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Comparison between GLIM and PG-SGA methods in the nutritional assessment of hospitalized oncological patients

Comparação entre os métodos GLIM e ASG-PPP na avaliação nutricional de pacientes oncológicos hospitalizados

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ABSTRACT

Objective
The aim of this study was to compare the Global Leadership Initiative on Malnutrition and Subjective Global Assessment methods produced by the patient in the nutritional assessment of cancer in-patients.

Methods
Cross-sectional study with a prospective variable, conducted with patients admitted to a public hospital in Pernambuco, Brazil. The application of these tools and the diagnosis of malnutrition were performed within the first 48 hours of admission. Sociodemographic, clinical and laboratory data were obtained from the medical records and weight, height, arm circumference, triceps skinfold and handgrip strength data were collected.

Results
The 82 patients evaluated included mostly men aged ≥ 60 years with less than 8 years education. Malnutrition frequency was 93.7% according to the Subjective Global Assessment and including 23.2% severe malnutrition while, according to the Global Leadership Initiative on Malnutrition, 50% of the patients were considered severely malnourished. Malnutrition by the Global Leadership Initiative on Malnutrition showed a sensitivity of 82.9% and when associated with handgrip strength sensitivity was 90.8%, considering the Subjective global assessment

produced by the patient as a reference; on the other hand, the specificity was 16.7% independently of adding handgrip strength. None of the anthropometric variables was associated with the reference tool.

Conclusion
The Global Leadership Initiative on Malnutrition proved to be a very sensitive tool for diagnosing malnutrition when compared to the gold standard, particularly for severe malnutrition, but with little specificity. The need for a comprehensive nutritional assessment in the clinical practice was confirmed, using the parameters available and not interpreting them separately.

Keywords: Inflammation. Malnutrition. Nutritionalstatus. Weightloss.

RESUMO

Objetivo
O objetivo deste estudo foi comparar os métodos Global Leadership Initiativeon Malnutrition e Avaliação Subjetiva Global Produzida pelo Próprio Paciente na avaliação nutricional de pacientes oncológicos hospitalizados.

Métodos
Estudo transversal com uma variável prospectiva, realizado com pacientes internados em um hospital público de Pernambuco. A aplicação dessas ferramentas e o diagnóstico de desnutrição foram realizados nas primeiras 48 horas de admissão. Dados sociodemográficos, clínicos e laboratoriais foram obtidos do prontuário, e dados com peso, altura, circunferência do braço, prega cutânea tricipital e força de preensão palmar foram coletados.

Resultados
Dos 82 pacientes avaliados, a maioria eram homens com idade ≥60 anos com menos de 8 anos de estudo. A frequência de desnutrição foi de 93,7% pela Avaliação Subjetiva Global; destes, 23,2% com desnutrição grave. Já pela Global Leadership Initiative on Malnutrition, 50% dos pacientes foram considerados desnutridos graves. A desnutrição pela Global Leadership Initiative on Malnutrition apresentou uma sensibilidade de 82,9% e de 90,8% quando associada à força de preensão palmar considerando a Avaliação Subjetiva Global Produzida pelo Próprio Paciente como referência. Por sua vez, a especificidade foi de 16,7% independentemente de adicionar a força de preensão palmar. Nenhuma das variáveis antropométricas apresentou associação com a ferramenta de referência.

Conclusão
A Global Leadership Initiative on Malnutrition mostrou-se uma ferramenta bastante sensível para diagnosticar desnutrição quando comparada ao padrão ouro, principalmente para desnutrição grave, porém pouco específica. Ratificou-se a necessidade de uma avaliação nutricional ampla na prática clínica, utilizando os parâmetros disponíveis e não os interpretando de forma isolada.

Palavras-chave: *Inflamação. Desnutrição. Estado nutricional. Perda de peso.*

INTRODUCTION

Cancer is a chronic disease characterized by disordered cell growth in different tissues and organs; it is considered a public health problem and, according to the *Instituto Nacional do Câncer José Alencar Gomes da Silva* (INCA, National Cancer Institute José Alencar Gomes da Silva) estimates, in the 2020-2022 period, 625.000 new cases were reported in Brazil each year [1,2]. Cancer is an important predisposing factor for protein-energy malnutrition and is associated with nutritional deviations caused by the stage of the disease, age, type of treatment that contributes to inadequate food intake, exacerbated inflammatory response and increased metabolic demand, as well as symptomatology and impairments in the assimilation of nutrients [3-5].

Protein-energy malnutrition is a very common condition in patients with cancer increasing the risk of development of sarcopenia and/or cachexia. Baracos et al. [6] demonstrated that this condition is directly related to the marked inflammatory response in these patients, which may result from an increase in the synthesis of cytokines and pro-inflammatory factors by tumor cells, stromal cells of the tumor microenvironment or the immune system, which affect the target tissues by stimulating

catabolism and interfering with the regulation of the central nervous system homeostasis. In addition, these cytokines activate signaling pathways that cause destruction of myofibrillar proteins, leading to muscle atrophy and reduced functionality [6].

Therefore, the assessment of the nutritional status is of paramount importance to identify said nutritional deviations at an early stage, allowing for adequate intervention and improved outcome; thus, it is fundamental to have evaluation methods that can be used in a practical, fast way and in different environments [7,8]. This assessment involves both the screening tools to identify nutritional risks and the diagnostic tools.

The Patient-Generated Subjective Global Assessment (PG-SGA), validated in the Portuguese version by Gonzalez et al. [8] is the gold standard for those patients, as it encompasses specificities such as symptomatology with an impact on nutritional status. The PG-SGA was effective as a predictor of changes in quality of life; in addition, it was sensitive to identify mortality risk, as it uses a numerical score that helps perceiving small changes allowing reassessments in a short period of time [8].

Objective measures of anthropometry, that includes circumferences, skinfold and Body Mass Index (BMI), are also used to assess nutritional status [9]. Anthropometry is considered a conventional method widely used in clinical practice; however, it only identifies ongoing changes if performed periodically, like BMI in weight changes that may be influenced by the underlying disease and by the treatment; in addition it fails to detect early malnutrition [10,11].

On the other hand, functionality measures can be used as they detect changes in short periods of time even before they change the anthropometry, thus complementing the nutritional assessment; an example is Handgrip Strength (HGS), which is positively associated with PG-SGA [12].

Persistence of malnutrition worldwide and the need for its proper diagnosis, as well as a lack of global consensus lead to the development of the Global Leadership Initiative on Malnutrition (GLIM) in 2018, which involves phenotypic criteria such as weight loss, low BMI and reduction in muscle mass as well as etiological factors: reduced intake and the inflammatory conditions. The GLIM was developed to be used in different audiences and contexts, in addition to the advantage of being applied by any health professional [13].

Although GLIM has not been validated in Brazil, its application in some studies has shown satisfactory results [14,15]. In view of all the benefits mentioned associated to early malnutrition diagnosis and the development of criteria to standardize this diagnosis, it is necessary to develop investigations to compare these evaluation and diagnosis methods. The objective of our study was to compare GLIM and PG-SGA in the nutritional assessment of cancer inpatients.

METHODS

Cross-sectional study, carried out with cancer inpatients of the Hospital das Clínicas da Universidade Federal de Pernambuco (Federal University of Pernambuco Clinical Hospital), located in the city of Recife (PE), Brazil, conducted from June to September 2021. The sample was for convenience and was composed by patients of both genders diagnosed with cancer; they were over 20 years of age and classified as nutritional risk according to the *Triagem de Risco Nutricional 2002* screening tool; patients with a score ≥3 within 48 hours of admission were classified as nutritional risk. Pregnant women, patients under palliative care or those with collection impairing conditions, such as being unable to perform anthropometric measurements, were excluded.

The investigation was approved by the Research Ethics Committee of the Hospital das Clínicas – Universidade Federal de Pernambuco under CAAE: 43920320.1.0000.8807, opinion number 5.359.086, and all participants consented to their participation and entered the Free and Informed Consent Form.

Initially, sociodemographic and clinical data were collected through interviews and by the transcription of the medical records: gender (self-explanatory), age (categorized as adults <60 years of age and older adults ≥60 years), marital status considering the dichotomous response with and without a partner, education(years) and family income in minimum wages, type of cancer (clinically defined according to the medical literature), time of diagnosis, staging (clinically defined according to the medical literature), current treatment (clinically defined according to the medical records) and other comorbidities (dichotomous answer yes or no) [16].

Anthropometric measurements of weight, height, Arm Circumference (AC) and Triceps Skinfold (TSF) were taken by a nutritionist following the technique suggested by Lohman et al. [17]. Those measurements were classified based on the cutoff points indicated by the World Health Organization [18] for adults and for older adults, the classification established by Lipschitz [19]. The Arm Muscle Circumference (AMC) was also calculated and the 50th percentile was determined using the Frisancho reference [20] and its classification established according to the cutoff points proposed by Blackburn and Thornton [21]. Unintentional weight loss in relation to time was significant following Blackburn and Thornton [21] indication.

Muscle strength was assessed using HGS, measured according to Luna-Heredia et al. [22] using a JAMAR® digital dynamometer. The cutoff points were established according to the classification criteria recommended by the European Working Group on Sarcopenia in Older People 2 [23], which are indicated by the *Sociedade Brasileira de Nutrição Oncológica* (Brazilian Society of Oncological Nutrition) [9]; HGS values <27kg/f for men and HGS <16kg/f for women were considered unfavorable.

The PG-SGA was applied and its result was obtained in scores and categories, using the Portuguese version validated by González et al. [8]. This tool contains four initial sections that were completed by the patient, after a simple verbal explanation by the professional in charge. When the interviewee was illiterate or found it difficult to answer, the professional helped with the filling out of the questionnaire. The sections contained questions regarding the respondents' body weight, food intake, symptoms, activities and functions. The rest of the evaluation was completed by the investigator and the individuals were classified into three categories according to the diagnosis: A (well nourished), B (moderately malnourished or at risk of malnutrition) and C (severely malnourished); the score was not considered to establish the diagnosis of malnutrition. The following signs and symptoms were extracted from the PG-SGA and reviewed: anorexia, nausea, vomiting, gastric fullness, fatigue, constipation, discomfort with smells, strange taste, diarrhea and swallowing difficulties.

The GLIM criteria were applied using an adapted form based on Cederholm et al. [13]. The diagnosis of malnutrition was based on the presence of at least one phenotypic and one etiological criterion. Phenotypic criteria included unintentional weight loss >5% during the last 6 months or >10% over a period longer than 6 months, low BMI, considering the cutoff points <22 for those over 70 years of age and <20 for those under 70 (different from those used for the Brazilian population) and reduced muscle mass.

Muscle mass was measured using the AMC and was considered reduced when lower than 90% according to the Blackburn and Thornton classification [21]. A second GLIM classification was established and associated with HGS used as an auxiliary parameter after determining the

reduction of muscle mass. In the absence of a reduced score in the AMC, the HGS was considered as a determinant for muscle mass reduction.

Etiological criteria include reduced intake, characterized by an intake ≤50% of the requirements for more than 1 week, or any reduction for more than 2 weeks, or any chronic gastrointestinal condition that adversely affects food assimilation or absorption, and the disease/inflammation load. The C-Reactive Protein (CRP) >10mg/dL and/or albumin <3.5g/dL were considered as inflammatory indicators [24]. These data were obtained by transcribing the biochemical tests which are routinely requested at the service and entered in the medical records.

Malnutrition was classified according to severity based on the phenotypic criteria: moderate malnutrition when the patient presented one or more of the following criteria: weight loss between 5 and 10% in the last 6 months or 10 to 20% in more than 6 months, or BMI <20 for individuals under 70 years of age and <22 for individuals over 70, or even mild to moderate lean mass deficit, considering AMC adequacy <90%; and in severe malnutrition when the patient scored one or more of the following criteria: weight loss >10% in the last 6 months or >20% in more than 6 months or BMI <18.5 in those patients under 70 years of age or <20 over 70 or severe lean mass deficit, considering AMC adequacy<70%.

The database was compiled using Excel 2010 and the statistical analysis was performed using the IBM®SPSS® software, version 25.0. Continuous variables were tested for normality using the Kolmogorov-Smirnov test and described as means and standard deviations.

Proportions were described by approximating the binomial distribution to the normal distribution using a 95% confidence interval. In the statistical inference tests, the proportions were compared using Pearson's chi-square test and/or Fisher's exact test. The classification of the BMI, AC and TSF variables were grouped into two categories: without malnutrition (eutrophy and overweight) and with malnutrition (mild, moderate and severe malnutrition). In the PG-SGA, moderate and severe malnutrition were grouped into the malnutrition category. When comparing GLIM with PG-SGA (the gold standard), sensitivity, specificity, Positive Predictive Value (PPV), Negative Predictive Value (NPV) and accuracy were determined.

RESULTS

A total of 82 patients was assessed; their mean age was 59±14.2 years and 43 of them were male. Some numerical differences occurred due to the absence of information in their medical records in relation to the variable's disease stage (54), CRP (3) and albumin (12).

The profile of the population assessed showed an average length of hospital stay of 16±13.2 days, and no association was observed with nutritional status according to the GLIM, PG-SGA or GLIM with HGS (p=0.152; p=0.442; p=0.758, respectively). The CRP mean value was 7.86±7.54mg/L and in relation to the PG-SGA the mean score was 18±6.5 and about 94% of the individuals had values equal to or above 9. With regard to symptoms, the main complaints were: anorexia 64.6% (n=53); nausea and/or vomiting 52.4% (n=43); gastric fullness 48.8% (n=40); fatigue 43.9% (n=36); constipation 37.8% (n=31); discomfort with smells and strange taste affected 31.7% (n=26); diarrhea 23.2% (n=19); and problems with swallowing 17.1% (n=14).

Table 1 describes the demographic and clinical characteristics of those patients. The sample consisted of a larger number of older adults (53.7%; 95% CI: 42.9-64.5). Most patients had a partner (54.9%; 95% CI: 44.1-65.6), had a family income of 1 minimum wage (47.6%; 95% CI: 36.8-58.4) and went to school ≤8 years (85.4%; 95% CI: 77.7-93.0).

Table 1 – Demographic and clinical characteristics of hospitalized cancer patients. Recife (PE), Brazil, 2021.

Characteristics	n	%	95% CI*
Gender			
Male	43	52.4	41.6-63.2
Famale	39	47.6	36.8-58.4
Age			
Adult	38	46.3	35.5-57.1
Elderly	44	53.7	42.9-64.5
Marital status			
No partner	37	45.1	34.4-55.9
Whith partner	45	54.9	44.1-65.6
Income			
<1 wage	16	19.5	10.9-28.1
1 wage	39	47.6	36.8-58.4
2 a 3 wages	10	12.2	5.1-19.3
>3 wages	17	20.7	12.0-29.5
Schooling			
Illiterate	6	7.3	1.7-13.0
≤8 years of study	70	85.4	77.7-93.0
≥8 years of study	6	7.3	1.7-13.0
Type of cancer			
Breast	6	7.3	1.7-13.0
Gynecologists	9	11.0	4.2-17.7
Gastric	11	13.4	6.0-20.8
Colon and rectum	12	14.6	7.0-22.3
Hematological	14	17.1	8.9-25.2
Others	30	36.6	26.2-47.0
Diagnostic time			
Até 1 month	18	22.0	13.0-20.5
1 a 3 months	11	13.4	6.0-20.8
3 a 6 months	12	14.6	7.0-22.3
≥6 months	12	14.6	7.0-22.3
≥1 year	29	35.4	25.0-45.7
Staging			
I	0	0.0	–
II	1	3.6	0.0-10.4
III	2	7.1	0.0-16.7
IV	25	30.5	77.8-100.0
Current treatment			
None	34	41.5	30.8-52.1
Radiotherapy	3	3.7	0.0-7.7
Chemotherapy	39	47.6	36.8-58.4
Surgery	6	7.3	1.7-13.0
Clinical Outcome			
Hospital discharge	72	87.8	80.7-94.9
Death	10	12.2	5.1-19.3
Comorbidities			
Systemic arterial hipertension			
Yes	37	45.1	34.4-55.9
No	45	54.9	44.1-65.6
Diabetes *Mellitus*			
Yes	14	17.1	8.9-25.2
No	68	82.9	74.8-91.1
Chronic kidney disease			
Yes	5	6.1	0.9-11.3
No	77	93.9	88.7-99.1

Note: *Confidence interval of 95%.

Regarding clinical data, the most frequent pathology was hematological cancer (17.1%; 95% CI: 8.9-25.2), followed by colon and rectum cancer (14.6%; 95% CI: 7.0-22.3); most of them had been diagnosed at least 1 year earlier (35.4%; 95% CI: 25.0-45.7). Most patients were in stage IV (30.5%; 95% CI: 77.8-100.0) and no stage I patient was found. With regard to treatment, 47.6% (95% CI: 36.8-58.4) were receiving chemotherapy and 41.5% (95% CI: 30.8-52.1) were not undergoing any type of treatment during the data collection period.

Among the associated comorbidities, arterial hypertension was the most frequent. Although discharge was the most common outcome (87.8%; 95% CI: 80.7-94.9), the survival analysis did not find any statistical difference in relation to malnutrition assessed by GLIM, PG-SGA or GLIM with HGS (p=0.149; p=0.864; p=0.161, respectively).

Table 2 shows that 69.6% (95% CI: 59.5-79.8) had adequate CRP and 64.3% reduced albumin (95% CI: 53.1-75.5). Most patients experienced significant weight loss (69.1%; 95% CI: 59.1-79.2) and the highest frequency of malnutrition found among objective measurements was with AC 68.3% (95% CI: 58.2-78.4) and the lowest with AMC 42.7% (95% CI: 32.0-53.4). Malnutrition and overweight measured by BMI affected 39.0% (95% CI: 28.5-49.6) and 46.3% (95% CI: 35.5-57.1) of the individuals, respectively. The HGS reduction frequency was 68.3% (95% CI: 58.2-78.4).

Table 2 – Biochemical tests and nutritional characteristics of hospitalized cancer patients. Recife (PE), Brazil, 2021.

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Characteristics	n	%	95% CI*
C-Reactive Protein			
Adequate	55	69.6	59.5-79.8
Elevated	24	30.4	20.2-40.5
Albumin			
Adequate	25	35.7	24.5-46.9
Elevated	45	64.3	53.1-75.5
Body mass index			
Malnutrition	12	14.6	7.0-22.3
Adequate weight	32	39.0	28.5-49.6
Overweight	38	46.3	35.5-57.1
Weight loss percentage			
Significant	56	69.1	59.1-79.2
Not significante	25	30.9	20.8-40.9
Arm circumference			
Malnutrition	56	68.3	58.2-78.4
Adequate	20	24.4	15.1-33.7
Overweight	6	7.3	1.7-13.0
Triceps skinfold			
Malnutrition	54	65.9	55.6-76.1
Adequate	13	15.9	7.9-23.8
Overweight	15	18.3	9.9-26.7
Arm muscle circumference			
Malnutrition	35	42.7	32.0-53.4
Adequate	47	57.3	46.6-68.0
Grip strenght			
Inadequate	56	68.3	58.2-78.4
Adequate	26	31.7	21.6-41.8
Patient-Generated Subjective Global Assessment			
Well nourished	6	7.3	1.7-13.0
Suspected or moderate malnutrition	57	69.5	59.5-79.5
Severely malnourished	19	23.2	14.0-32.3
Global Leadership Initiative on Malnutrition			
Does not have malnutrition	14	17.1	8.9-25.2
Moderately malnourished	27	32.9	22.8-43.1
Severely malnourished	41	50.0	39.2-60.8

Table 2 – Biochemical tests and nutritional characteristics of hospitalized cancer patients. Recife (PE), Brazil, 2021.

Characteristics	n	%	95% CI*
Global Leadership Initiative on Malnutrition with handgrip strength			
Does not have malnutrition	8	9.8	3.3-16.2
Moderately malnourished	27	32.9	22.8-43.1
Severely malnourished	47	57.3	46.6-68.0

Note: *Confidence interval of 95%.

Regarding the PG-SGA, considering the classification into categories, 92.7% (n=76) of the individuals were considered malnourished, regardless of the degree, and moderate malnutrition was observed in 69.5% (95% CI: 59.5-79.5). According to the GLIM criteria, 82.9% of the individuals were classified as malnourished, with the highest percentage being considered severely malnourished (50.0%; 95% CI: 39.2-60.8). When HGS was added to GLIM, the percentage of malnourished individuals raised to 90.2% and those severely malnourished to 57.3% (Table 2).

Table 3 shows that none of the tested variables was associated with the PG-SGA. Out of the patients considered malnourished by the PG-SGA (n=76), 13 were not malnourished by the GLIM (false negative) and 63 had the same diagnosis, regardless of the degree of malnutrition. Regarding patients diagnosed as well nourished by the PG-SGA (n=6), GLIM diagnosed 5 as malnourished (false positive). On the other hand, according to the BMI, 64 patients who were considered malnourished by the PG-SGA were considered well nourished.

Table 3 – Patient-Generated Subjective Global Assessment and anthropometric and functional variables in the nutritional assessment of hospitalized cancer patients. Recife (PE), Brazil, 2021.

Characteristics	Patient-Generated Subjective Global Assessment				*p*-value*
	Well nourished		Malnourished		
	n	%	n	%	
Body mass índex					0.585
Without malnutrition	6	8.6	64	91.4	
With malnutrition	0	0.0	12	100.0	
Arm circumference					1.000
Without malnutrition	2	7.7	24	92.3	
With malnutrition	4	7.1	52	92.9	
Triceps skinfold					0.406
Without malnutrition	3	10.7	25	89.3	
With malnutrition	3	5.6	51	94.4	
Arm muscle circumference					1.000
Without malnutrition	4	8.5	43	91.5	
With malnutrition	2	5.7	33	94.3	
Grip strength					1.000
Adequate	4	7.1	52	92.9	
Inappropriate	2	7.7	24	92.3	
Global Leadership Initiative on Malnutrition					1.000
Without malnutrition	1	7.1	13	92.9	
With malnutrition	5	7.4	63	92.6	

Note: *Fisher's exact test.

When evaluating the GLIM criteria, the highest percentages found were reduced food intake and unintentional weight loss; they were present in 81.7% of the sample, followed by inflammation 57.3% and low BMI 35.4%. If the combinations of criteria that provided a higher prevalence of

malnutrition are taken into account, the association of inflammation with unintentional weight loss was found in 45.6% of the patients, reduction of muscle mass with inflammation in 27.9% of the patients and reduction of mass muscle with reduced intake also 27.9% (data not shown in the tables).

In Table 4, when comparing the results of the GLIM and PG-SGA criteria, it was observed that the GLIM has a sensitivity of 82.9% and a specificity of 16.7% for diagnosing malnutrition; the GLIM PPV was 92.6% and NPV 7.1%. When the GLIM tool was added to the HGS, its sensitivity increased to 90.8% and specificity remained the same. When considering the degree of malnutrition, GLIM obtained a lower sensitivity and maintained specificity for the diagnosis of moderate malnutrition (63.9%); on the other hand, for severe malnutrition its sensitivity was 100% and its specificity 20%. There was no association in the assessment of accuracy between the GLIM and GLIM with HGS methods.

Table 4 – Validity of the Global Leadership Initiative on Malnutrition for the diagnosis of malnutrition considering the Patient-Generated Subjective Global Assessment as a reference.

Condition	Sensitivity		Specificity		Positive predictive value		Negative predictive value	
	%	95% CI*	%	95% C*	%	95% CI*	%	95% CI*
Malnutrition								
Global Leadership Initiative on Malnutrition	82.9	74.7-91.0	16.7	8.6-24.7	92.6	87.0-98.3	7.1	1.6-12.7
Global Leadership Initiative on Malnutrition with handgrip strength	90.8	84.5-97.0	16.7	8.6-24.7	93.2	87.8-98.7	12.5	5.3-19.7
Moderate malnutrition								
Global Leadership Initiative on Malnutrition	63.9	48.6-79.2	50.0	34.1-65.9	95.8	89.5-100.0	7.1	0.0-15.3
Global Leadership Initiative on Malnutrition with handgrip strength	76.7	62.0-91.3	50.0	32.7-67.3	95.8	88.9-100.0	12.5	1.0-24.0
Severe malnutrition								
Global Leadership Initiative on Malnutrition	100.0	–	20.0	2.9-37.1	80.0	62.9-97.1	100.0	–
Global Leadership Initiative on Malnutrition with handgrip strength	100.0	–	20.0	2.9-37.1	80.0	62.9-97.1	100.0	–

Note: *Confidence interval of 95%.

DISCUSSION

Nutritional deviations such as nutritional risk and malnutrition have effects on the morbidity and mortality of cancer patients; therefore, adequate investigation of such conditions should contribute to early nutritional intervention measures, since poor nutritional conditions are also directly associated to reduced response to cancer treatment, increased risk of postoperative complications, length of hospital stay, hospital costs and quality of life [25,9].

Data from the present study revealed that the GLIM criteria, when compared with the gold standard PG-SGA, show good sensitivity, but low specificity for diagnosing malnutrition, regardless of the degree of the disorder; when added to HGS, the sensitivity of the method increased; hence HGS can be used in an auxiliary way, although it does not directly reflect the quantity of muscle mass.

In fact, HGS, which determines functionality and contributes to the assessment of nutritional status and the effectiveness of nutritional therapy, should be considered an important parameter for cancer patients, either as an easy-to-apply measure to aid in anthropometry or for situations in which muscle mass cannot be measured [5-9]. However, these findings are not consistent in the literature. De Groot et al. [15] observed reduced sensitivity to 20% and increased specificity with the addition of HGS to GLIM, requiring the elaboration of other studies to elucidate these questions.

The GLIM diagnosed fewer individuals with malnutrition, but a higher rate of severe malnutrition compared to PG-SGA. A possible explanation would be that severe malnutrition may be due to a chronic process not scored by the PG-SGA, particularly considering that the most frequent diagnosis lag time in the sample was over one year. This caused, for example, continuation of a low food intake, not detecting recent changes.

When reviewing the validity of the GLIM criteria for the diagnosis of malnutrition, De Groot et al. [15] in their cross-sectional study conducted in Australia, which evaluated 246 cancer patients in an outpatient setting found76% sensitivity and 73% specificity, respectively;such values are close to those found in the study of 80% in terms of sensitivity. The data are also consistent with those of the studies by Brito et al. [26] conducted with cancer inpatients. Those authors found satisfactory sensitivity and specificity of the GLIM (>80%).

However, regarding specificity, the values found in our study were much lower than expected; this difference may be due to the small number of well nourished patients according to the PG-SGA (n=6), reducing the opportunity of better evaluating the criteria GLIM in relation to false positives. It is important to note that there is no methodology standardization with regard to the application of the GLIM criteria in the inflammatory state and in the reduction of muscle mass, thus impairing comparison between them [26,13].

This can be observed in the comparison of the prevalence of malnutrition between the studies, indicating that the malnutrition assessment varies according to the evaluation methods used and the use or not of nutritional screening as a tool to be included because it is a mandatory item that precedes the application of the GLIM. In the comparison between the GLIM and the PG-SGA, the differences between the tools stand out: a subjective versus an objective difference. The GLIM does not depend on the professional's judgment; its form does not require to be filled in by the patient an advantage that expands its potential use and allows the use of measures such as BMI, contrary to what is required in the PG-SGA, which considers symptoms and differences such as the weight loss criterion measured ≥6 months in the GLIM and starting from one month in the PG-SGA. Hence, individuals with a history of weight loss even if they are in recovery, can score in the GLIM and those who present an initial weight loss can score in the PG-SGA [15].

As to the combination of the GLIM criteria to diagnose malnutrition, Henrique et al. [27] in their prospective cohort study at Hospital das Clínicas de Minas Gerais using a sample of 206 gastrointestinal surgery patients, identified different rates depending on the criteria used; the combinations with the highest prevalence of malnutrition were: weight loss associated with inflammation and reduced muscle mass with inflammation. This finding confirms our study results; there is a difference though in the parameters used to assess reduced muscle mass and inflammation, using calf circumference and the patient's clinical diagnosis, respectively.

Regarding the other GLIM criteria, we know that if inflammation is objectively measured, it is associated with unintentional weight loss, which was found in a large proportion in our study, in addition to loss of muscle mass, anorexia and worse quality of life [24]. The CRP and albumin are considered important biomarkers; levels above 10mg/L and below 3.5mg/L, respectively, were associated with a higher risk of developing the above alterations, which is why they were used as a parameter in the present study. Although a higher frequency of reduced albumin was found, there was no association with PG-SGA, unlike the results by Zhang et al. [28] that showed an association between reduced levels of albumin and high CRP with higher PG-SGA scores and diagnosis of moderate and severe malnutrition.

As for the weight loss criterion, it is important to emphasize its importance as a negative prognostic indicator associated with reduced performance and consequent response to treatment with a greater number of anatomical sites with metastases [25,9]. The last Brazilian Survey of Oncological Nutrition [25] estimated that approximately 40% of patients experienced unintentional weight loss. Our study found an even higher prevalence. This could be explained, among other factors, by as ample composed of individuals at nutritional risk, by the reported symptoms and due to the prevalence of older adults as they generally present a considerable and progressive reduction of muscle mass [9].

With regard to symptoms, resulting mainly from treatment with chemotherapy and radiotherapy, the symptoms associated most to malnutrition are: difficulty swallowing, anorexia, vomiting, gastric fullness and nausea [7-9]. These were found in a large proportion in the sample studied, in which most patients undergo chemotherapy, with a greater predominance of anorexia, nausea and/or vomiting followed by gastric fullness.

Similar results were found by Contreras-Bolívar et al. [14]; the authors state that BMI cannot be used as a sensitive marker for malnutrition because it requires intense weight loss to produce changes. In their study, only 20% of the patients were malnourished according to their BMI, while according to the PG-SGA they were 81% and according to the GLIM from 72.2 to 80%, depending on the parameter used to measure the reduction in muscle mass.

It is important to emphasize that this study brought relevant points regarding the use of nutritional screening as an inclusion criterion so that an early nutritional intervention can be instituted following the GLIM guidelines, the use of biochemical markers to measure inflammation and the encouragement to use easily accessible measures such as circumferences and skinfolds. However, one should still consider the absence of a gold standard tool to measure muscle mass and the fact that GLIM uses BMI cutoff points that are different from those used in Brazil. Furthermore, the PG-SGA category B classification involves not only patients with moderate malnutrition, but also patients at risk of malnutrition, unlike GLIM; which may lead to differences in comparisons. The sample size and failure to apply the tools using at least two independent evaluators must also be considered.

CONCLUSION

The GLIM proved to be a very sensitive tool for diagnosing malnutrition when compared to PG-SGA, mainly for severe malnutrition, but not very specific; when associated with HGS, an increase in its sensitivity in the malnutrition diagnosis could be observed.

Although PG-SGA is the main diagnostic method for nutritional deviations in oncology patients, the use of GLIM should be considered, due to its good sensitivity and accuracy. In addition, GLIM application is fast, requiring less information from the patient a fact that is especially useful when it is impossible to obtain all the necessary information using the PG-SGA.

Thus, there is a need for a comprehensive nutritional assessment in the clinical practice, using the parameters available, such as anamnesis, physical examination, anthropometry and dietary history, and none of the parameters should be interpreted separately to establish a nutritional diagnosis.

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CONTRIBUTORS

LA SOLON, SBG CAMPOS and ICG DE ARRUDA contributed to the conceptualization; formal analysis; investigation; methodology; statistical analysis; data discussion. MTO TOMIYA contribuited statistical analysis and KP GOMES contribuited to data collection. Finally MCL DA LUZ contributed to review and approval of the final version of the article.