Thumb Adductor Muscle Thickness in the Diagnosis of Malnutrition in Cancer Patients

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Espessura do Músculo Adutor do Polegar no Diagnóstico de Desnutrição em Pacientes Oncológicos

Espesor del Músculo Aductor del Pulgar en el Diagnóstico de Desnutrición en Pacientes con Cáncer

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ABSTRACT

Introduction: Cancer patients are at high risk of malnutrition due to the metabolic disorders of the disease and the required treatments. The adductor pollicis muscle thickness (APMT) evaluates the muscular compartment and can be useful to detect early malnutrition. **Objective:** To verify the frequency of malnutrition in cancer patients according to APMT and correlate with the body mass index (BMI), mid arm circumference (MAC) and patient generated subjective global assessment (PG-SGA). **Method:** Cross-sectional study, with individuals aged 20 years or older, admitted for chemotherapy treatment, in a hospital in Vale do Taquari-RS. Anthropometric data were collected: weight, height, MAC and APMT during nutritional screening. PG-SGA was applied to assess nutritional status. Data were analyzed using SPSS software version 26.0 and the variables were related using Pearson's Chi-square test and correlated by Spearman's test. **Results:** 41 patients were evaluated. Of these, 68.3% were classified with some degree of reduction by APMT. The PG-SGA classified 78% in nutritional risk/moderate malnutrition and severe malnutrition. There was a significant correlation between APMT and PG-SGA. An inverse correlation was observed between APMT and BMI. APMT had a significant association with BMI, MAC and PG-SGA. **Conclusion:** APMT is an effective method utilized to diagnose malnutrition and can be associated with other assessment methods for the nutritional diagnosis of cancer patients.

Key words: nutritional assessment; malnutrition/diagnosis; neoplasms/complications; cross-sectional studies.

RESUMO

Introdução: Pacientes oncológicos apresentam alto risco de desnutrição, em razão das desordens metabólicas da doença e de tratamentos necessários. A espessura do músculo adutor do polegar (EMAP) avalia o compartimento muscular, podendo ser útil para detectar a desnutrição precoce. **Objetivo:** Verificar a frequência de desnutrição em pacientes oncológicos conforme a EMAP e correlacionar com o índice de massa corporal (IMC), circunferência do braço (CB) e avaliação subjetiva global produzida pelo próprio paciente (ASG-PPP). **Método:** Estudo transversal, com indivíduos com idade maior ou igual a 20 anos, internados para administração de quimioterapia, em um hospital do Vale do Taquari-RS. Foram coletados dados antropométricos: peso, altura, CB e EMAP durante a triagem nutricional. A ASG-PPP foi aplicada para avaliação do estado nutricional. Os dados foram analisados por meio do *software* SPSS versão 26.0, e as variáveis relacionadas por meio do teste qui-quadrado de Pearson e correlacionadas pelo teste de Spearman. **Resultados:** Foram avaliados 41 pacientes. Destes, 68,3% foram classificados com algum grau de redução pela EMAP. A ASG-PPP classificou 78% em risco nutricional/desnutrição moderada e desnutrição grave. Houve correlação significativa entre a EMAP e a ASG-PPP. Foi observada correlação inversa entre a EMAP e o IMC. A EMAP teve associação significativa com o IMC, a CB e a ASG-PPP. **Conclusão:** A EMAP é um método eficaz, utilizado para diagnosticar desnutrição, podendo ser associado a outros métodos de avaliação para o diagnóstico nutricional de pacientes oncológicos.

Palavras-chave: avaliação nutricional; desnutrição/diagnóstico; neoplasias/complicações; estudos transversais.

RESUMEN

Introducción: Los pacientes con cáncer tienen un alto riesgo de desnutrición, debido a los trastornos metabólicos de la enfermedad y los tratamientos necesarios. El grosor del músculo aductor del pulgar (EMAP) evalúa el compartimento muscular y puede ser útil para detectar la desnutrición precoz. **Objetivo:** Verificar la frecuencia de desnutrición en pacientes oncológicos según la EMAP y correlacionar con el índice de masa corporal (IMC), circunferencia del brazo (CB) y evaluación global subjetiva producida por el paciente (EGS-PPP). **Método:** Estudio transversal, con individuos de 20 años o más, ingresados para administración de quimioterapia, en un hospital de Vale do Taquari-RS. Se recogieron datos antropométricos: peso, talla, CB y EMAP durante el cribado nutricional. Se aplicó EGS-PPP para evaluar el estado nutricional. Los datos se analizaron mediante el software SPSS versión 26.0 y las variables se relacionaron mediante la prueba de chi-cuadrado de Pearson y se correlacionaron mediante la prueba de Spearman. **Resultados:** Se evaluaron 41 pacientes. De estos, el 68,3% fueron clasificados con algún grado de reducción por EMAP. La EGS-PPP clasificó al 78% en riesgo nutricional/desnutrición moderada y desnutrición severa. Hubo una correlación significativa entre EMAP y EGS-PPP. Se observó una correlación inversa entre EMAP e IMC. EMAP tuvo una asociación significativa con IMC, CB y EGS-PPP. **Conclusión:** EMAP es un método eficaz para diagnosticar la desnutrición y puede utilizarse junto con otros métodos de evaluación para el diagnóstico nutricional de pacientes con cáncer.

Palabras clave: evaluación nutricional; desnutrición/diagnóstico; neoplasias/complicaciones; estudios transversales.

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INTRODUCTION

Oncologic patients are at high risk of malnutrition because both the disease and its treatment cause metabolic disorders[1]. The infirmity provokes physiologic alterations inducing more energetic expenditure and shifts of the body composition[2,3]. Malnutrition affects from 20% to 80% of patients with cancer[4].

Nutritional deficit is a negative prognostic factor related to the decreased response to treatment, decreased functional ability and quality of life, increase of morbidity and mortality[5,6]. Nearly 10% to 20% of deaths of patients with cancer can be attributed to malnutrition and not to the disease itself[1,4].

Malnutrition results from systemic inflammation causing anorexia and breakdown of the fatty and muscle tissue resulting in alterations in body composition, weight loss and declining physical function[1], favoring cancer-related cachexia with weight loss and functional impairment[7]. Depletion of muscle mass detrimentally impacts the treatment and clinical outcomes of oncologic patients[6]. The combination of objective and subjective methods allow proper nutritional diagnosis and planning of specific and patient-centered nutritional strategies[5,6].

The Patient Generated Subjective Global Assessment (PG-SGA) is one of the subjective methods of nutritional evaluation, a golden-standard for oncologic patients as it assesses different aspects as weight loss and alterations of dietary intake. It classifies the patient in well-nourished, suspicion of or moderate malnutrition or severely malnourished and defines a patient-centered nutritional intervention[4,8].

Among anthropometric measurements, the adductor pollicis muscle thickness (APMT) assesses the muscle compartment in a rapid, non-invasive and low-cost way, useful to detect early malnutrition, monitoring of muscle compartment and nutritional recovery[5,9-11].

Studies evaluating different nutritional status methods concluded that none of the methodologies can be analyzed alone as it is necessary to combine objective and subjective methods for improved nutritional diagnosis[12,13]. Mostly APMT-based researches of nutritional evaluation are associated with patients submitted to surgery. Few studies evaluated this measurement in cancer patients and reference values are yet undefined for this population[5,9].

The aim of this study is to analyze the frequency of malnutrition in oncologic patients according to APMT and correlate with body mass index (BMI), arm circumference (AC) and PG-SGA.

METHOD

Cross-sectional, observational and quantitative study with individuals of both sexes, aged 20 years or older diagnosed with cancer regardless of the tumor site admitted for chemotherapy treatment in a hospital of Vale do Taquari-RS. The sample was by convenience. The patients were approached during nutritional screening routine at admission, invited to participate and signed the Informed Consent Form (ICF).

The exclusion criteria were: edema in upper limbs and/or anasarca, amputation of unilateral or bilateral upper limb and diagnosis of degenerative diseases as Guillain-Barré Syndrome and amyotrophic lateral sclerosis (ALS). Data were collected between April and July 2020.

Anthropometric data as weight, height, AC and APMT were collected at nutritional screening. Weight was checked with 150kg maximum capacity digital portable scale brand Omron®; the patient was standing on the center of the scale, barefoot and wearing light clothes[14]. Height was measured with Cescorf® anthropometric tape. The patient was barefoot, standing, erect, still with arms along the body and horizontal head orientation[14]. The BMI was obtained with height and weight and adult individuals were classified according to the World Health Organization (WHO)[15] and older adults according to Lipschitz[16].

AC was obtained with 2-meters flexible flat tape brand Cescorf® in the mid-point between the acromion and olecranon. The percentile values defined by Frisancho[17] were utilized to classify the AC. APMT was measured with the patient seated, arm bent at 90º and forearm resting on the knee. With the caliper brand Cescorf®, the vertex of an imaginary triangle formed by the extension of the index finger and thumb was pinched in the non-dominant hand and the average of three consecutive measures was considered to be the APMT[18]. The criteria established by Bragagnolo et al.[19] for a population similar to the present study was adopted to classify the APMT for malnutrition diagnosis with values lower than 12.6 mm and 11.8 mm for women younger and older than 60 years old respectively. For men, the values of 13.3 mm for younger than 60 years and 13.1 mm, for older than 60 years.

PG-SGA was applied to evaluate the nutritional status considering change of weight and dietary intake, presence of symptoms of nutritional impact, alteration of functional ability and physical exam. The results were classified in three categories: A (well-nourished), B (risk of malnutrition or moderate mal-nourishment) and C (severely malnourished)[20,21]. Clinical history (tumor site and other comorbidities) were collected from the patient's charts. It was not possible to determine the tumor staging because this information was not found in the charts.

The data collected were tabulated in a Microsoft Office Excel® 2013 spreadsheet and analyzed with software Statistical Package for the Social Science (SPSS) version

26.0, utilizing descriptive statistics for frequency, central tendency measures and dispersion. The variables were selected through Pearson's chi-square test and Spearman's test to identify the correlation among the variables. The level of significance was p<0.05 and confidence interval of 95%.

The "*Centro de Ensino e Pesquisa (Cenepe)*" of the hospital where the study was conducted approved the study as well as the Institutional Review Board (IRB) of "*Universidade do Vale do Taquari (Coep/Univates)*" report number 3.918.919 (CAAE 28864720.2.0000.5310). All the patients enrolled signed the Informed Consent Form (ICF) after being briefed in compliance with Resolution 466/2012 of the National Health Council[22].

RESULTS

41 patients were evaluated, mostly males, 63.4% (n=26), median age of 54 years. Colorectal neoplasms were the most frequent, 31.7% (n=13) of the patients had metastasis. Chemotherapy as main treatment was predominant, 53.7% (n=22), and 70.7% (n=29) have completed the first and third cycles. In all, ten (24.4%) participants were earlier diagnosed with systemic arterial hypertension, three (7.3%) with dyslipidemia, two (4.9%) with depression and one with diabetes (2.4%). Table 1 shows the sample's clinical profile.

The sample's mean according to APMT was 12.39±3.38 mm, of these, 68.3% were classified with some level of decrease. The mean BMI of the participants was 25.5±5.8 kg/m². According to AC measurement, 51.2% (n=21) were with some degree of malnutrition, the mean was 28.1±4.57. The PG-SGA classified 78% (n=32) at moderate nutritional risk/malnutrition and severe malnutrition. Table 2 shows these results.

There was positive moderate correlation between APMT and PG-SGA (p=0.546; p<0.01). Negative moderate correlation between APMT and BMI was found (p=-486; p<0.01) and between PG-SGA and BMI (p=-669; p<0.01).There was no correlation between APMT and AC according to the Spearman's test. APMT had significant association with BMI, AC and PG-SGA according to the Pearson's chi-square test; these results are presented in Table 3. Among the patients classified as malnourished by APMT, 53.6% (n=15) were classified as eutrophic by BMI. 64.3% (n=18) of the individuals considered malnourished by AC were also classified as malnourished by APMT. The participants at moderate nutritional risk/malnourished and severe malnourished by PG-SGA reached 92.9% (n=26) of the classified as malnourished by APMT. Figure 1 shows these results.

Table 1. Clinical characteristics of patients admitted for chemotherapy

Variable	N	%
Sex		
Female	15	36.6
Male	26	63.4
Race/ethnicity		
White	36	87.8
Brown	3	7.3
Black	2	4.9
Age		
20 to 59 years	27	65.9
>60 years	14	34.1
Diagnosis		
Colorectal cancer	13	31.7
Leukemia/lymphoma	9	22
Head and neck cancer	6	14.6
Gastric cancer	5	12.2
Pancreatic cancer	3	7.3
Other	5	12.2
Treatment		
Chemotherapy	19	46.3
Surgery and chemotherapy	16	39
Radiotherapy and chemotherapy	2	4.9
Surgery, radiotherapy and chemotherapy	4	9.8

DISCUSSION

The results of this study revealed high frequency of malnourishment by PG-SGA and APMT, similar to the results of Valente et. al.[5], where 60% of the participants had some degree of malnutrition by PG-SGA and 57.5% had decreased APMT of the non-dominant hand. Another study evaluated patients with head and neck cancer and classified 69.8% as malnourished by APMT and 62.7% according to PG-SGA[23].

Malnutrition can cause atrophy of the adductor pollicis muscle due to the reduction of the activities of daily life. Muscle trophism results in progressive reduction of APMT; thus, APMT measures relate to the evaluation of muscle depletion[10,24]. APMT measurement in the non-dominant hand is considered higher than in the dominant hand since the most used muscles tends to decline faster due to malnourishment[9].

Recently, the study of Weschenfelder et al.[9] was aimed to determine a cutoff for malnutrition according to APMT for the non-dominant hand. The authors proposed 13.3

Table 2. Nutritional status according to APMT, BMI, PG-SGA and AC of patients admitted for chemotherapy

Nutritional status	N	%
APMT		
Eutrophy	13	31.7
Malnutrition	28	68.3
BMI		
Thinness	5	12.2
Eutrophy	18	43.9
Overweight	7	17.1
Obesity	11	26.8
PG-SGA		
Well-nourished	9	22
Nutritional risk or moderate malnourishment	24	58.5
Severely malnourished	8	19.5
AC		
Eutrophy	15	36.6
Malnourishment	21	51.2
Overweight	3	7.3
Obesity	2	4.9

Captions: APMT = Adductor Pollicis Muscle Thickness; BMI = Body Mass Index; PG-SGA = Patient-Generated Subjective Global Assessment; AC = arm circumference.

mm; the study has also evaluated the nutritional status by PG-SGA, 64% of the participants were classified as moderately or severely malnourished, similar to the current research.

PG-SGA is a clinical, easy, low-cost, non-invasive and subjective method of nutritional evaluation, useful to detect early nutritional changes because it considers several characteristics of the oncologic patient for a short and objective intervention[9].

Studies evaluating the nutritional status by PG-SGA found high levels of malnutrition. Paz et al.[25] classified 89.3% (n=75) of the participants as moderately or severely malnourished in their research. Lima et al.[26], Khoshnevis et al.[27] and Pinho et al.[28] found similar results with 75.61%, 57.1%, 53%, respectively, including the individuals classified in B and C by PG-SGA. In counterpart, a study[29] which evaluated individuals in oncologic clinical treatment concluded that 86.4% were classified as well-nourished when evaluated by PG-SGA. Opanga et al.[30] assessed 471 patients, of these, 69% were classified as well-nourished. Another study[31] evaluated 53 individuals in chemotherapy treatment where 24.8% were classified as B and C by PG-SGA and 75.2%, well-nourished.

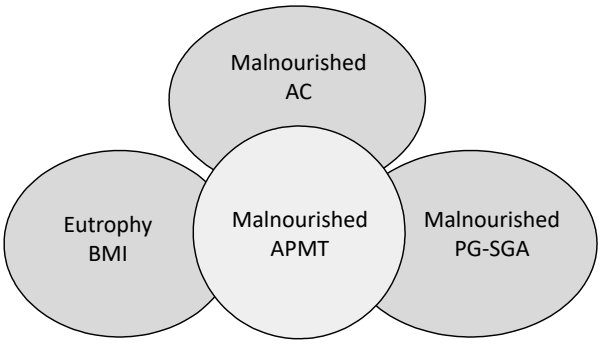

Figure 1. Characterization of the patients classified as malnourished by APMT, BMI, AC and PG-SGA

Captions: AC = arm circumference; BMI = Body Mass Index; APMT = Adductor Pollicis Muscle Thickness; PG-SGA = Patient-Generated Subjective Global Assessment.

Poziomyck et al.[32] evaluated patients with stomach cancer and noticed moderately negative significant correlation between APMT of the dominant hand and of the non-dominant hand by PG-SGA, unlike the current study whose relation was positive, that is, patients classified as malnourished by APMT were also classified as malnourished by PG-SGA. Valente et al.[5] found significant correlation between APMT of the non-dominant hand and PG-SGA and, still, with handgrip strength of both hands. Another study[10] detected significant association between the nutritional status defined by APMT with PG-SGA and BMI with nutritional risk showing that APMT is a parameter that can be utilized for nutritional evaluation to help define the proper nutritional diagnosis.

Table 3. Relation between APMT measurement and nutritional diagnosis according to BMI, AC and PG-SGA of patients admitted for chemotherapy

Variable	APMT Classification			
	Pearson	p	Spearman	p
BMI	9.783	0.021*	-0.486	0.001**
AC	8.805	0.032*	0.270	0.088
PG-SGA	13.035	0.001*	0.546	0.000**

Captions: APMT = Adductor Pollicis Muscle Thickness; BMI = Body Mass Index; AC = arm circumference; PG-SGA = Patient Generated Subjective Global Assessment.
(*) p<0.05 Pearson's chi-square test.
(**) p<0.01 Spearman's test.

While evaluating BMI, this study found low percentage of individuals classified as malnourished, similar to other studies[31,33], where 10.8% and 7.8% of the patients had BMI of thinness. Conversely, in the sample of Lima et al.[26], 43.9% of the participants had low weight and 4.88%, obese. It is known, however, that BMI is a parameter with limited scope and should be associated with other methods of nutritional diagnosis because it does not split muscle mass and fat tissue, potentially masking the nutritional status[31].

Although no significant correlation between AC and APMT has been found, this anthropometric parameter is utilized as an indicator of thinness or adiposity[34]. More than half of the sample presented some decrease in this measurement. Investigators evaluated the AC of patients hospitalized and detected poor lean and adipose mass[35]. Lima et al.[26] evaluated individuals with gastrointestinal neoplasms where 68.29% were classified with some level of malnutrition by this measurement, unlike a study which evaluated women with breast cancer in chemotherapy where only 10% were malnourished by this parameter accounting for 47% of the sample classified as eutrophy[36].

The cross-sectional design, the misaligning between the oncological diagnoses and the treatments, the lack of tumor staging, and the small sample size are some of the limitations.

It was possible in the current study to compare subjective and objective nutritional evaluation methods and contribute to reinforce the utilization of different methods, suggesting that APMT is a safe tool that can be incorporated to the nutritionist's clinical practice for accurate diagnosis.

CONCLUSION

It has been found high frequency of malnutrition by APMT with significant correlation with PG-SGA. It also held significant association with BMI, AC and PG-SGA. It is suggested that APMT is an effective method to diagnose malnutrition and can be considered as routine in nutritional evaluations associated with other subjective and objective methods, for more effective and trustworthy nutritional diagnosis.

Further studies with larger samples are necessary to define a cutoff to utilize APMT measurements in oncologic patients, facilitating its incorporation into clinical practice.

CONTRIBUTIONS

Tamiris Suzeti Gottlieb contributed for the study conception and/or design, data acquisition, analysis and interpretation, wording and critical review. Alice Bertotto Poersch contributed for the wording and critical review. Both authors approved the final version to be published.

DECLARATION OF CONFLICT OF INTERESTS

There is no conflict of interests to declare.

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