RESEARCH ARTICLE

Editorial Process: Submission:09/18/2024 Acceptance:06/02/2025

Scored Patient-Generated Subjective Global Assessment (PG-SGA) in Brazilian Cancer Patients and Association with Anthropometric Parameters

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Abstract

Introduction: The Scored Patient-Generated Subjective Global Assessment (PG-SGA) is a multidimensional tool used to assess malnutrition and associated risk factors. Objective: To evaluate the nutritional status of Brazilian cancer patients hospitalized using the Scored PG-SGA and to examine the correlations with selected nutritional parameters. **Methods:** This observational study included 2.027 cancer patients aged over 18 years at a hospital of cancer, Brazil. All patients were assessed for nutritional status using the Brazilian PG-SGA and anthropometric measurements were evaluated. **Results:** According to the PG-SGA global assessment categories, 56.2% (1.138) cancer patients were well-nourished, 29.3% (594) were moderately malnourished, and 14.4% (292) were severely malnourished. The average body mass index (BMI) was 23.7±5.49 kg/m², and the current weight was 66.34±58.07 kg. The PG-SGA, nutritional status and clinical variable assessed by PG-SGA, were all significantly correlated with body mass index ($p < 0.005$) and weigh < 0.005). **Conclusions:** The Brazilian PG-SGA showed a 43.7% of malnourished cancer patients. The classification of severely malnourished by PG-SGA demonstrated strong positive correlations with BMI. Anthropometric parameters correlates with PG-SGA variable, weigh with sex, nausea, diarrhea, dysgeusia, diagnostics of cancer, fever and death and BMI with sex, food intake, nausea, diarrhea , dysgeusia.

Keywords: Nutritional assessment- nutritional status- scored patient-generated subjective global assessment-malnutrition

Asian Pac J Cancer Prev, **26 (6)**, 2009-2014

Introduction

Malnutrition is prevalent in cancer patients, with a reported incidence ranging from 39% to 87% [1]. Cancer and anti-cancer treatments could adversely affect the patient's nutritional status, where they interfere with appetite and dietary intake [2]. All of which leads to malnutrition and may cause an increased risk of complications, reduced response and tolerance of treatment, decreased quality of life, increased healthcare costs, and prolonged hospitalization [3-6]. Nutritional screening is a is essential for triaging patients and fast to detect risk of malnutrition and provided determines nutritional status then intervention to improve clinical outcomes [3,7]. Currently, there is no gold standard for assessing the nutritional status of cancer patients, although various nutritional assessment tools have been developed [8].

The Subjective Global Assessment (SGA), is the most widely used tool for assessing the nutritional status of cancer patients [3-5,9] because it shows better sensitivity, specificity, positive, and negative predictive values than other tools based on the concept of medical history and physical examination [10]. It has been used in several clinical settings and has been proven to correlate with clinical variables [11].

The Patient-Generated Subjective Global Assessment (PG-SGA), adaptation of SGA, developed and validated by Ottery et al. [12] tool to estimate nutritional status. The PG-SGA tool is endorsed by the Oncology Nutrition

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Dietetic Practice Group of the American Dietetic Association as the standard for nutrition assessment in cancer patients and is a rapid, cost-effective and feasible tool, which can be easily implemented in clinical settings [7]. The Patient-Generated Subjective Global Assessment (PG-SGA) was translated and validated in Brazil in 2010, demonstrating the usefulness of the tool, which is used to categorize nutritional status and screen for the degree of need for professional intervention [13].

PG-SGA differs from the ASG by including items specifically developed to address the characteristics of cancer patients. Therefore, questions regarding symptoms that impact nutrition in these patients have been included, whether due to the tumor itself or the treatment (chemotherapy, radiotherapy, and surgery). Another distinguishing feature of this method is that it allows not only for nutritional assessment in three categories (A = well-nourished, B = suspected or moderate malnutrition, and C = severe malnutrition) but also generates a numerical score. This score enables the identification of patients at nutritional risk, who can then be referred for various levels of nutritional intervention. The presence of the numerical score also allows for periodic repetition, facilitating the identification of changes in the need for nutritional intervention in these patients over shorter intervals than those used with the ASG [13].

Therefore, considering the importance of understanding the nutritional status of cancer patients, this study aimed to evaluate the nutritional status of cancer patients hospitalized at a philanthropic institution in Teresina, Piaui (Brazil) using the Patient-Generated Subjective Global Assessment (PG-SGA) and to examine the correlations with anthropometric parameters, body mass index (BMI) and weight.

Materials and Methods

A cross-sectional study was conducted at a philanthropic hospital specializing in cancer treatment at Brazil, to evaluate nutritional status in cancer patients through the Brazil version of the Scored PG-SGA, validated tool by Goncalvez et al. [13] and analyze the correlation with the anthropometric parameters, body mass index (BMI) and weight

Participants

Cancer patients from inpatient of Hospital São Marcos in Teresina (PI), Brazil, were recruited into the study through convenience sampling between March 2018 and March 2019. Eligibility criteria included being over 18 years of age, undergoing anticancer treatment (chemotherapy and/or radiotherapy and/or surgery), and consenting to participate in the study. Patients with physical limitations, cognitive impairments, those who were pregnant, patients admitted to the Intensive Care Unit or unable to read and write in Portuguese were excluded. The research was approved by the National Commission of Ethics in Research - CONEP/Research Ethics Committee of the Associação Teresinense de Combate ao Câncer (N°2.775.354).

Nutritional assessment

The nutritional status of all cancer patients was assessed using the tool BRAZIL PG-SGA [13] by a trained dietitian experienced within 48 hours of the patient's admission. In the evaluation process, the trained dietitian applies criteria to the standard protocols and making measurements with great care in categorizing nutritional status by PG-SGA. Data from electronic medical records were used for age, diagnosis, and stages of cancer. Anthropometrics date, weigh (kg), height (cm) and %weight loss. Nutritional diagnosis was determined by to the score and classification of the Patient-Generated Subjective Global Assessment (PG-SGA). Each patient was either classified as well nourished (category A), moderately malnourished or suspected of being malnourished (category B), or severely malnourished (category C). The total score of PG-SGA were the sum of scores from patient-generated component and professional component, where the higher score indicating higher severity of malnutrition. The score of 0-1 suggests no intervention required, 2-3, educating patient and family is recommended, 4-8, requiring intervention as indicated by symptoms, and the score of 9 or more implying critical need for intervention. Weight loss was classification of one-month period when available, and /or a six-month period was used only if the one-month record was not available. Classification is as follows 1 month or six months, respectively: 4 points (10% or more; 20% or more), 3 points(5-9%;10-19%), 2 points (3-4.9%;6-9.9%), 1 (2-2.9%;2-5.9%), and 0 points (0-1.9%;-1.9%). Hospital nutrition department used the formula for %weight loss = (usual weight - current weight) x100/ usual weight).

Anthropometric assessment

Patients were physically assessed by the nutritionists team responsible for applying the ASG-PPP. Current weight (kg), usual weight (kg), height (cm). The body mass index (BMI) was calculated weight/ weight2 (kg/m²). BMI was examined using the World Health Organization (WHO) categories, which are widely accepted: < 18.5, underweight; 18.5 to 24.9, normal weight; 25.0 to 29.9, overweight; and ≥ 30.0 obese.

Statistical analysis

All data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 22.0 for Windows. Descriptive statistics included mean, standard deviation, minimum, maximum, frequency, and percentage (%). Student's t-test, chi-square test, and Spearman's correlation test were applied. A p-value < 0.05 was considered statistically significant.

Results

The nutritional status of 2.027 hospitalized cancer patients was evaluated. The characteristics of the patients are summarized in Table 1. The age was 56.9±16.82 years, with a predominance of males (52.7%, n = 1069). The most frequent types of tumors were gastrointestinal (29.9%, n=1069), The most prevalent symptoms were Nausea (23.6%, n = 479), According to the PG-SGA,

Table 1. Characteristics of of 2.027 Patients with Cancer

Characteristic	No. (%)
Age, y	2.027 (100)
<65	1.423 (70.2)
≥65	604 (29.8)
Sex	
Female	958 (47.3)
Male	1,069 (52.7)
Diagnosis Cancer	
Gastrointestinal	607 (29.9)
Female reproductive system	341 (16.9)
Hematologic	284 (14.1)
Male reproductive system	209 (10.4)
Head and neck	161(7.9)
Urinary system	66 (3.2)
Skin	63 (3.1)
Bone	50 (2.4)
Respiratory system	49 (2.4)
Central nervous system	47 (2.3)
Others	150 (7.4)
PG-SGA Symptoms	
Nausea	479 (23.6)
Sensitivity to smells	396 (19.5)
Dysgeusia or ageusia	326 (16.1)
Constipation	249 (12.3)
Xerostomia	227 (11.2)
Dysphagia	192 (9.5)
Vomiting	178 (8.8)
Anorexia	171 (8.4)
Gastric fullness	90 (4.4)
Diarrhea	66 (3.3)
Fever	43 (2.1)
Mouth pain	28 (1.4)
Functional capacity	
Unable to do most things, sometimes stays in bed or seated	671 (33.1)
Not at usual level, but reports being able to stand and engage in usual activities	423 (20.9)
Normal without limitations	216 (10.7)
Little physical activity, spends most of the day seated or lying down	534 (26.3)
Spends most of the time in bed, rarely gets up	183 (9.0)

Data are presented for categories No, Number of cancer patients; (%), percentual; PG-SGA, Patient-Generated Subjective Global Assessment

Table 2. Score and Classification of Patients with Cancer by PG-SGA.

Characteristic	Mean (Range)	No. (%)
Score PG-SGA		
0-1 No need for intervention		68 (3.4)
2-3 Education for the patient and their family		182 (9)
4-8 Nutritional intervention required		773 (38.1)
≥ 9 Critical needs for nutritional intervention		1004 (49.5)
Classification PG-SGA		
A (well nourished)		1138 (56.2) [a]
B (moderately malnourished)		594 (29.3)
C (severely malnourished)		292 (14.4)
Score PG-SGA		
A (well nourished)	4 (1-6)	
B (moderately malnourished)	11 (7-20)	
C (severely malnourished)	28 (24-33)	
% weight loss		
Significant Weight loss		113 (9.5) [b]
Severe weight loss		373 (31.3)
No weight loss		502 (42.2)
Gain weight		203 (17)
Death (30 days)		
Yes		182 (9)
No		1845 (91.0)

Data are presented for categories as No: Number of cancer patients; (%) percentual; mean ± standard deviation number; PG-SGA: Patient-Generated Subjective Global Assessment a, p-values are for comparisons between well-nourished and malnourished patients using MannWhitney-U test; b, p-values are for comparisons between well-nourished and malnourished patients using Chi-square;

56.2% (n = 1138) of the patients were Well-nourished (A) and the mean (range) PG-SGA score was 8±4.84 (1–33) points Table 2.

There was a significant difference (P = .0001) in the mean of PG-SGA scores for each of the subjective classification groups (A, B, and C). According to our findings, the numerical score of group A, or Well-nourished, was significantly higher than classification B and C, was significantly higher than group C (A > B > C), as shown in the Table 1.

Patients responded to the ASG-PPP questions regarding majority of oncology patients were fed orally, 94.4% (1912), followed by 5.2% (106) through nasogastric enteral nutrition, 2% (4) through gastrostomy, and 2% (4) through jejunostomy. Regarding food intake (P = 0.009), symptoms (P = .0001), and activities and function (P =0.002) were observed significant differences in patients who had been classified as B or C when the differences between the scores of the PG-SGA compared A.

Malnourished cancer patients had significantly higher average percentage of weight loss in one month compared to those who classified as well-nourished (p <0.001). On the contrary, actual body weight, BMI, not differ between well-nourished and malnourished patients.

The anthropometric parameters are described in Table 3. In a study examining the classification of body mass index (BMI) among cancer patients, the results revealed that 53.8% of the cencer participants were classified as 52% eutrophic (n = 1.056), 26.8% as overweight (n =526), 7.7% as obese (n =151), and 11.7%

Table 3. Characteristics of Anthropometric Parameters of Oncology Patients

Variable	Mean	Standard Deviation	Minimum	Maximum
BMI (Kg/m^2)	23.7	5.5	12.1	65.00
Height (Cm)	159.0	12.5	100.0	190.0
Weight (Kg)	66.34	58.0	29.00	145.00

Table 4. Correlation Analysis between the Anthropometric Assessment, Weight and BMI and PG-SGA Variables in Cancer Patients

Weight (Kg)	PG-SGA variables	Spearman correlation	p-value
	Sex	0,051	0.05
	Nausea	0,032	0.05
	Diarrhea	0,031	0.01
	Dysgeusia	0,010	0.01
	Cancer	0,076	0.05
	Fever	0,038	0.01
	Death	0,006	0.05
BMI(kg/m^2)			
	Sex	0,037	0.01
	Food Intake	0,019	0.01
	Nausea	0,022	0.01
	Diarrhea	0,007	0.01
	Dysgeusia	0,012	0.01

were as malnourished (n=229).

There was a strong and significant positive correlation between the nutritional status PG-SGA classification C- Severity of malnutrition and BMI (r= .759, $p < 0.001$). For the anthropometric assessment, weight and BMI, had positive correlation with PG-SGA variables (Table 4).

Discussion

This study aimed to assess the nutritional status of hospitalized Brazilian cancer patients using the brazilian tool of Patient-Generated Subjective Global Assessment (PG-SGA) and to correlate with anthropometric measurements. Our study is representative of the brazil population treated at center for the prevention and treatment of cancer in Brazil,

Our findings reveal a complex of nutritional status of cancer patient, Despite prevalence of well-nourished patients there was significant indicators of nutritional risk, the prevalence of malnutrition in our sample was 29.3% identified as moderately malnourished or at nutritional risk and 14.4% as severely malnourished. This date similar with some previous studies, such as Nitichai et at., [4] Thai PG-SGA, 75 (39%) of patients were well-nourished (PG-SGA A), 53 (27%) were moderately/ suspected malnutrition (PG-SGA B) and 67 (34%) were severely malnutrition (PG-SGA C). There was difference severely malnutrition may be attributed to the sensitivity of PG-SGA in identifying nutritional risk factors through its comprehensive assessment of nutritional impact symptoms, high patient population, cancer type diversity, and staging.

The PG-SGA's extensive range of symptoms may identify more patients at risk of malnutrition. Identifying nutrition impact symptoms at an early stage could be beneficial for proactively preventing malnutrition, allowing timely intervention during cancer and anti-cancer treatments. These extensive range of symptoms provided by PG-SGA may identify more patients at risk of malnutrition. Being able to identify nutrition impact symptoms at the early stage could be beneficial for proactively preventing malnutrition allowing timely intervention during cancer and anti-cancer treatments [13].

Systematic review showed that hospital malnutrition is highly prevalent in Latin America (40%–60%) and is associated with several adverse clinical outcomes such as infectious and non-infectious complications, as well as increased length of hospitalization. This emphasizes the essential need to assess nutritional status of patients. Therefore, it is of most importance to identify nutritional assessment parameters that are applicable and reliable for clinical use, in order to stratify patients' risk and prescribe nutritional intervention accordingly prescribed.

The PG-SGA in our study revealed that 49.5% (1004) of cancer patients scored ≥9, indicating a critical need for nutritional intervention. This finding highlights the prevalence of malnutrition and the associated risks faced by this population, which can include impaired treatment response, increased susceptibility to infections, and diminished quality of life. Nutritional intervention is paramount in oncology care, as personalized dietary strategies can not only help mitigate these risks but also enhance patient recovery and overall well-being. By identifying those at higher nutritional risk through the PG-SGA, healthcare providers can implement timely and appropriate interventions that are essential for optimizing treatment outcomes in cancer patients [7].

In our study, we found that a significant proportion of patients (53.8%) were classified as eutrophic according to BMI, while 11.7% of participants were identified as underweight. These results contrast with those reported by Guimarães et al. [14] in Goiânia-GO, Brazil , who observed a higher prevalence of malnutrition within their study population. This discrepancy may reflect variations in patient demographics, types of cancer, or dietary habits within different regions. Importantly, malnutrition is often associated with fluid retention, which can lead to an unintentional gain in weight. This phenomenon underscores the complexity of nutritional assessment in cancer patients, where apparent weight may not accurately represent nutritional status due to factors like edema or ascites [15]. Therefore, further investigation into the interplay between body composition, nutritional status, and symptom management remains essential

for developing effective treatment strategies for cancer patients.

In this study, mean PG-SGA scores were significantly lower in malnourished compared to well-nourished patients which was consistent with previous studies [7, 16, 17] but similar to the study in the Brazilian population Gonzalez et. al. [13]. The PG-SGA numerical scores showed positive correlation with nutritional status assessed by PG-SGA in the anticipated direction. The numerical score is useful to show small improvements or deteriorations in nutritional status, which cannot be reflected by the subjective score [18].

The percentage of weight loss in one month was significantly higher in malnourished than well-nourished group. It also had significantly positive correlation with PG-SGA numerical scores, nutritional status assessed by PG-SGA. This finding was consistent with Bauer et al. [7] which reported significant correlation between PG-SGA scores and %weight loss in 6 months ($r= 0.31$, $p = 0.012$). In this study, actual body weight and BMI were not significantly different between well-nourished and malnourished patients. This was also reported by Gabrielson et al. [17] that body weight was not significantly different between classification ($p = 0.218$). However, the findings indicated that BMI and body weight alone may have limitations in predicting malnutrition since malnourished cancer patients may have normal or overweight BMI range. Therefore, malnutrition can happen at any BMI while, in some cases, body fat could mask loss of lean body mass [7, 19].

The correlation analysis between the variables weight and PG-SGA, as well as BMI and PG-SGA, revealed significant insights into the nutritional status of patients. The strong correlation between the PG-SGA classification C- Severity of malnutrition and BMI suggests that the severity of malnutrition is closely related to body mass index, indicating that patients with a lower BMI tend to exhibit greater nutritional severity. The results revealed strong correlation between clinical variables—including factors such as sex, nausea, diarrhea, and dysgeusia and changes in body weight and nutritional status affect the symptom burden experienced by patients.

Understanding these correlations is crucial for informing clinical practices, as they can guide timely nutritional interventions and holistic management approaches aimed at enhancing the health outcomes and quality of life for individuals undergoing cancer treatment. The results also suggested that nutritional status could not be determined by using any single clinical parameter alone because each parameter has different limitation in nutrition assessment. Therefore, data collection from a variety of domains are necessary for nutrition assessment to determine appropriate diagnosis of malnutrition [20].

The systematic review showed that PG-SGA could serve as a nutritional assessment tool as it covers all components of the definitions of malnutrition as published by European Society for Clinical Nutrition and Metabolism (ESPEN) and the American Society for Parenteral and Enteral Nutrition (ASPEN) [21]. It also has several advantages as a nutritional instrument in comparison to SGA in terms of numerical scoring system rather than category. In addition, it provides extensive range of nutritional impact symptoms which often experienced by oncology patients [7, 22].

The strength of this study lies in the assessment of various nutritional parameters through anthropometric measurements. Furthermore, it included a diverse population of cancer patients across all stages of the disease and different inpatient treatment departments. However, a limitation of the study is the exclusion of critically ill patients admitted to the intensive care unit and those receiving palliative care. This limitation may influence the study results and limit the generalizability. Another potential limitation of this study is that the nutritional assessment was evaluated by trained dietitian only which may affect to the results. However, it avoids inter-rater variability.

In conclusion, the results of this study suggest that a significant prevalence of malnutrition at 43.7% among Brazilian cancer patients by PG-SGA. A strong positive correlation was identified between severe malnutrition, as assessed by the PG-SGA, and Body Mass Index (BMI), indicating that BMI is a valuable indicator of nutritional status. Furthermore, anthropometric parameters were found to correlate with key PG-SGA variables, including weight, sex, nausea, diarrhea, dysgeusia, cancer diagnosis, fever, and mortality. These findings underscore the critical need for targeted nutritional interventions in oncology patients. To enhance the identification and management of nutritional status, it is essential to integrate multidimensional assessment tools that encompass a variety of clinical variables. This comprehensive approach not only improves the effectiveness of nutritional interventions but also highlights the importance of a multidisciplinary team in managing the nutritional care of cancer patients, ultimately leading to better health outcomes.

Author Contribution Statement

All authors contributed equally in this study.

Acknowledgements

We gratefully acknowledge the assistance of nutritionist at São Marcos Hospital for data collection. We also would like to thank all staff members of Department of Nutrition and Dietetics for support and encouragement.

Funding Statement

This study was supported by Piauí Association for the Fight Against Cancer/São Marcos Hospital and Santo Agostinho University Center, Teresina (PI), Brazil.

Statement conflict of Interest

No conflict of interest in this study.

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