

# Hand Grip Strength and nutritional status in hospitalized oncological patients

## *Força de Preensão Manual e estado nutricional em pacientes oncológicos hospitalizados*

Thais STEEMBURGO<sup>1</sup>  0000-0003-3351-9901

Natália Cristina AVERBUCH<sup>2</sup>  0000-0003-4427-1198

Christy Hannah Sanini BELIN<sup>2</sup>  0000-0001-6805-2876

Estela Beatriz BEHLING<sup>2</sup>  0000-0001-9224-5723

### ABSTRACT

#### Objective

To evaluate the nutritional status and functional capacity of hospitalized adult patients.

#### Methods

Cross-sectional study of adult oncology patients at *Hospital de Clínicas de Porto Alegre*. Patients were evaluated according to Solid Tumors and Hematologic Tumors. The nutritional status was obtained using Patient Generated Subjective Global Assessment, and the functional capacity was evaluated by Handgrip Strength using a Jamar<sup>®</sup> dynamometer – and the Performance Index of the Eastern Cooperative Oncology Group.

#### Results

This study evaluated 76 patients (56±17 years old, 35.5% female), 63.2% with Solid Tumors and 36.8% with Hematologic Tumors. According to the Patient Generated Subjective Global Assessment, 53.9% of the patients were moderately and severely malnourished and demonstrated functional capacity, according to the Handgrip Strength and Performance Index of the Eastern Cooperative Oncology Group, of 47.9% and 32.2%, respectively. The functional capacity instruments showed a moderate agreement (Kappa=0.427,  $p<0.001$ ) and positive correlation ( $r=0.136$ ,  $p=0.028$ ). Severely malnourished patients had a lower Handgrip Strength when compared to well nourished (24.0±10.4 vs. 34.2±16.6kg,  $p=0.015$ ). The results were confirmed among moderately and severely malnourished patients, who were rated at the 40 percentile, considered low functional capacity.

<sup>1</sup> Universidade Federal do Rio Grande do Sul, Faculdade de Medicina, Programa de Pós-Graduação em Alimentação, Nutrição e Saúde. R. Ramiro Barcelos, 2400, 2º andar, 90035-003, Porto Alegre, RS, Brasil. *Correspondência para/*Correspondence to: T STEEMBURGO. E-mail: <tsteemburgo@gmail.com>.

<sup>2</sup> Universidade Federal do Rio Grande do Sul, Faculdade de Medicina, Departamento de Nutrição. Porto Alegre, RS, Brasil. Support: *Fundo de Incentivo à Pesquisa do Hospital de Clínicas de Porto Alegre* (project nº16.0226).

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## Conclusion

In this study, hospitalized oncological patients presented poor nutritional status and low functional capacity. The Patient Generated Subjective Global Assessment identifies the nutritional specification earlier. In addition, Handgrip Strength dynamometry can be a useful tool to evaluate the low functional capacity and nutritional status. It can be included in cancer patient's evaluation, along with other nutritional assessment tools.

**Keywords:** Handgrip Strength. Nutritional status. Hospitalized patients. Neoplasms.

## RESUMO

### Objetivo

*Avaliar o estado nutricional e capacidade funcional de pacientes adultos oncológicos hospitalizados.*

### Métodos

*Estudo transversal em pacientes oncológicos adultos do Hospital de Clínicas de Porto Alegre. Os pacientes foram divididos de acordo com a presença de Tumores Sólidos e Tumores Hematológicos. O estado nutricional foi identificado pela Avaliação Subjetiva Global Produzida pelo Paciente e a capacidade funcional pela Força do Aperto de Mão – medida por dinamometria – e pelo Índice de Desempenho do Eastern Cooperative Oncology Group.*

### Resultados

*Foram avaliados 76 pacientes (56±17 anos, 35,5% do sexo feminino), 63,2% apresentaram Tumores Sólidos e 36,8% Tumores Hematológicos. De acordo com a Avaliação Subjetiva Global Produzida pelo Paciente, 53,9% dos pacientes estavam moderadamente e gravemente desnutridos e demonstraram baixa capacidade funcional de acordo com a Força do Aperto de Mão e Índice de Desempenho do Eastern Cooperative Oncology Group, 47,9% e 32,2%, respectivamente. Os instrumentos de capacidade funcional demonstraram uma concordância moderada (Kappa=0,427;  $p<0,001$ ) e correlação positiva ( $r=0,136$ ;  $p=0,028$ ). Pacientes gravemente desnutridos demonstraram ter uma menor Força do Aperto de Mão quando comparados aos bem nutridos (24,0±10,4 vs. 34,2±16,6kg;  $p=0,015$ ). Resultados foram confirmados entre pacientes moderadamente e gravemente desnutridos que apresentaram Força do Aperto de Mão abaixo do percentil 40, considerado uma baixa capacidade funcional.*

### Conclusão

*Neste estudo, os pacientes oncológicos hospitalizados, independentes do tipo de tumor, apresentaram comprometimento do estado nutricional e baixa capacidade funcional. A Avaliação Subjetiva Global Produzida pelo Paciente identifica de forma mais precoce a necessidade de uma intervenção nutricional específica. Ainda, a Força do Aperto de Mão deve ser considerada para complementar a avaliação nutricional neste grupo de pacientes.*

**Palavras-chave:** Força de Preensão Manual. Estado nutricional. Pacientes hospitalizados. Neoplasias.

## INTRODUCTION

Cancer is a non-transmissible chronic disease with a multifactorial etiology that interacts with genetic, environmental, and lifestyle factors [1]. It is among the leading causes of death in the world [2]. Malnutrition is common in cancer patients and is associated with increased mortality and morbidity [3]. The etiology of malnutrition in these patients is wide and involves anorexia, activation of the systemic inflammatory system, changes in metabolism,

and increased energy expenditure. All these factors combined lead to an exacerbated weight loss, cachexia, and sarcopenia [4]. A previously conducted study in hospitalized adult oncology patients showed that 66.3% of the patients were considered malnourished while 33.7% were classified as well nourished. The high prevalence of malnutrition in these individuals was associated with the reduction in total food intake and metabolic changes caused by the tumor, evidencing the negative influence of the disease on the nutritional status [5].

In fact, the nutritional deficit reduces the response to treatment, affecting organic functions and leading to a longer hospital stay, higher rates of complications, worse prognosis, and increased morbidity and mortality [6]. Thus, the early identification of nutritional risk, aiming to offer an adequate nutritional behavior in order to minimize malnutrition and the side effects of oncological treatment, becomes extremely important and relevant from a clinical and nutritional point of view [7].

Comprehensive nutritional assessment is one of the readily available resources applicable in cancer patients, making it possible to reduce the risk of nutritional changes resulting from disease and therapy. This evaluation includes clinical, physical, anthropometric, dietary, social, subjective, laboratorial, and functional capacity parameters. Two instruments are highly recommended by the National Oncology Nutrition Consensus in 2015, such as the Patient-Generated Subjective Global Assessment (PG-SGA) and the Hand Grip Strength (HGS) [7].

The PG-SGA is a validated and specific tool for the oncology population, simple and at a low cost. Studies in cancer patients have shown that the highest scores obtained from the PG-SGA correlate significantly with length of hospital stay, quality of life, and with the highest number of signs and symptoms that directly affect the nutritional status of these patients [8,9].

The HGS, measured through dynamometry, is an important technique that evaluates the functional capacity of the individual and complements the nutritional evaluation, associating with the malnutrition [10]. This method is considered as a simple, quick, non-invasive evaluation that detects functional changes in short periods of time before anthropometric and biochemical changes occur [7]. A study conducted with cancer patients showed that low HGS index at hospital admission was associated with a decrease of about three (3) times in the probability of hospital discharge [11]. In patients with advanced malignant neoplasia, patients

with low HGS values ( $\leq 10$  percentile) required referral to palliative care, and patients with HGS values around 25 percentile had greater potential for stability or strength improvement. In this group, improving muscle strength in general could be a possible way to reduce the risk of mortality [12]. The same study also compared HGS categories with the Eastern Cooperative Oncology Group's Performance Index (ECOG-PS), a scale that assesses the functional level of individuals according to their physical capacity, self-care, and ability to perform daily tasks. The results show that, on average, the group with HGS  $\leq 10$  presented worse functional performance according to ECOG-PS when compared to patients with good performance [12].

The data found in the literature demonstrates the importance of assessing nutritional status early, if possible, in the first 48 hours of hospital stay [7-12]. A complete nutritional assessment is one of the resources available and it is easy to apply, in order to collaborate in the elaboration of a nutritional conduct adequate to the patient's needs, which can minimize the damages caused by the disease and cancer treatment. Thus, the objectives of the present study are: (1) to assess nutritional status through the PG-SGA and functional capacity through (HGS) and ECOG; and (2) associate HGS and nutritional status according to PG-SGA in these patients.

## METHODS

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### Patients

A cross-sectional study was performed in adult patients of both genders, with any type of cancer, hospitalized at the *Hospital de Clínicas de Porto Alegre* (HCPA) from September 2016 to September 2017. Patients hospitalized at the Intensive Care Unit, Palliative Care Unit, Emergency Unit, and in postoperative recovery were excluded from the study. The Informed

Consent Form (ICF) was signed by all participants and by the researcher who carried out the evaluation. Data collection and assessment of nutritional status and functional capacity were carried out on a patient's bedside visit, within 48 hours after hospital admission.

### **Data collection, assessment of nutritional status and functional capacity**

Demographic and clinical data were collected through a pre-prepared clinical record and, when not fully answered by the patients, were searched in an electronic medical record. For the evaluation of nutritional status, a translated and validated version the PG-SGA was used [13]. The initial part of the form contains questions about recent changes in body weight, daily activities, food intake, and symptoms. Based on the final score, the patients were categorized as: A (well nourished), B (moderately malnourished or suspected of malnutrition), or C (severely malnourished) [13].

To evaluate the functional capacity, the HGS was used with Jamar® (Sammons Preston, Chicago, United States) hydraulic dynamometer. The patients were instructed to sit in a chair, both feet touching the floor, and with the test arm comfortably at 90° in the armrest. The non-dominant arm was in a neutral position beside the participant's body. Participants underwent a period of familiarization, which consisted of one to two attempts. The test was performed with the dominant hand and three maximum performances were measured, each with duration of 3 seconds of contraction and a rest interval of 1 minute between each test. The participant was instructed to initiate and stop the contractions; however, no other verbal encouragement was given. The highest value of the three tests was registered to the nearest 0.5kg and classified in percentiles [14]. The values were categorized into five HGS percentiles ( $\leq 20$ ; 20-40; 40-60; 60-80, and  $\geq 80$ ).

The performance index of the Eastern Cooperative Oncology Group (ECOG-PS) was also used to assess the functional capacity. Its rating scale ranks the individual in 5 levels: completely active (0), restriction to rigorous physical activities (1), able to perform all self-care (2), able to perform limited self-care (3), and completely unable to perform self-care (4) [15].

### **Statistical analysis**

The sample size was based on the study that evaluated the prevalence of malnutrition according to the PG-SGA. Thus, considering a 6% error, it was necessary to evaluate 74 patients hospitalized with cancer [16]. The software Computer Programs for Epidemiologists (Winpepi) 11.43 (Salt Lake City, Utah, United States) was used for the sample calculation.

Unpaired Student's *t*-test, chi-square test, ANOVA and Kruskal-Wallis U tests were used as appropriated. Correlations between the functional capacity assessment instruments were analyzed using the Spearman correlation coefficient. The Kappa coefficient was used to assess the agreement between the instruments of functional capacity, HGS and PS-ECOG. Data were confirmed by demonstration of the significant association among the nutritional status (PG-SGA) and HGS (dynamometry) categories in all patients by chi-square Monte Carlo simulation.

Data are presented as mean and standard deviation, median (P25–P75), or number (%) of patients with the characteristic under study.

The calculations were developed with the SPSS software 23.0 (Statistical Package for the Social Sciences, Chicago, Illinois, United States) and  $p < 0.05$  was adopted for statistical significance.

### **Ethical aspects**

The "*Methods of Evaluation of Nutritional Status in Hospitalized Oncology Patients*" was

a cross-sectional study, carried out at *Hospital de Clínicas de Porto Alegre*, approved by its Research Ethics Committee registration number 16.0226, and it is in accordance with Resolution 466/12 of the National Health Council and the Declaration of Helsinki. All procedures with the participants were performed only after their signing the ICF.

## RESULTS

This study included 76 individuals, with a mean age of  $56.0 \pm 17.0$  years, 35.5% of which were female. Patients were divided into two groups according to the type of tumors: Solid Tumors (ST) ( $n=48$ ) and Hematological Tumors (HT) ( $n=28$ ). The ST group was characterized by the presence of the following cancers: lung, breast, cervix, prostate, penis, testicular, digestive, hepatic, kidney, bladder, and sternocleidomastoid. The HT group was composed by the presence of acute myelogenous leukemia, acute lymphocytic leukemia, chronic lymphocytic leukemia, non-Hodgkin's lymphoma, Hodgkin's lymphoma, plasmablastic lymphoma, mantle cell lymphoma, Burkitt's lymphoma, and multiple myeloma. It was observed that patients <60 years old had the higher prevalence of HT when compared to ST patients (78.6% vs. 31.3%;  $p < 0.001$ ). In patients aged  $\geq 60$  years the prevalence of ST was higher than HT patients (68.7% vs. 22.4%;  $p < 0.001$ ). Regarding the gender, no significant differences were observed according to the type of tumor. The proportion of ethnicity and scholarship did not differ between groups. The smoking and the presence of malnutrition was more prevalent in ST patients than in HT patients. Regarding the type of cancer treatment, patients with ST underwent more surgery, whereas patients with HT presented more chemotherapy, as expected. There was no difference between groups in radiotherapy treatment.

Nutritional status and functional capacity according to tumor type are shown in Table 1. The nutritional status assessed by the

PG-SGA categories identified that 53.9% of the patients ( $n=41$ ), regardless of tumor type, was moderately malnourished (B) and severely malnourished (C). This difference was not significant between tumor types and nutritional status ( $p=0.285$ ). Furthermore, 47.9% of patients with ST and 32.2% of patients with HT presented a need for aggressive nutritional therapy, which was identified by the highest PG-SGA score ( $\geq 9$  points). Functional capacity was assessed by HGS and ECOG-PS (Table 1). The HGS was classified in quintiles and did not differ between the two groups of tumor types. However, in this rating, low functional capacity (percentile <40) was observed in 81.3% of the patients with ST and 75.0% of patients with HT. Also, according to the ECOG-PS instrument, 39.2% of individuals with ST and 42.9% of subjects with HT presented limitations in daily activities, identified by ECOG performance  $\geq 2$ . No significant differences were observed in this assessment between the groups according to the type of tumor.

In Table 2 we evaluated the association of nutritional status and functional capacity of all patients, regardless of tumor type. There was a significant association between the worst nutritional status (severely malnourished), assessed by PG-SGA with the lowest maximum HGS ( $24.0 \pm 10.4$ kg;  $p=0.015$ ) and the PS-ECOG [ $3.0(1.0-3.0)$ ;  $p=0.004$ ]. Results were confirmed in relation to the highest PG-SGA score and the worst nutritional status ( $18.0 \pm 4.7$  points;  $p=0.001$ ). In addition, the moderately (B) and severely malnourished (C) patients were below the 40 percentile and had ECOG  $\geq 2$ .

Association of HGS according to gender and age are describe in the Table 3. Female oncological patients had a lower HGS (maximum values and percentile) when compared to male patients ( $p < 0.001$ ). In addition, the proportion of HGS below the <40th percentile was higher in female than in male patients (100% vs. 67.3%,  $p < 0.001$ ). We did not observe differences between the values of HGS according to age <60 years old and  $\geq 60$  years old.

**Table 1.** Nutritional status and functional capacity of hospitalized adult patients according to tumor type. *Porto Alegre* (RS), Brazil, 2016-2017.

Nutritional status/Functional capacity	Solid Tumors (n=48)		Hematologic Tumors (n=28)		p-value
	n	%	n	%	
<i>PG-SGA (categories)<sup>1</sup></i>					
(A) Well-nourished	19	39.6	16	57.2	0.285*
(B) Moderately malnourished	19	39.6	9	32.1	
(C) Severely malnourished	10	10.8	3	10.7	
<i>PG-SGA (score)<sup>1</sup></i>					
0-1	3	6.3	2	7.1	0.433*
2-3	6	12.5	7	25.0	
4-8	16	33.3	10	35.7	
≥9	23	47.9	9	32.2	
<i>HGS (percentile)<sup>1</sup></i>					
≤20	14	29.2	10	35.7	0.548*
[20-40]	25	52.1	11	39.3	
[40-60]	7	14.6	7	25.0	
[60-80]	1	2.1	0	0.0	
≥80	1	2.1	0	0.0	
<i>PS- ECOG<sup>1</sup></i>					
0	16	33.3	7	25.0	0.580*
1	18	37.5	9	32.1	
2	6	12.5	7	25.0	
3	7	14.6	5	17.9	
4	1	2.1	0	0.0	

Note: \*Chi-square test for categorical variables. Statistical significance:  $p \leq 0.05$ . Values expressed as: <sup>1</sup>number and prevalence (%).

PG-SGA: Patient-Generated Subjective Global Assessment; HGS: Hand Grip Strength; PS-ECOG: Performance Index of the Eastern Cooperative Oncology Group.

**Table 2.** Association of nutritional status and functional capacity of 76 hospitalized adult oncology patients. *Porto Alegre* (RS), Brazil, 2016-2017.

Nutritional status/ Functional capacity	Well-Nourished (A) (n=35)	Moderately Malnourished (B) (n=28)	Severely Malnourished (C) (n=13)	p-value
PG-SGA (score) <sup>1</sup>	4.2 ± 2.7	11.5 ± 5.5	18.0 ± 4.7	<0.001*
Maximum HGS (Kg) <sup>1</sup>	34.2 ± 16.6	25.1 ± 10.3	24.0 ± 10.4	0.015*
Percentil <40 <sup>2</sup>	24 (40.0%)	24 (40.0%)	12 (20.0%)	0.109**
Percentil ≥40 <sup>2</sup>	11 (68.8%)	4 (25.0%)	1 (6.3%)	
PS-ECOG (index) <sup>3</sup>	1.0 (0.0-3.0)	1.0 (0.0-4.0)	3.0 (1.0-3.0)	0.004***
ECOG <2 <sup>2</sup>	27 (54.0%)	17 (34.0%)	6 (12.0%)	0.103**
ECOG ≥2 <sup>2</sup>	8 (30.8%)	11 (42.3%)	7 (26.9%)	

Note: \*ANOVA; \*\*Chi-square test; \*\*\*Kruskal-Wallis test. Statistical significance:  $p \leq 0.05$ . Values expressed as: <sup>1</sup>Mean and Standard Deviation. <sup>2</sup>Number and prevalence (%). <sup>3</sup>Median (P25–P75).

PG-SGA: Patient-Generated Subjective Global Assessment; HGS: Hand Grip Strength; PS-ECOG: Performance Index of the Eastern Cooperative Oncology Group.

**Table 3.** Association of Hand Grip Strength (HGS) according to gender and age in 76 hospitalized adult oncology patients. *Porto Alegre (RS), Brazil, 2016-2017.*

HGS	Gender						Age					
	Male (n=49)		Female (n=27)		p-value	<60y old (n=37)		≥60y old (n=39)		p-value		
	n	(%)	n	(%)		n	(%)	n	(%)			
Percentile												
≤20	8	16.3	16	59.3		15	40.5	9	23.1	0.183**		
20-40	25	51.0	11	0.7		13	35.1	23	59.0			
40-60	14	28.6	0	0.0	<0.001**	7	19.0	7	17.9			
60-80	1	2.0	0	0.0		1	2.7	0	0.0			
≥80	1	2.0	0	0.0		1	2.7	0	0.0			
	M	± SD	M	± SD		M	± SD	M	± SD			
Maximum (kg) <sup>1</sup>	35.4	± 11.1	18.7	± 4.9	<0.001*	30.0	± 14.7	29.1	± 9.1	0.807*		

Note: \*Student's t-test; \*\*Chi-square test for categorical variables. Statistical significance:  $p \leq 0.05$ . Values expressed as: <sup>1</sup>Mean and standard deviation; <sup>2</sup>Number and prevalence (%).

HGS: Hand Grip Strength; y: years.

Figure 1 demonstrates the correlation between the maximum HGS with PS-ECOG and PG-SGA in all patients and according to gender, regardless of the type of tumor. The maximum HGS was correlated positively with the higher functional capacity evaluated by PS-ECOG ( $r=0.136$ ,  $p=0.028$ ). When assessed according to gender, the correlation remained significant in males ( $r=0.243$ ,  $p=0.007$ ). The positive correlation also observed between HGS and PG-SGA in all oncological patients ( $r=0.112$ ;  $p=0.001$ ) and male patients ( $r=0.203$ ;  $p=0.001$ ). No correlation was found between functional capacity and nutritional status instruments in female patients.

The agreement between the HGS and PS-ECOG functional capacity instruments evaluated in this study were confirmed by concordance analysis, which identified a moderate and significant concordance (Kappa=0.427,  $p<0.001$ ).

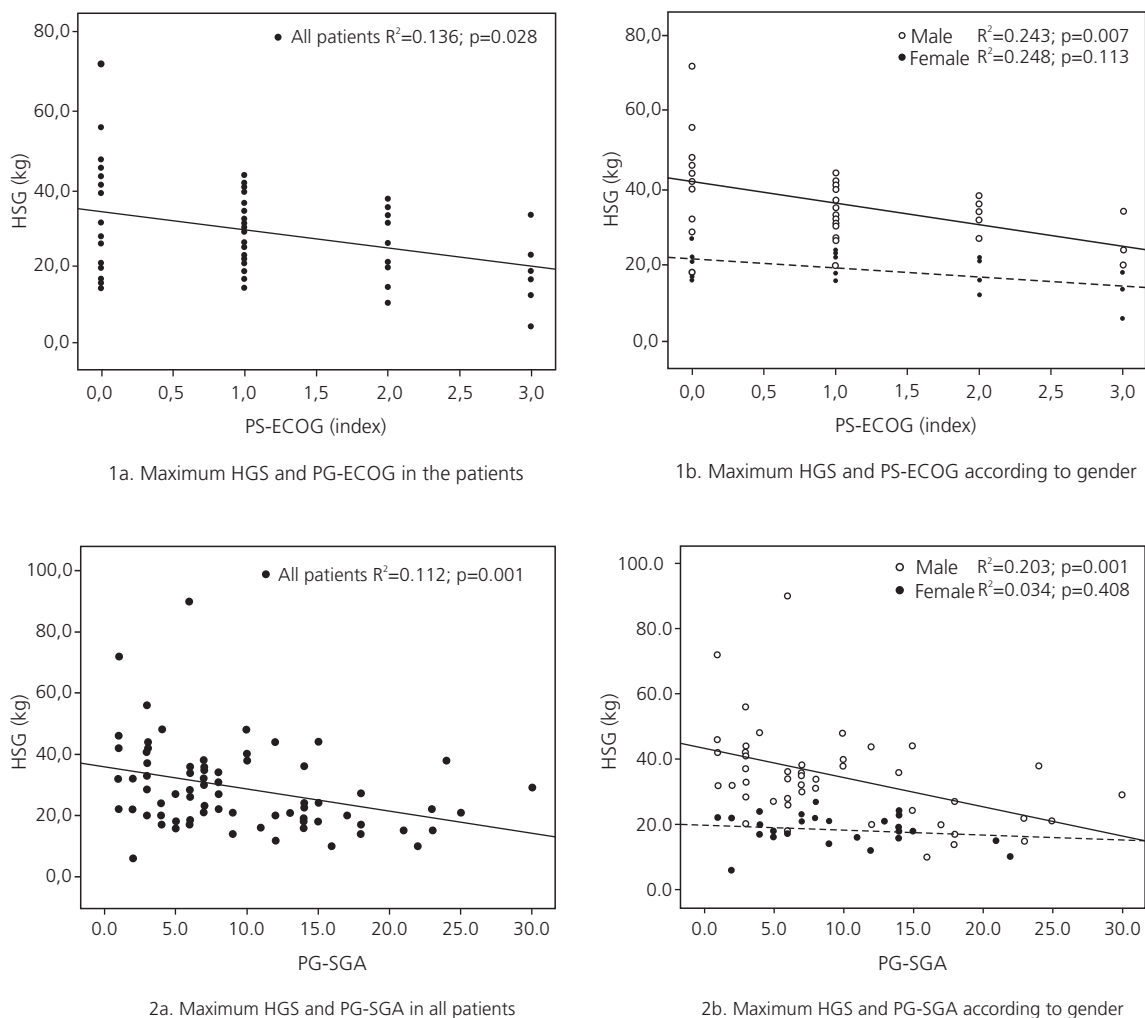
The association of HGS, measured by dynamometry, with nutritional status assessed by PG-SGA can be observed in Figure 2. Well-nourished patients (PG-SGA=A) presented HGS above the 60 percentile, considered a moderate HGS. Patients moderately and severely malnourished (PG-SGA B+C) scored percentile

<40, rated as a poor HGS. The third quintile [40-60] presented no differences in HGS among groups according to their nutritional status. Data were confirmed by demonstration of the significant association among the nutritional status (PG-SGA) and HGS (dynamometry) categories in all patients [chi-square by Monte Carlo simulation,  $p=0.028$ , 95% Confidence Interval =(0.024; 0.032)].

## DISCUSSION

Malnutrition has a high incidence in cancer patients [3] and is associated with higher morbidity and mortality [5,6]. Nutritional deficits have a direct impact on reducing the response to cancer treatment and the loss of functional capacity and the consequent inability to perform daily activities are factors related to the decrease in cancer patients' quality of life [10,12].

In our study, according to PG-SGA, a prevalence of 53.9% of malnutrition was observed, and most of these patients had a critical need for nutritional intervention, indicated by the score obtained in this evaluation ( $\geq 9$  points). These results are in agreement with previously described data, where the presence



**Figure 1.** Correlation between the Maximum Hand Grip Strength (HGS) with (1) Performance Index of the Eastern Cooperative Oncology Group (PS-ECOG) and (2) Patient-Generated Subjective Global Assessment (PG-SGA): in all patients (1a; 2a) and according to gender (1b; 2b), respectively.

Note:  $R^2$ =Spearman correlation. Statistical significance:  $p \leq 0.05$ .

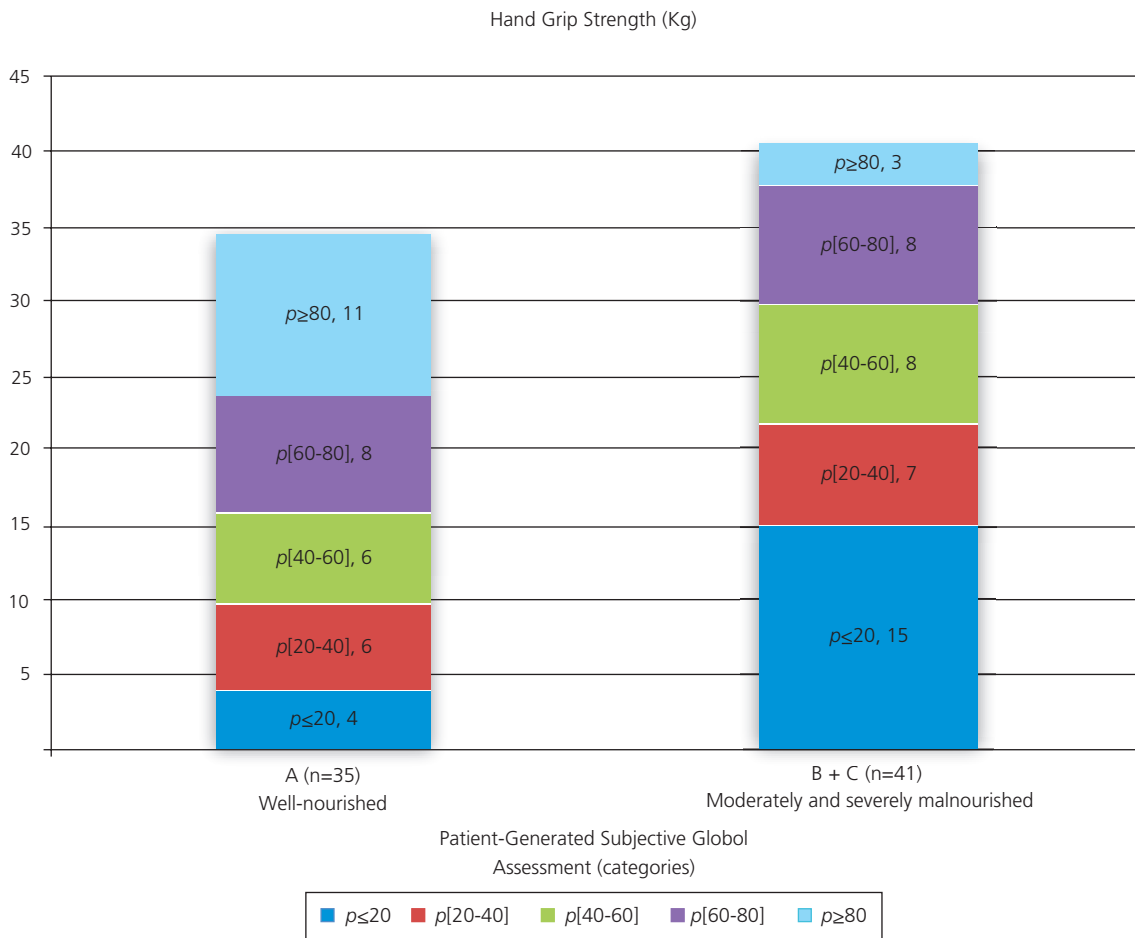
of malnutrition was observed in 66.3% of hospitalized but not oncological patients [5]. In 68 hospitalized cancer patients the prevalence of severe malnutrition was 7.4% and moderate malnutrition 83.8%, and only 8.8% of the patients were well nourished according to the PG-SGA [16]. Similar data were demonstrated in patients undergoing chemotherapy treatment, where 76.6% had some type of nutritional impairment and/or nutritional risk [17].

A study conducted by the Brazilian Oncology Nutrition Research, which evaluated

patients with cancer using PG-SGA, showed that approximately 45.6% of the patients required a specific nutritional intervention [18]. In our study we observed similar data. More than 50.0% of the evaluated patients presented the highest PG-SGA score ( $\geq 9$  points), indicating the immediate need for nutritional intervention, and when added to patients with a score of 4 to 8, the total percentage of nutritional intervention needs increased to 76.6%.

In the present study, 34.2% of all the patients had functional limitation (ECOG-PS  $\geq 2$ ).





**Figure 2.** Association of Hand Grip Strength (HGS), measured by dynamometry, and nutritional status, evaluated by the Patient-Generated Subjective Global Assessment (PG-SGA).

Note: Chi-square test by Monte Carlo.

We also observed that severely malnourished patients, evaluated by PG-SGA, presented worse functional capacity by HGS and ECOG-PS. In addition, the moderately and severely malnourished patients were below the 40 percentile and had ECOG  $\geq 2$ . A previous study in patients with advanced cancer also observed a low functional capacity evaluated by HGS and ECOG. Furthermore, an association between functional assessment instruments, HGS and ECOG-PS was demonstrated [12]. In our study, was observed a moderate and significant agreement between the functional capacity assessment tools (Kappa=0.427;  $p < 0.001$ ).

The HGS is an instrument for the assessment of functional capacity that may

complement the nutritional evaluation, since it may be associated with malnutrition [10,19]. Moreover, the importance of using HGS as an indicator of nutritional status in clinical practice is suggested by the American Society for Parenteral and Enteral Nutrition (ASPEN) in its recommendations for the diagnosis of malnutrition [20]. To date, there are no reference values for HGS in cancer patients. In healthy adults (age >20 years old) was demonstrated that the mean values of HGS were 42.8kg for males and 25.3kg for females [21]. In the elderly (>65 years old) the values considered of low functional capacity by HGS are <30kg for men and <20kg for women [22]. In our study the HGS values were 35.4kg and 18.7kg for male

and female patients, respectively. And, female patients presented a higher proportion of HGS below the <40 percentile compared to male patients (100% vs. 67.3%;  $p < 0.001$ ).

Associations between HGS and the PG-SGA evaluation instruments were demonstrated in hospitalized patients with no cancer [19]. In this sample of patients with cancer, we observed positive correlation between HGS with PG-SGA and the ECOG-PS. However, when assessed according to gender, the correlations remained significant only in males patients. On the other hand, data were confirmed by demonstration of the significant association among the nutritional status (PG-SGA) and HGS (dynamometry) categories in all patients ( $p = 0.028$ ).

The factors such as gender and age are the most studied and highly recommended in the evaluation of HGS [14,21,23-26]. In this study the data found suggest an association with the lower HGS in oncological female's patients. However, we did not observe significant differences between HGS and age, perhaps because in our sample most patients had <60 years old. More recently, a longitudinal cohort study in the elderly, without cancer, of both sexes, showed that the mean of the HGS declined progressively with age and, women presented lower values of HGS compared to the elderly men [27]. Additionally, scientific evidence demonstrates the existence of a multitude of parameters that influence HGS such as height, hand size, arm muscle circumference, thumb adductor muscle thickness, and body weight [23-26]. Thus, it is important to consider several variables in the evaluation of the association between HGS and malnutrition.

Limitations were verified in the present study in the application of nutritional assessment methods and in data collection through medical records. Regarding the application of PG-SGA, patients found difficulties in answering questions related to weight loss in the last months and previous dietary intake, which may interfere in the classification of nutritional status. It was

also not possible for all patients to answer to the first part of the assessment without help because some patients are illiterate or foreigners or have reduced visual acuity. Regarding data collection, biochemical tests such as albumin and C-reactive protein were not performed routinely in all patients, which resulted in loss of information. Moreover, further information for a more complete assessment such as the stage of cancer was also not available in the medical records of the patients evaluated in this study.

## CONCLUSION

In this study, we observed that 53.9% of the patients evaluated were moderately malnourished and/or severely malnourished. According to the PG-SGA, most of these patients needed aggressive nutritional therapy. A correlation was observed between the instruments of functional capacity, HGS, measured by dynamometry, ECOG performance index and PG-SGA score. Patients moderately and severely malnourished had a low functional capacity and lower HGS when compared to well-nourished patients. The highest score obtained by the PG-SGA showed it is a reliable method to identify the need for a specific nutritional intervention at an earlier stage and should be considered as a parameter for nutritional assessment. More, we believe that dynamometry is a useful instrument to evaluate nutritional and functional status and should be used in the oncological patients' evaluation along with other nutritional assessment instruments such as PG-SGA.

## CONTRIBUTORS

This paper was written by T STEEMBURGO and E BEHLING. Data were collected, organized and tabulated by N AVERBUCH and C BELIN. The statistical analysis was written by T STEEMBURGO. Data were analyzed by T STEEMBURGO and, reviewed by E BEHLING and T STEEMBURGO.

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