Association Between Nutritional Status and Manual Grip Strength in Oncologic Patients in Palliative Care

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Associação entre Estado Nutricional e Força de Preensão Manual em Pacientes Oncológicos em Cuidados Paliativos

Asociación entre Estado Nutricional y Fuerza de Asimiento Manual en Pacientes Oncológicos en Cuidados Paliativos

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Abstract

Introduction: Nutritional monitoring in palliative care is extremely important, since levels of mortality, malnutrition and unintentional weight loss occur in the majority of cancer patients. In this way, it is possible to prevent nutritional deficiencies and weight loss, which leads to a worsening nutritional status. **Objective**: The aim of the study was to evaluate the association between the classification of nutritional status obtained by the patient-generated subjective global assessment (PG-SGA), handgrip strength (HGS) and adductor pollicis muscle (APM) in cancer patients palliative. **Method:** We evaluated 70 cancer patients enrolled in the exclusive palliative care program. The PG-SGA was used to assess the nutritional status. To evaluate the association of nutritional status with other predictive measures, HGS measurements were performed with a dynamometer and APM with an adipometer. Descriptive statistics and linear regression analysis were used to evaluate the ability of these measures to predict nutritional status. **Results**: Of the 70 patients, aged between 31 and 101 years, in which 58.6% were male and malnutrition (B+C) was found in 87.2% (n=61) according to PG-SGA. The value of APM was altered in 72.9% (n=51) patients and 42.9% (n=30) in HGS. HGS was associated with PG-SGA (b=-0.273, p=0.04) and APM didn't (b=-0,124; p=0.546); therefore, only HGS was a good predictor of nutritional status in this study. **Conclusion:** It's suggested the use of HGS to evaluate nutritional status in palliative cancer patients.

Key words: Palliative Care; Neoplasms; Nutritional Status; Malnutrition; Muscle Strength.

Resumo

Introdução: O acompanhamento nutricional nos cuidados paliativos é de extrema importância, já que os níveis de mortalidade, desnutrição e perda de peso não intencional ocorre na maioria dos pacientes oncológicos. Dessa maneira, é possível prevenir carências nutricionais e perdas de peso, o que leva a uma piora do estado nutricional. **Objetivo:** O objetivo do estudo foi avaliar a associação entre a classificação do estado nutricional obtido pela avaliação subjetiva global produzida pelo próprio paciente (ASG-PPP), a força de preensão manual (FPM) e a espessura do músculo adutor do polegar (EMAP) em pacientes oncológicos em cuidados paliativos exclusivos. **Método:** Foram avaliados 70 pacientes oncológicos cadastrados no Programa de Cuidados Paliativos. Para a avaliação do estado nutricional, foi utilizada a ASG-PPP. Para avaliar a associação do estado nutricional com outras medidas preditoras, foram realizadas as medidas da FPM com um dinamômetro e a EMAP com um adipômetro. Foram utilizadas estatísticas descritivas e a análise de regressão linear para avaliar a capacidade dessas medidas de predizer o estado nutricional. **Resultados:** Dos 70 pacientes, com idade entre 31 e 101 anos, 58,6% eram do sexo masculino e foi encontrada frequência de desnutrição (B+C) em 87,2% (n=61) de acordo com a ASG-PPP. O valor da EMAP estava alterado em 72,9% (n=51) pacientes e 42,9% (n=30) na FPM. A FPM foi associada ao ASG-PPP (β=-0,273; p=0,04) e o EMAP não (β=-0,124; p=0,546); portanto, somente o FPM foi um bom preditor do estado nutricional neste estudo. **Conclusão:** Sugere-se a utilização da FPM para avaliação do estado nutricional em pacientes oncológicos paliativos.

Palavras-chave: Cuidados Paliativos; Neoplasias; Estado Nutricional; Desnutrição; Força Muscular.

Resumen

Introducción: El seguimiento nutricional en los cuidados paliativos es de extrema importancia, ya que los niveles de mortalidad, desnutrición y pérdida de peso no intencional ocurre en la mayoría de los pacientes oncológicos. De esta manera, es posible prevenir carencias nutricionales y pérdidas de peso, lo que lleva a un empeoramiento del estado nutricional. **Objetivo**: El objetivo del estudio fue evaluar la asociación entre la clasificación del estado nutricional obtenido por la valoración subjetiva global generada por el Paciente (GP-VSG), la fuerza de asimiento manual (FAM) y el espesor del músculo aductor del pollicis (EMAP) en pacientes oncológicos paliativos exclusivos. **Método:** Se evaluaron 70 pacientes oncológicos registrados en el Programa de Cuidados Paliativos. Para la evaluación del estado nutricional se utilizó la GP-VSG.Para evaluar la asociación del estado nutricional con otras medidas preditoras, se realizaron las medidas de la FAM con un dinamómetro y EMAP con un adipómetro. Se utilizaron estadísticas descriptivas y análisis de regresión lineal para evaluar la capacidad de esas medidas de predecir el estado nutricional. **Resultados:** De los 70 pacientes, con edad entre 31 y 101 años, en que 58,6% eran del sexo masculino y se encontró frecuencia de desnutrición (B+C) en el 87,2% (n=61) de acuerdo con la GP-VSG. El valor del EMAP estaba alterada en el 72,9% (n=51) pacientes y el 42,9% (n=30) en la FAM. La FAM fue asociada al GP-VSG (b=-0,273, p=0,04) y el EMAP no (b=-0,124, p=0,546), por lo tanto, sólo el FAM fue un buen predictor del estado nutricional en este estudio. **Conclusión:** Se sugiere la utilización de la FAM para evaluación del estado nutricional en pacientes oncológicos paliativos.

Palabras clave: Cuidados Paliativos; Neoplasias; Estado Nutricional; Desnutrición; Fuerza Muscular.

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INTRODUCTION

When a patient starts palliative care is because cancer reached a phase where healing-driven therapies have no long the expected outcome, increasing the levels of mortality. The purpose of this line of care is to improve the life condition of this patient[1].

Nutritional support in palliative care has the objective of preventing the nutritional deficiency, ensure the patient keeps the nutritional status to avoid weight and anthropometric measures loss, favor the symptom modulation and side effects because of the treatment, provide the patient the pleasure of nourishing itself and reduce the levels of mortality because of the disease[2].

It is recommended the use of patient generated global subjective assessment to follow up the nutritional status for patients with cancer in palliative care (PG-GSA)[3]; but one of the challenges during the evaluation of the patient's nutritional status is that the methods, when used in separate and isolated, produce an inadequate assessment [4]. When different parameters are combined to assess the nutritional status of the patient, the screening of oncologic patients may possibly be optimized, making it more sensitive to detect malnutrition[5].

It is remarkable that the loss of lean mass leads to the loss of functional capacity; the assessment through the dynamometer is the most recommended practice to perform this mensuration for early detection of the nutritional deficit [6].

Therefore, the manual grip strength (MGS) is useful to determine during the nutritional assessment whether malnutrition exists because it affects directly the muscles[7] with reduction of the muscular strength of the patient[8].

Another parameter to assess the muscular loss and consequently evaluate the nutritional status of these patients is the adductor pollicis muscle thickness (APMT)[9]. The use of the adductor thumb muscle is indicated because its anatomy is quite accurate since it is located between two bones. Furthermore, it is a non-invasive technique of fast mensuration and low cost. When the malnutrition process onsets, the adductor pollicis muscle presents a very important atrophy; it can be used, therefore, to evaluate the nutritional status and the clinical evolution of the patients [10].

Consequently, it is clear how an oncologic patient may have its nutritional status damaged and to what extent this can produce a poor prognosis. In the other hand, it is essential to have a fast screening and an effective evaluation of the nutritional status of these patients [11].

Although the literature shows too many data about the malnutrition of patients hospitalized and in several clinical conditions, still are rare the studies with palliative patients, including the evaluation of MGS and APMT. Based in the aforementioned, the goal of the study was to evaluate the association between the classification of the nutritional status obtained by patient guided global subjective evaluation (PG-GSA), the manual grip strength (MGS) and the adductor pollicis muscle thickness (APMT) in oncologic patients in exclusive palliative care.

METHOD

It is a cross-sectional study from July to November 2016 with oncologic patients registered at the Palliative Care Program (PCP) of "Hospital do Câncer de Uberlândia". The Institutional Review Board of "Universidade Federal de Uberlândia" reviewed and approved the clinical trial number CAAE 54864316.8.0000.5152. It complied with the norms of the Health National Council contained in resolutions number 466/12 and 251/97. The patients enrolled in PCP were invited to participate, its object was informed and they were asked to sign an Informed Consent Form.

The population consisted of 92 patients, which is the total of patients enrolled in PCP, whose inclusion criteria were: more than 18 years old, both genders and enrolled at PCP. Exclusion criteria were: low level of consciousness, mental delusion, Alzheimer Disease reported in the chart and less than 18 years old. Of the total population, it were excluded 22 patients in total (23.9%) according to the criteria selected. At the end of the study, there were 70 patients.

It were collected several social-economics and clinical variables (time of register at PCP, year of the diagnosis, site of the primary tumor and former treatments through a form previously structured). If the patient was unable to report the disease-related information, these were drawn from the charts.

It was used the PG-GSA in the version translated into Portuguese and validated by Gonzalez et al.[12] to assess the nutritional status. Upon filling out the form, the nutritional status of the patient was classified in three categories: A (well nourished); B (moderately malnourished or suspected malnourishment); or C (severely malnourished)[12].

This tool considers the involuntary weight change, symptoms of the gastrointestinal tract, physical exam, metabolic stress and aspects of the treatment, being recommended during the nutritional support in oncology for early detection of the nutritional risk or of the malnourishment [12].

It was conducted an anthropometric evaluation to verify the association of the nutritional status with other

predictive measures through weight, triceps skinfold (TS), APMT and MGS. Further, it was calculated the body mass index (BMI) /kg/m². The electronic scale Tanita® - *Tanita Body Fat Monitor Scale* (Model TBF 531®, *Tanita Corporation of America, Illinois*) was used for weight measurement. The height was considered as reported by the patient or its care provider. For BMI classification, it were utilized the cut-off defined for the classification of the nutritional status proposed for adults[13] (≥18 and ≤ 60 years) and for elders[14] (≥60 years). The classification of TS followed Frisancho[15] criteria.

To collect APMT, it was used the Sanny® adipometer; it was repeated three times and it was considered the final mean. The values of APMT were classified according to Bragagnolo et al.[16]: thickness ≤13,4 mm "altered" and >13,4 mm "unaltered".

For MGS, it was used hydraulic dynamometer Jamar®. The patient remained seated comfortably, with their feet landing on the floor, and at 90º flexion in both hips and knees. The shoulder of the dominant hand was adduced and in neutral rotation, elbows at 90º, forearm in neutral position and wrist between 0 and 30º extension and from 0 and 15º of adduction. The dominant hand lays in repose at the side of the thigh in the same side [17]. The MGS values of the patients were extremely lower than the values of the study of Bohannon et al.[18]. As this a population-based study, it was used the median for classification, considering for men, the strength ≤14 kgf "altered and >14 kgf "unaltered"; and for women, ≤2 kgf "altered" and >2 kgf "unaltered".

The data were processed with double typing and consistency check through the *software* EpiInfo 3.5.4®. It was used the statistic package *Software Package Statistical System 12.0 for Windows* version 17.0 (SPSS) for the analyzes. Initially, it was tested the distribution of variables in normal and non-normal analyzed by the test Kolmogorov-Smirnov. The descriptive analysis was made through mean ± standard-deviation or median (minimum-maximum) for quantitative variables and by the proportion for qualitative variables and the analysis of statistical significance, through the analysis of variance Anova for quantitative analyses and chi-square test.

It was done the analysis of linear regression to evaluate the predictive capacity of APMT and MGS for nutritional status (score of PG-GSA) as variable endpoint (dependent). It were considered as confounding values, the socio-demographic variables (age, gender) family income and BMI. For all the analyzes it as considered statistical significance when p≤0.05 and confidence interval (CI) of 95%.

RESULTS

The study had the participation of 70 oncologic patients in exclusive palliative care, older than 18 years; of these, 58.6% (n=41) were males and 41.4% (n=29), females, 30% (n=21) were classified as adults and 70% (n=49) elders (≥60 years – data not shown). For 68.2% (n = 45), their registration time at PCP was less than six months. The social-economic characteristics and clinics are presented in Table 1.

It were identified 20 different locations of primary tumors, the majority affecting areas of head and neck, totaling 24.3% (n=17), followed by gynecologic 21.4% (n=15). The majority of the patients, 49.3% (n = 34) have been diagnosed for more than 2 years. Among the treatments done, the larger frequency was for radiotherapy with 72.9% (n = 51), followed by chemotherapy, 65.7% (n = 46) and, lastly, surgical treatment with 55.7% (n = 39) (Table 1).

According to PG-GSA, 12.9% (n=9) were classified as well nourished, 62.9% (n = 44), moderately malnourished and 24.3% (n=17) were severely malnourished. Considering BMI, 14.7% (n = 10) were overweighed, 25% (n = 17), eutrophic and 60.3% (n = 41) were malnourished. According to APMT, 72.9% (n=51) were malnourished and 27.1% (n = 19), nourished (Table 2).

Pursuant to MGS classification, 57.1% (n=40) were nourished and 42.9% (n=30) were nourished and finally, according to DCT, 5.7% (n=4) had excess of fat, 57.1% (n=40) were eutrophic, 11.4% (n=8) were at risk of malnourishment and 25.7% (n=18) malnourished. Male patients presented the larger prevalence of malnutrition for almost all the indicators of nutritional status (Table 2).

Under APMT classification of nutritional status, it is observed that 89.5% (n=17) of the malnourished were in the age range of 66 to 75 years. According to MGS, the age range of the majority of malnourished were older than 76 years, representing 60.0% (n=12) of the sample. Still per the classification of the nutritional status of MGS, the patients who underwent chemotherapy treatment presented a significant difference in comparison to other treatments; however, because of the ample variation among the types of cancers, there is a relevant variability of the doses of chemotherapy, which could be a confounding factor for the analyzes (Table 3).

The APMT was not associated to PG-GSA, (r^2=0.080; b=-0.124; p=0,.546; IC=95% [-0.531 – 0.284]), which showed prediction of 8% in relation to the score of PG-GSA. But the MGS was associated to the score of PG-GSA (r^2=0.141; b=-0.273; p=0.04; IC=95% [-0.459 - 0.063]), while MGS explained 14.1% of the variances of the score of PG-GSA, even after adjustment per age, gender, family income and BMI (Table 4).

Table 1. Social-economic and clinic characteristics of oncologic patients in palliative care

Variables	Total % (n=70)	Gender		Value of p*
		Female (41.4%. n=29)	Male (586%. n=41)	
Age range (years)				0.437
<55	22.9 (16)	56.2 (9)	43.8 (7)	
56-65	21.4 (15)	46.7 (7)	53.3 (8)	
66-75	27.1 (19)	31.6 (6)	68.4 (13)	
>76	28.6 (20)	35.0 (7)	65.0 (13)	
Family income (minimum wage)**				0.967
<1	3.1 (2)	50.0 (1)	50.0 (1)	
1-3	55.4 (36)	41.7 (15)	58.3 (21)	
>3	41.5 (27)	40.7 (11)	59.3 (16)	
Time of register at of Palliative Care Program (months)				0.440
<6	68.2 (45)	42.4 (17)	57.6 (28)	
6-12	10.6 (7)	42.9 (3)	57.1 (4)	
>12	21.2 (14)	57.1 (8)	42.9 (6)	
Time of diagnosis				0.959
1-6 months	18.8 (13)	46.2 (6)	53.8 (7)	
7-11 months	8.7 (6)	33.3 (2)	66.7 (4)	
1-2 years	23.2 (16)	43.8 (7)	56.2 (9)	
>2 years	49.3 (34)	41.2 (14)	58.8 (20)	
Location of the tumor				0.005
Head and neck	24.3 (17)	17.3 (5)	22.0 (9)	
Ginecologic	21.4 (15)	51.7 (15)	0 (0)	
Prostate	8.6 (6)	0 (0)	14.7 (6)	
Lung	12.8 (9)	13.7 (4)	12.1 (5)	
Others***	32.9 (23)	17.3 (5)	51.2 (21)	
Treatment				
Radiotherapy				0.117
Yes	72.9 (51)	47.1 (24)	52.9 (27)	
No	27.1 (19)	26.3 (5)	73.7 (14)	
Chemotherapy				0.132
Yes	65.7 (46)	47.8 (22)	52.2 (24)	
No	34.3 (24)	29.2 (7)	70.8 (17)	
Surgery				0.132
Yes	55.7 (39)	46.2 (18)	53.8 (21)	
No	44.3 (31)	35.5 (11)	64.5 (20)	

Captions: *Chi-square test; **Minimum wage in 2016 R$ 880,00; ***Other tumor location (Liver, esophageal, colon, bladder, adrenal glands and others)

DISCUSSION

In the present study, it was possible to observe that the frequency of malnutrition was significant for several markers evaluated; it was found a frequency of 87.2% (n=61) according to PG-GSA; 72.9% (n=51) according to APMT and 42.9% (n=30) according to MGS. PG-GSA is a tool with high specificity and sensitiveness for oncologic patients to detect specific signs and symptoms of the disease and considers the involuntary weight alteration, symptoms of the gastrointestinal tract, physical exam and aspects of the treatment as verified by Santos et al.[19].

MGS, in our study, showed to be a tool with predictive ability of the nutritional status of this population, but APMT showed the opposite. The use of MGS explained 14.1% of the variances of the final score obtained in PG-GSA, while APMT explained 8%.

The malnutrition of these patients is the result of a combination of several factors that influence the nutritional status as the therapy of choice and the progress of the growth of tumoral cells. Therefore, it is important to combine a nutritional intervention with the oncologic treatment to improve the nutritional status and the quality of the patients life[20].

Table 2. Anthropometric characteristics and nutritional status of oncologic patients in palliative care

Variables	Total % (n=70)	Gender		Value of p*
		Female (41.4%. n=29)	Male (58.6%. n=41)	
Body Mass Index (kg/m²)				0.116
Overweight	14.7 (10)	30.0 (3)	70.0 (7)	
Eutrophy	25 (17)	29.4 (5)	70.6 (12)	
Malnourishment	60.3 (41)	41.5 (17)	58.5 (24)	
Patient guided global subjective assessment				0.490
Well nourished	12.8 (9)	44.4 (4)	55.5 (5)	
Malnourished	62.9 (44)	36.4 (16)	63.6 (28)	
Severe malnutrition	24.3 (17)	52.9 (9)	47.1 (8)	
Thickness of adductor pollicis muscle (mm)				0.634
Unaltered	27.1 (19)	36.8 (7)	63.2 (12)	
Altered	72.9 (51)	43.1 (22)	56.9 (29)	
Manual Grip Strength (kgf)				0.484
Unaltered	57.1 (40)	45.0 (18)	55.0 (22)	
Altered	42.9 (30)	36.7 (11)	63.3 (19)	
Triceps Skinfold (mm)				0.971
Overweight	5.7 (4)	50.0 (2)	50.0 (2)	
Eutrophy	57.2 (40)	42.5 (17)	57.5 (23)	
Risk of malnourishment	11.4 (8)	37.5 (3)	62.5 (5)	
Malnourishment	25.7 (18)	38.9 (7)	61.1 (11)	

Caption: *Chi-square test.

MGS, in addition to contributing to evaluate the nutritional status, is interesting to evaluate the functional capacity, being a good parameter to verify the prognosis of the patient. Because the treatment is aggressive and invasive, as much autonomy the patient has and succeeds in maintaining its daily chores, better are the odds of keeping the nutritional status of these patients[21].

In a study performed by Kilgour et al.[22], with 203 oncologic patients in advanced stage, the authors concluded that more than 70% of the patients presented MGS below the percentile 50 and about 27% below the percentile MGS10. The group of patients with MGS lower than percentile 10, presented relevantly low lean mass and fat mass in comparison with other groups. They observed as well that the result of MGS can help the implementation of measures to recover the nutritional status of the patient, since MGS was an independent predictor for survival.

Pursuant to a study by Queiroz et al.[23] with 210 patients with advanced cancer in palliative care, more than 20% of the patients were dynapenic (low muscle mass – MGS < percentile 10), more than 15% had muscle atrophy (low muscle mass – adjustment of the arm muscle circumference - AMC < 90%) and 32.4% of the patients were sarcopenic. Still, it was possible to analyze that the anthropometric variables were significantly lower in the individuals with sarcopenia; besides, the presence of sarcopenia is associated to a major score obtained in PG-GSA.

Another study with 60 oncologic patients in surgery treatment due to lung cancer found a significant association (p=0.01) between the reduction of MGS and malnutrition of the patients, with results lower than the group of eutrophic patients [24].

A study with 203 patients with advanced cancer showed that the low MGS was associated to major losses of lean and fat mass, jointly with bigger incidence of sarcopenia and less isokinetic strength of the quadriceps, according to Wallengren et al.[25]. The outcomes encountered resulted from associations to non-intentional weight loss.

In this evaluation, according to APMT, it was noticed that in 72.9% (n = 51) of the patients, malnutrition was detected. Because there are few studies conducted with the same population, it was not possible to compare the incidence of malnutrition with APMT on palliative oncologic patients. But, on the other hand, APMT is fairly studied as a parameter for diagnosis of the nutritional status of patients submitted to surgery according to a study conducted by Valente et al.[26], where in a sample of 150 patients eligible for surgery, 40% (n = 60) were diagnosed by APMT as malnourished.

As earlier reported, few are the studies that used either APMT or MGS and PG-GSA to evaluate the nutritional status of palliative oncologic patients, which hampered a better comparison of the results with the findings of the literature. The objective was to investigate whether similar results would be encountered in other studies with palliative oncologic patients.

Table 3. Anthropometric and nutritional characteristics of oncologic patients in palliative care according to APMT and MGS

Variables	APMT (mm)**			MGS (kgf)***		
	Unaltered (27.1%. n=19)	Altered (72.9%. n=51)	Values of p*	Unaltered (57.1%. n=40)	Altered (42.9%. n=30)	Values of p*
Age range (years)			0.295			0.169
<55	31.2 (5)	68.8 (11)		68.8 (11)	31.2 (5)	
56-65	33.3 (5)	66.7 (10)		73.3 (11)	26.7 (4)	
66-75	10.5 (2)	89.5 (17)		52.6 (10)	47.4 (9)	
>76	35.0 (7)	65.0 (13)		40.0 (8)	60.0 (12)	
Time of diagnosis			0.697			0.174
1-6 months	30.8 (4)	69.2 (9)		30.8 (4)	69.2 (9)	
7-11 months	16.7 (1)	83.3 (5)		50.0 (3)	50.0 (3)	
1-2 years	18.8 (3)	81.2 (13)		68.8 (11)	31.2 (5)	
>2 years	32.4 (11)	67.6 (23)		61.8 (21)	38.2 (13)	
Location of the tumor		0.630			0.795	0,795
Head and neck	35.3 (6)	64.7 (11)		47 (8)	53 (9)	
Gynecologic	13.3 (2)	86.7 (13)		73.3 (11)	26.7 (4)	
Prostate	33.3 (2)	66.7 (4)		50.0 (3)	50.0 (3)	
Lung	22.2 (2)	77.8 (7)		55.5 (5)	44.5 (4)	
Others****	30.5 (7)	69.5 (16)		56.5 (13)	43.5 (10)	
Treatment applied						
Radiotherapy			0.484			0.313
Yes	29.4 (15)	70.6 (36)		60.8 (31)	39.2 (20)	
No	21.1 (4)	78.9 (15)		47.4 (9)	52.6 (10)	
Chemotherapy			0.783			0.016
Yes	26.1 (12)	73.9 (34)		67.4 (31)	32.6 (15)	
No	29.2 (7)	70.8 (17)		37.5 (9)	62.5 (15)	
Surgery			0.823			0.728
Yes	28.2 (11)	71.8 (28)		59.0 (23)	41.0 (16)	
No	25.8 (8)	74.2 (23)		54.8 (17)	45.2 (14)	
PG-GSA***			0.211			0.536
Well nourished (A)	44.4 (4)	55.6 (5)		66.7 (6)	33.3 (3)	
Malnourished and severely malnourished (B+C)	24.6 (15)	75,4 (46)		55,7 (34)	44,3 (27)	

Captions: *Chi-square test; **Thickness of the adductor pollicis muscle; ***Manual grip strength; ****Other locations of the tumor (liver, esophageal, colon, bladder, adrenal glands and others); *****Patient guided subjective global evaluation.
Note: The *n* varies according to the availability of the data.

Table 4. Linear Regression of MGS APMT in the association with the score of PG-GSA***

Variable	R^2 Adjusted**	Beta	Confidence Interval		Value of p*
			Inferior	Superior	
Thickenss of the thumb adduction muscle (mm)					
Non-adjusted model	0.030	-0.234	-0.558	0.090	0.154
Adjusted model **	0.080	-0.124	-0.531	0.284	0.546
Manual grip strength (kgf)					
Non-adjusted model	0.092	-0.261	-0.459	-0.063	0.011
Adjusted model **	0.141	-0.273	-0.533	-0.013	0.04

Captions: *Level of significance p<0.05; **Adjusted per age, gender, family income, BMI***Depending variable

According to the linear regression, when the value of APMT was associated to the final score of PG-GSA, it was not found a significant association in the non-adjusted and adjusted models by gender, age, and family income and BMI. No other study was encountered that had performed the same analysis in oncologic patients in palliative care.

Nonetheless, a study conducted by Valente et al.[26] with 110 patients submitted to surgery, where the eligibility for surgery was of 33.6 % (n = 37) because of neoplasms, it was concluded that APMT is an efficient method to detect malnutrition. Therefore, APMT appears to be a good predictor for some groups of patients. But for oncologic palliative care, it would be necessary more studies with a larger sample.

However, when MGS is related with the final PG-GSA score, it is encountered a significant and negative association, even when adjusted by gender, age, family income and BMI. The results concur with a study by Flood et al.[27] that noted that MGS can predict independently the nutritional status and the change of the nutritional status defined by the score and PG-GSA in an heterogeneous group of patients hospitalized. The study concluded also that the use of MGS can provide quick information related to the nutritional status in a non-subjective and non-invasive manner.

As reported by Bauer et al.[28], it can be more advantageous to use MGS to monitor the nutritional status of the patients than PG-GSA, because the current weight of the patient needs to be known. Therefore, the nutritionist will be able to evaluate the nutritional status of the patient even without the weight and conduct an accurate evaluation to start the nutritional therapy when needed.

It was observed in the study that, pursuant to PG-GSA, the majority of the patients in palliative care was classified as malnourished per the indicators utilized, which is expected in nutritional care for patients with advanced stage cancer. The study conducted by Marin Caro et al.[29] reached similar results, where around 81% of the patients were malnourished. In another study by Kwang, Kandiah[30], approximately 70% of the population were malnourished. The participants of both studies were palliative oncologic patients.

According to the "*Consenso Nacional de Nutrição Oncológica*[3]" (National Consensus of Oncologic Nutrition), during the nutritional evaluation of patients in palliative care, it should be avoided any method that may cause physical or psychological stress. As dynamometry is a non-invasive method and it is referenced for evaluation of the oncologic patient – combined with NRS-2002 (evaluation of the nutritional risk), ASG or PG-GSA in adult patient in clinical treatment (chemotherapy and radiotherapy), the current study suggests the expansion of its use to predict malnutrition in patients in palliative care.

Some limitations need to be taken into account, as the reverse causality of the cross-section design where it is not possible to determine the cause-effect relation of the results observed and because a large portion of the sample has less than six months in PCP. Furthermore, regardless of obtaining the total population of the patients registered for palliative care, caution is necessary when data are extrapolated to other populations in the same context, considering there are no standard reference of anthropometric parameters and specific MGS for individuals with advanced cancer in palliative care.

CONCLUSION

It is suggested the use of MGS as practical method, of low cost and non-invasive to predict the nutritional status in oncologic patients, being a major advantage, specifically for countries in development.

CONTRIBUTIONS

Eliza Helena Eliete da Silva contributed to data collection, preparation of the database, critical revision and approval of the final version. Florença Maria Borges contributed to data collection and preparation of the database. Franciele Carolina Soares da Cruz contributed to the study design, data collection and analysis. Geórgia das Graças Pena contributed to the study design, data analysis, critical revision and approval of the final version.

DECLARATION OF CONFLICT OF INTERESTS

Nothing to declare.

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