 25th percentile \leq weak; <25 and <75 = average; >75 = very good. Values below the 25th percentile were considered risk of depletion while values above the 25th percentile were considered as appropriate.

For statistical analysis, a database was designed with the software Excel 2010. After this procedure, the data were exported to the software **SPSS**, version 20.0, for statistical analysis.

For analysis of categorical variables, the relative frequencies were recorded and presented with their respective confidence intervals.

The measures in the form of continuous variables were tested as to the nature of their distribution and presented by means of measures of central tendency and dispersion (mean/median and standard deviation).

To identify the nature of the distribution of data, the Kolmorov-Smirnoff test was used at a significance level of 5%.

Results and discussion

The results suggest that the study population was composed of 53.57% (n=47) of males and 46.42% (n=41) of females. Mean age of the sample was 53.10 ± 21.23 years. Mean BMI (kg/m^2) was 28.46 ± 7.04 , when the whole length of the sample was analyzed.

The measurement results of calf circumference (cm) yielded an average total of 35.38 ± 4.37 , and it was classified as normal for the different types of people. Reis et al.¹⁶ also found such higher prevalence in CC: 81.2% of the patients showed normal measurements while only 11.3% had muscle mass depletion, depending on the region assessed in those hospitalized patients admitted to a general hospital. Soares & Mussoi²² identified that CC in two out of every five elderly patients in their study was less than 31 cm. It should be noted as nutritional status is weakened or preserved, mean values for BMI, arm circumference and calf circumference match the level of nutritional status.

The measurement of HGS (mm) showed lower static force in females while the elderly showed higher depletion when compared with adults. Costa et al.,²³ in their study with non-institutionalized elderly, showed lower HGS in females, but all the elderly had a risk of muscle mass depletion. HGS is used to evaluate the static force of a person's handgrip, because this force is associated with their functionality.²⁴ These anthropometric changes are usually associated with loss of muscle strength and endurance, and they may lead to a decline of functional capabilities.

Age, sex, ethnicity, region, type of associated disease and stimulus to physical activity are some variables that interfere in the decrease of lean body mass and increase in the percentage of body fat. These changes can affect static force, therefore anthropometric assessment becomes relevant.^{25,26} Table 1 shows the anthropometric variables of this study by sex.

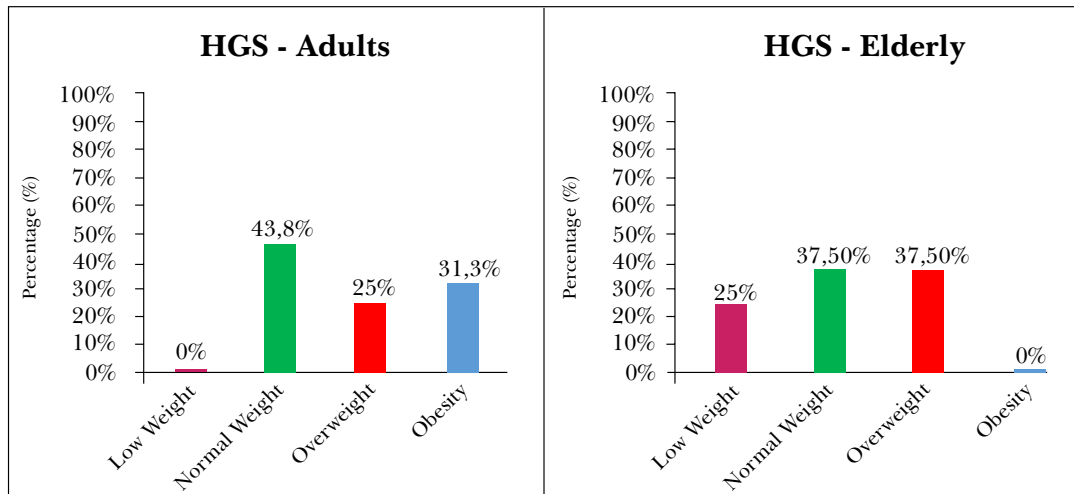
Table 1. Anthropometric profile of patients hospitalized in the hospital of Natal - RN, 2017.

Variables/Categories	Total		Male		Female	
	n	%	n	%	n	%
Sex	88	100.0	47	53.57	41	46.42
Age (Mean \pm SD)	53.10 \pm 21.23		55.88 \pm 21.08		49.69 \pm 21.7	
Weight (Mean \pm SD)	77.88 \pm 20.84		80.83 \pm 22.98		74.92 \pm 19.00	
BMI (Kg/m ²)	28.46 \pm 7.0		27.75 \pm 6.45		29.17 \pm 7.80	
HGS (mm)	17.96 \pm 16.21		23.86 \pm 18.6		9.70 \pm 6.48	
APMT (mm)	98.75 \pm 40.83		94.61 \pm 34.80		103.84 \pm 48.22	
CC (cm)	35.38 \pm 4.37		35.69 \pm 4.42		35.00 \pm 4.45	

Note: SD = standard deviation, BMI= body mass index, HGS = handgrip strength, APMT= adductor pollicis muscle thickness; CC = calf circumference

Source: Research data.

Figure 1 shows nutritional status according to BMI. Although BMI cannot indicate body composition, it is measured because this is simple to perform and also because it is related to morbidity and mortality.

**Figure 1.** Anthropometric nutritional status using the BMI of adult and elderly patients hospitalized in Natal-RN, 2017.

Source: Research data.

In the present study, normal weight is prevalent in adulthood, and there is a decline in the stage of senescence. The female participants showed higher BMI when compared with the male ones, and they tend to have a higher rate as they age. In their study, Barbosa et al.²⁷ found a reduction of BMI according to age, which was prevalent in females.

The highest prevalence of overweight found among women is possibly due to greater accumulation of visceral fat. During aging, there is progressive redistribution of fat, with reduction of subcutaneous adipose tissue from the limbs and accumulation in the intra-abdominal region. Women accumulate more subcutaneous fat than men and lose it as they grow older.²⁸ In general, the elderly presented equivalence of normal weight and overweight.

Body composition at this age is more susceptible to an increase in the percentage of body fat and a reduction in lean body mass. These are anthropometric changes which are usually associated with loss of muscular strength and endurance, and they may lead to a decline in functional capabilities.²⁹ As mentioned above, BMI does not differentiate body composition; thus, many of the hospitalized patients are classified as having normal weight or being overweight, but anyway they may show malnutrition or associated edema.

With respect to the data on calf circumference, most adults and elderly were classified as having normal measures in both sexes; however, some of the elderly had malnutrition. Rosa et al.,³⁰ in their study, found prevalence of malnutrition in elderly inpatients in a hospital. Most of them showed risk of malnutrition, hence it could be assumed that there was loss of muscle mass resulting from a catabolic process and/or a decrease of activity, because CC is an instrument that provides a more sensitive measurement on the muscle mass of the elderly, compared with the arm muscle area. Figure 2 shows the results for calf circumference.

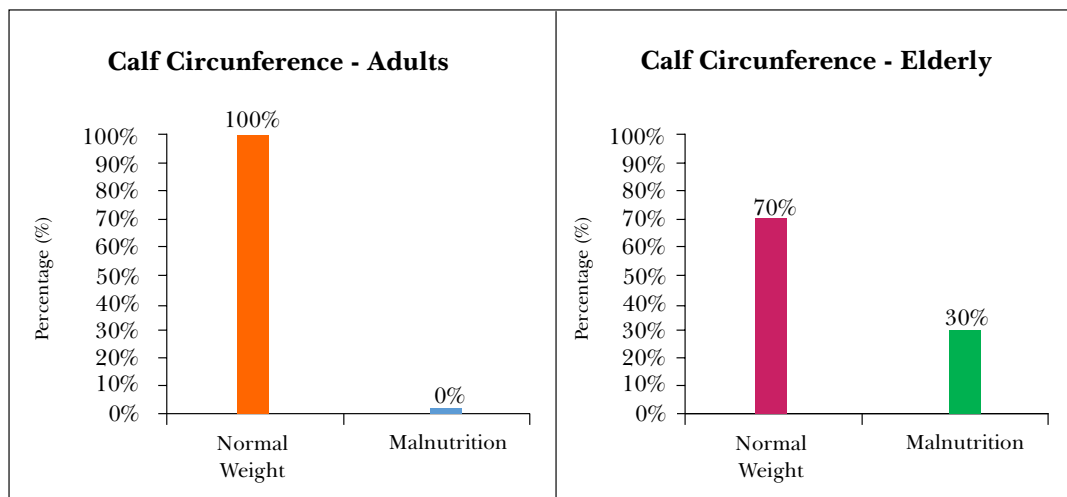


Figure 2. Anthropometric nutritional status using calf circumference values of adult and elderly patients hospitalized in Natal-RN, 2017.

Source: Research data.

Also in the present study, there was a prevalence of normal weight in both adults and the elderly as regards AC, but a portion of them presented malnutrition, which ranged from mild to moderate to severe. Gonzalez et al.³¹ found that, in hospitalized elderly patients, out of the parameters for assessment of nutritional status (BMI and AC), only AC was associated with increased mortality. In addition, similar results were described by Dent et al.,³² who found an association between shorter arm circumference and a higher level of assistance to hospitalized elderly.

Structural and functional disorders may occur, especially in the elderly, such as progressive loss of muscle mass and changes in the pattern of body fat distribution, in which the adipose tissue of the arms and legs decreases while the accumulation of fat increases in the region of the trunk, as previously emphasized.³³ The results are shown in Figure 3.

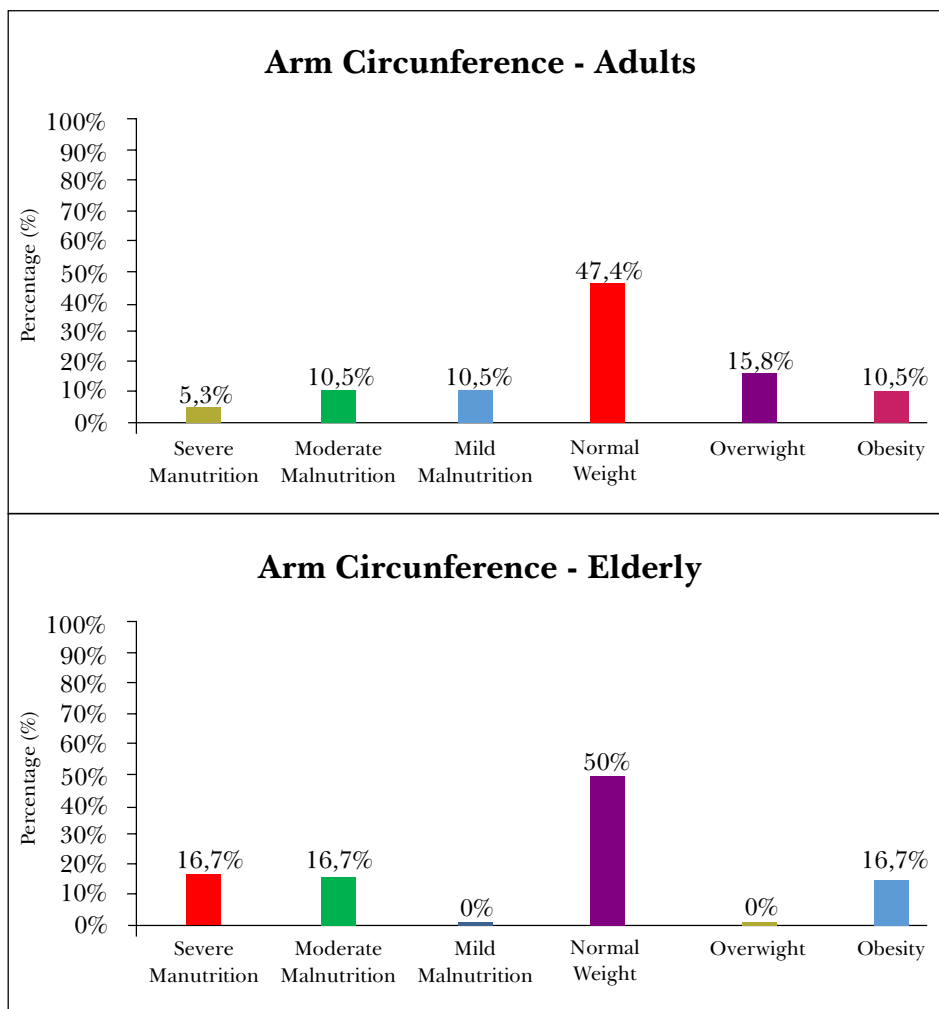


Figure 3. Anthropometric nutritional status using arm circumference values of adult and elderly patients hospitalized in Natal-RN, 2017.

Source: Research data.

APMT had a higher rate of depletion in adults, when compared with the elderly, who showed a higher rate of moderate and severe depletion, however. Côbero et al.³⁴ found a weak correlation between APMT and AC and BMI, although the majority had excess weight, according to their BMI. Out of the study samples, 50% of the patients showed some percentage of weight loss and 22.3% changed their food consumption habits to a low-calorie diet as a result of loss of appetite. This is indicative that, in spite of the nutritional classification found, one must always be attentive to the risk of malnutrition in hospitalized patients.

Chronic diseases, often present in these patients, leads to a reduction of activities and an increase of their inflammatory and catabolic state;³⁵ thus, they are associated with the reduction of muscle trophicity and, consequently, of the APMT value.

Still in the study cited above, the functional capacity of a great part of the sample was below normal. Probably physical inactivity exacerbates APMT reduction, regardless of catabolism and the patient's underlying disease. Pereira et al.⁹ claim that there were no associations between APMT and the conventional parameters cited, because the target public was restricted to patients under dialysis treatment, who often have edemas.

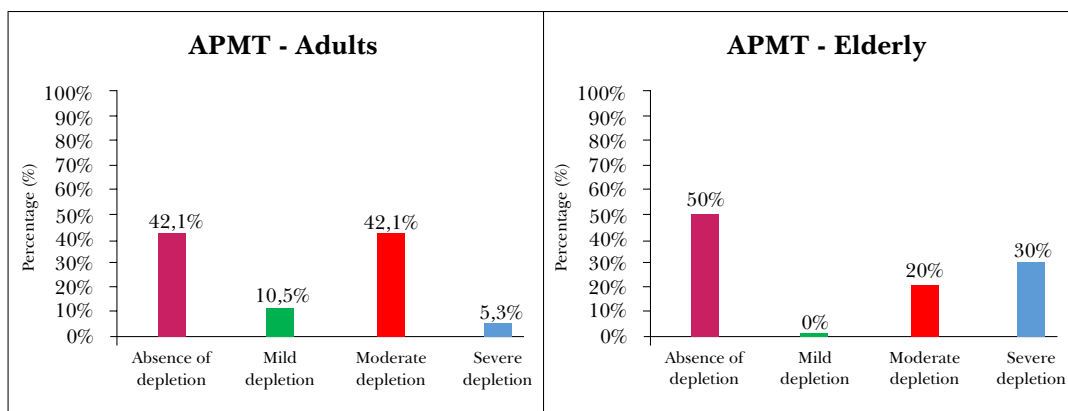


Figure 4. Anthropometric nutritional status using the adductor pollicis muscle thickness of adult and elderly patients hospitalized in Natal-RN, 2017.

Source: Research data.

As shown in Figure 5, it was found that HGS for adults showed high percentage of nutritional adequacy, while risk of depletion had the highest percentage in the elderly group. Women showed lower HGS and reduction of strength depending on age, as reported in different studies.^{27,36} Men have greater muscle mass compared with women, and both of them show a reduction of muscle mass as they age (linear relationship between the process of sarcopenia and age)³⁷, thus justifying the reduction of HGS in females and a greater risk of depletion in the elderly.

Lédo et al.,³⁸ in their analysis of sarcopenia in a sample of individuals infected by the human immunodeficiency virus (HIV), found that HGS amounted to 21.3 ± 6.4 , when compared to patients without sarcopenia (34.6 ± 10.5). Loss of skeletal muscle mass associated with reduction of force and/or physical performance characterizes this condition. This is present in many patients with clinical risk and it is regularly found in the elderly. Through HGS, one can see a progression of disease complications, which can be helpful for the diagnosis of sarcopenia, especially when associated with other methods.

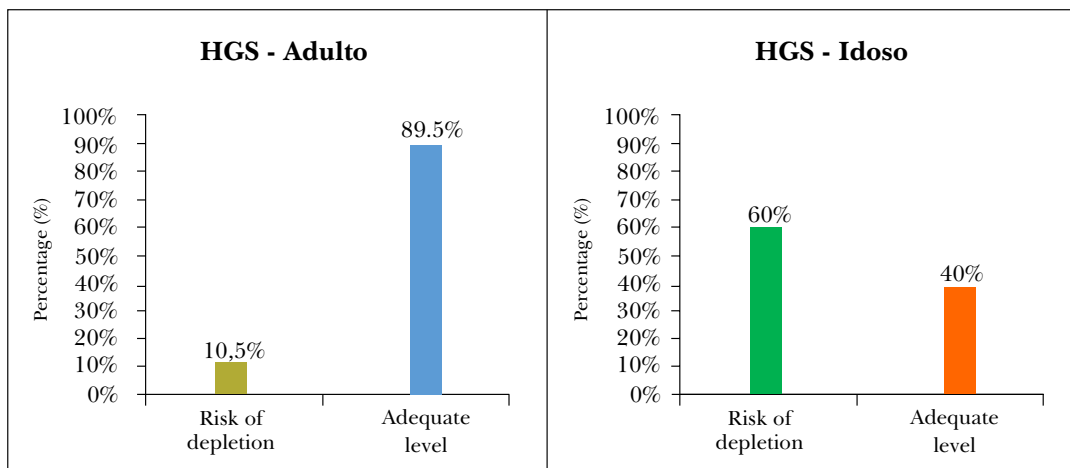


Figure 5. Anthropometric nutritional status using the handgrip strength of adult and elderly patients hospitalized in Natal-RN, 2017.

Source: Research data.

Conclusion

It was found that patients hospitalized in a public hospital in the period of data collection had normal weight, when evaluated by both conventional and non-conventional methods. Exceptions were HGS in elderly individuals and APMT in both populations that presented a risk of depletion.

Thus, non-conventional methods, especially when associated with conventional ones, enabled more accurate measurements of the nutritional status of hospitalized patients.

Because of the scarcity of studies and the lack of parameters for classification of nutritional status in hospitalized patients evaluated by unconventional methods, further research should standardize the classification of nutritional status, as well as recognize positive and negative points in these unconventional methods for nutritional assessment of hospitalized patients.

Contributors

Serquiz AC and Fernandes LL participated in project creation, study design, guidance and counseling in data collections and revision of the draft and final version of the manuscript. Oliveira CM, Araújo ASM, Santos RD and Sousa JCS participated in study design, data collection, data interpretation and writing of the article.

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