Original Article

Anthropometry versus subjective nutritional assessment in cancer patients

Antropometria versus avaliação subjetiva nutricional no paciente oncológico

Antropometría versus evaluación subjetiva nutricional en el paciente oncológico

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Abstract
Objective: Compare the results of anthropometry and subjective nutritional assessment applied to cancer patients.
Methods: Cross-sectional study with patients undergoing chemotherapy between March and June 2017. The instruments applied were anthropometry (body mass index, body fat percentage, muscle mass and edema) and the Patient-Generated Subjective Global Assessment (PG-SGA). Data were entered into a Microsoft Excel® spreadsheet. Statistical analyses were performed using SPSS® version 21.0. Central tendency (mean and standard deviation), absolute frequency and corresponding percentages were measured. The analyses used the t-test and Pearson correlation, considering a significance level of 5%.
Results: Of all 99 participants and based on the body mass index, 60.6% were healthy, 24.2% presented fat depletion, 51.5% had severe or moderate muscle depletion, and 87.9% had edema. According to the Patient-Generated Subjective Global Assessment, 31.3% were well-nourished participants, 37.4% moderately malnourished and 31.3% severely malnourished. Incompatibility of nutritional diagnosis was observed when comparing the body mass index and the Patient-Generated Subjective Global Assessment due to the high frequency of edema in the participants.
Conclusion: The results indicated that the body mass index should not be considered as the only assessment for cancer patients, requiring a complete anthropometric evaluation associated with the Patient-Generated Subjective Global Assessment.

Resumo
Objetivo: Comparar os resultados da antropometria e avaliação subjetiva nutricional aplicadas ao paciente oncológico.
Métodos: Estudo transversal com pacientes em tratamento de quimioterapia entre março e junho de 2017. Os instrumentos aplicados foram a antropometria (Índice de Massa Corporal, percentual de gordura corporal, massa muscular e edema) e a Avaliação Subjetiva Global Produzida pelo Próprio Paciente. Os dados foram digitados no programa Microsoft Excel®. As análises estatísticas foram realizadas no programa SPSS® 21.0. Realizaram-se medidas de tendência central (média e desvio-padrão), frequência absoluta e percentual. As análises ocorreram por meio do Teste *t* e *Correlação de Pearson*, adotando-se um nível de significância de 5%.
Resultados: Dentre os 99 participantes, 60,6% apresentaram eutrofia, segundo o Índice de Massa Corporal, 24,2% com depleção de gordura, 51,5% com depleção muscular grave ou moderada e 87,9% com edema. A categorização da Avaliação Subjetiva Global Produzida pelo Próprio Paciente foi de 31,3% participantes bem nutridos, 37,4% desnutridos moderadamente e 31,3% desnutridos graves. Houve incompatibilidade do diagnóstico nutricional proveniente do Índice de Massa Corporal e Avaliação Subjetiva Global Produzida pelo Próprio Paciente, em decorrência da alta frequência de edema nos participantes.
Conclusão: Os resultados apontaram que o Índice de Massa Corporal não deve ser considerado um indicador único de avaliação do paciente oncológico, necessitando-se de avaliação antropométrica completa associada à Avaliação Subjetiva Global Produzida pelo Próprio Paciente.

Resumen
Objetivo: Comparar resultados de antropometría y evaluación subjetiva nutricional aplicados al paciente oncológico.
Métodos: Estudio transversal con pacientes en tratamiento quimioterápico entre marzo y junio de 2017. Se aplicaron los instrumentos Antropometría (Índice de Masa Corporal, porcentaje de grasa corporal, masa muscular y edema) y la Evaluación Subjetiva Global Producida por el Propio Paciente. Datos introducidos en planilla Microsoft Excel®. Los análisis estadísticos fueron realizados con el programa SPSS® 21.0. Se aplicaron medidas de tendencia central (promedio y Desvío Estándar), frecuencia absoluta y porcentual. Análisis realizados mediante Test de t y Correlación de Pearson, adoptándose nivel de significatividad del 5%.
Resultados: De los 99 participantes, 60,6 presentó eutrofia según el Índice de Masa Corporal, 24,2% con depleción de grasa, 51,5% con depleción muscular grave o moderada, y 87,9% con edema. La categorización de la Evaluación Subjetiva Global Producida por el Propio Paciente fue de 31,3% participantes bien nutridos, 37,4% moderadamente desnutridos y 31,3% gravemente desnutridos. Existió incompatibilidad del diagnóstico nutricional derivada del Índice de Masa Corporal y Evaluación Subjetiva Global Producida por el Propio Paciente, determinada por la alta frecuencia de edema en los participantes.
Conclusión: Los resultados expresan que el Índice de Masa Corporal no debe considerarse indicador único de evaluación del paciente oncológico, precisándose de evaluación antropométrica completa asociada a la Evaluación Subjetiva Global Producida por el Propio Paciente.

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Introduction

Cancer is an abnormal (malignant) cell growth that can invade or spread to tissues and organs. This process involves metastasis when it spreads through the body. This evolution can happen quickly, leading to the formation of tumors (accumulation of cancer cells) or malignant neoplasms. If the tumor is classified as benign, it is rarely considered a life-threatening condition, a local mass of cells that is similar to the original tissue.[1]

Cancer has no symptoms in its early stage; however the first signs appear with the disease evolution and can be very distinct based on the neoplasm location. Symptoms may be classified as local effects (ulceration), systemic symptoms (weight loss, fever, excessive tiredness, epithelial changes), symptoms of metastasis (lymphadenopathy, hepatomegaly or splenomegaly, pain or fracture of affected bones), and neurological symptoms.[2]

Chemotherapy, which aims to control and treat cancer, has an impact on the patients' nutritional status. Symptoms such as nausea, vomiting, diarrhea, constipation and anorexia are possible consequences. Although some drugs can minimize the effects of this procedure, the symptoms are still a major obstacle for patients.[3]

Nutritional status is a very important aspect, as it has a direct influence on the evolution of cancer patients. Malnutrition is very frequent in these individuals, which may be a result of changes in metabolism caused by the disease and treatment, as well as reduced total intake and increased energy demand for tumor evolution.[4]

One of the evaluation instruments to determine the nutritional status is anthropometry, which includes the evaluation of weight, height, edema, skin folds and circumferences. This instrument indicates the presence of malnutrition, eutrophy or obesity. As its method of analysis, the reference values should be compatible with the population evaluated to identify and quantify the nature and severity of nutritional diseases.[5]

As an instrument for cancer patient screening, the Patient-Generated Subjective Global Assessment (PG-SGA) has 98% sensitivity and 82% specificity. It was translated into Portuguese and validated in Brazil in 2010, demonstrating its usefulness. Its use consists in the categorization of the nutritional status and screening of the degree of required professional intervention.[6]

In order to promote the recovery of cancer patients, several health areas should be supported. Nutrition professionals should conduct a nutritional assessment and define an intervention for the resulting diagnosis.[7]

Therefore, the objective of this study was to compare the results of the anthropometric assessment and the PG-SGA applied to cancer patients.

Methods

This is an observational cross-sectional quantitative study with 99 patients in outpatient chemotherapy in the Triângulo Mineiro region, Minas Gerais. Data collection was conducted from March to June 2017.

The inclusion criteria were: cancer patients undergoing chemotherapy in the third cycle or after, of both sexes, adults over 20 years old, elderly patients who knew how to read and write for the self-applied instrument. Individuals who presented mental confusion were excluded from the study, since the instrument required patient collaboration for data collection.

According to the procedures requested by the Research Ethics Committee, formal contact with the institution and participants occurred only after approval by the committee no. 1.974.551. Data collection started after the signature of an informed consent form. Guidance was provided on the benefits of the scientific study to the society.

Participants were contacted in the outpatient clinic and after agreement with the study terms; each participant was individually taken to a private room so that the instruments were applied by a qualified professional, spending on average 60 minutes.

The following methods were used to collect data: anthropometry (BMI, body fat percentage, muscle mass and edema) and PG-SGA.

The procedures were applied according to the Anthropometry Manual.[8] Height was measured with a stadiometer (WCS®, 2016, Paraná, Brazil), weight was measured with a wireless digital scale (Bioland®, 2016, São Paulo, Brazil), a caliper (CESCORF® Innovare, 2016, Porto Alegre, Brazil) was used to measure skin folds, and a meter tape (WCS®, 2016, Paraná, Brazil) was used to measure the circumference of limbs.

The BMI classification was based on cut-off points, according to the World Health Organization (WHO)[9] which is considered appropriate for healthy adult subjects. For the elderly, the reference values were those proposed by Lipschit.[10]

For the participants who were unable to walk, calculation formulas were used to estimate their height and weight.[11,12]

Regarding body composition, the Petroski Protocol was used[13], which evaluated four skin folds: medial axillary, supra iliac, medial calf and thigh for female participants, and subscapular, triceps, supra iliac, and medial calf for male participants. Data were calculated by providing the body density value. This value was applied to a final formula that determined the fat percentage. The ideal fat percentage was classified according to sex and age of each participant.[14]

Mid-arm circumference (MAC) and mid-arm muscle circumference (MAMC) (triceps fold) were considered in the analysis of muscle mass, whose values were used in a formula that provides the percentage of muscle mass (without bone correction), according to the percentile by age and sex.[15,16]

Godet signal was used for edema assessment, which consists of palpation with intense pressure for one or two seconds, classifying the degree according to a scale.[17]

PG-SGA is divided into two parts; the first is answered by the patient. Issues such as weight changes, gastrointestinal symptoms and changes in food intake were addressed. The results provided two types of classification: nutritional status and scores that identify four levels of nutritional risk, allowing different interventions for each of them.[6]

Participants were taken to a nutrition clinic in the Triângulo Mineiro region, Minas Gerais, according to the nutritional status diagnosed.

Data obtained from the application of both instruments were carefully described and analyzed with the development of a database in Microsoft Excel®, in a double-typing process to avoid inconsistency. Then, the variables were submitted to statistical analyses and testing using the Statistical Package for the Social Sciences - SPSS Statistics® 21.0.

In the statistical analysis, absolute frequency and percentage measurements were used. The t-test was performed for the bivariate analysis of categorical variables, considering a significance level of 5%.

Pearson correlation was performed for the quantitative variables, considering ρ=1 perfect positive correlation between the two variables, ρ=-1 perfect negative correlation between the two variables, and ρ=0 meaning that the two variables do not linearly depend on one another. The level of significance was 5%.

Results

Of the 99 cancer patients undergoing chemotherapy, 56.6% were male. The age group of 20 to 60 years included 40.4% of the participants. Regarding the types of cancer, gastrointestinal cancer presented a higher frequency (36.4%), and 24.2% presented metastasis.

Of all participants, 60.6% were healthy, that is, proper total body weight in relation to height, followed by 30.3% of overweight and 9.1% of underweight participants. Regarding body fat percentage, 57.6% were classified as adequate, 24.2% presented depletion and 18.2% were above the recommended level. For the percentage of muscle mass, 51.5% had severe or moderate depletion, 44.4% presented mild and 4% adequate depletion. The edema classification was as follows: 37.4% of the patients with mild edema, 27.3% with moderate edema, 23.2% had severe edema, and 12.1% were free from this condition (Table 1).

Table 1 shows the nutritional status categorized according to PG-SGA. About 31.3% were classified as 'well nourished,' 37.4% identified as 'moderately malnourished,' and 31.3% as 'severe-

Table 1. Nutritional status according to anthropometry and the Patient-Generated Subjective Global Assessment

Variables	Classifications	n(%)
BMI	Underweight	9(9.1†)
	Healthy	60(60.6†)
	Overweight	30(30.3†)
Body fat %	Depletion	24(24.2†)
	Adequate	57(57.6†)
	Over	18(18.2†)
Muscle mass %	Mild depletion	44(44.4†)
	Adequate	4(4†)
	Moderate or severe depletion	51(51.5†)
Edema	No presence	12(12.1†)
	Mild	37(37.4†)
	Moderate	27(27.3†)
	Severe	23(23.2†)
Categorization of nutritional status	Well-nourished	31(31.3†)
	Moderately malnourished	37(37.4†)
	Severely malnourished	31(31.3†)
Degree of professional intervention	Not required	29(29.3†)
	Nutritional education	21(21.2†)
	Nutritional intervention	25(25.3†)
	Important intervention	24(24.2†)

†Each relative frequency was calculated using the total sample (99 subjects)

ly malnourished.' Regarding the degree of professional intervention, 29.3% did not need nutritional intervention at the moment, but reassessment was required, 21.2% lacked individual and family nutritional education, 25.3% required nutritional intervention, and 24.2% required significant nutritional intervention to control symptoms.

Table 2 shows the comparison of mean values from the results of anthropometry and PG-SGA according to the variables of sex, age group, type of cancer and metastasis. For BMI, and percentage of fat and muscle mass, the lowest mean values were for males, individuals aged over 60 years, with gastrointestinal cancer and the presence of metastasis. Regarding the edema severity and the PG-SGA scores for the categorization of the nutritional status and degree of intervention, higher mean values were obtained for men, elderly, with gastrointestinal cancer and metastasis.

Table 3 shows the correlation between anthropometry and the PG-SGA. The percentage of muscle mass (ρ=0.68, p=0.001) and presence of edema (ρ=0.61, p=0.003) can be considered as moderately positive. The percentage of body fat (ρ=0.41,

Table 2. Comparison of mean values from the results of anthropometry and the Patient-Generated Subjective Global Assessment, according to the variables of sex, age group, type of cancer and metastasis

Variables	Mean	SD*	p-value
BMI			
Sex			
Male	21.4	0.61	0.004‡
Female	23.0	0.55	
Age group			
20 to 60	20.8	0.60	0.001‡
> 60	19.5	0.56	
Cancer type			
Gastrointestinal	21.7	0.56	0.002‡
Other	22.4	0.61	
Metastasis			
Yes	21.3	0.53	0.004‡
No	22.4	0.61	
Body fat %			
Sex			
Male	18.4	0.68	0.003‡
Female	20.7	0.59	
Age group			
20 to 60	20.1	0.65	0.004‡
> 60	17.3	0.60	
Cancer type			
Gastrointestinal	17.8	0.54	0.004‡
Other	20.3	0.69	
Metastasis			
Yes	19.2	0.71	0.003‡
No	19.5	0.63	
Muscle mass %			
Sex			
Male	64.6	0.53	0.002‡
Female	66.0	0.62	
Age group			
20 to 60	65.8	0.59	0.003‡
> 60	63.8	0.49	
Cancer type			
Gastrointestinal	65.2	0.61	0.001‡
Other	65.3	0.50	
Metastasis			
Yes	64.8	0.52	0.002‡
No	66.7	0.70	
Edema			
Sex			
Male	2.05	0.89	0.004‡
Female	2.46	0.99	
Age group			
20 to 60	2.26	0.98	0.003‡
> 60	2.35	0.89	
Cancer type			
Gastrointestinal	2.37	1.02	0.003‡
Other	2.14	0.83	
Metastasis			
Yes	2.31	0.97	0.003‡
No	2.21	0.93	
Categorization of nutritional status			
Sex			
Male	2.09	0.81	0.004‡
Female	1.88	0.76	

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Continuation.

Variables	Mean	SD*	p-value
Age group			
20 to 60	1.93	0.77	0.001 [t]
> 60	2.19	0.84	
Cancer type			
Gastrointestinal	2.05	0.79	0.003 [t]
Other	1.92	0.80	
Metastasis			
Yes	2.02	0.80	0.004 [t]
No	2.00	0.78	
Degree of professional intervention			
Sex			
Male	2.55	1.19	0.003 [t]
Female	2.30	1.10	
Age group			
20 to 60	2.34	1.12	0.003 [t]
> 60	2.73	1.21	
Cancer type			
Gastrointestinal	2.51	1.16	0.004 [t]
Other	2.33	1.14	
Metastasis			
Yes	2.48	1.16	0.004 [t]
No	2.33	1.12	

*SD – Standard deviation; t-test

Table 3. Correlation between anthropometry and the Patient-Generated Subjective Global Assessment

Variables	Categorization of nutritional status	
	ρ	*p-value*
BMI	0.06	0.003 [ρ]
Body fat %	0.41	0.001 [ρ]
Muscle mass %	0.68	0.001 [ρ]
Edema	0.61	0.003 [ρ]

ρ – Pearson correlation

p=0.001) presented a weak positive correlation. BMI presented the lowest positive correlation (ρ=0.06, p=0.003), which shows a low degree of correlation between the methods.

Discussion

This study had a predominance of male participants (56.6%), which is similar to a study with 70 subjects (54.3%).[18] Regarding nutritional status, male participants presented higher severity. This representativeness may be associated with their resistance to seeking health services, a behavior rooted in our society and still frequent.[19,20]

Regarding age, 40.4% were aged 20 to 60 years, in disagreement with most studies. The inclusion criterion of knowing how to read and write was determinant, since most illiterates correspond to the elderly. In this study, the higher the age group, the worse their nutritional status. According to the literature, about 70% of deaths caused by cancer occur among elderly people aged 65 or over.[21]

Regarding the type of cancer, gastrointestinal cancer presented a higher frequency (36.4%) and the most severe results in anthropometry and the PG-SGA. This type of cancer causes inappetence, malabsorption and poor digestion, leading to complications in the nutritional situation, such as malnutrition, anemia and changes in body composition.[22]

Another study used the PG-SGA with gastrointestinal cancer patients, and 98% of the cases required intervention, with improved nutritional status in 54% of these individuals.[23]

As for metastasis, 24.2% of the participants presented this condition, predisposing them to a greater nutritional risk, thus indicating greater attention and care required in this aspect.[24]

Some researchers have reported that insufficient food intake, type of cancer, disease progression, and chemotherapy are responsible for the loss of fat and muscle mass.[18]

This study found 24.2% of patients with body fat depletion and 51.4% with severe or moderate muscle mass depletion, in agreement with the estimated prevalence of malnutrition in cancer patients from 40 to 80%.[7] Another study detected malnutrition in 60% of patients based on arm circumference, and 73.3% using muscle circumference.[25]

The presence of edema affects the accuracy of nutritional diagnosis through BMI. Only 12.1% of the patients did not present the condition: 37.4% were mild, 27.3% moderate, and 23.2% severe. Chemotherapy increases the occurrence of edema, so a positive correlation was observed in more advanced stages of the disease.[26]

In the BMI assessment, most participants were classified as healthy (60.6%). In a study with 50 breast cancer patients, about 50% of the sample presented obesity according to the BMI.[27]

In the PG-SGA categorization, 31.3% were classified as 'well-nourished,' 37.4% as 'moderately malnourished,' and 31.3% as 'severely malnourished. In a prospective study with 416 cancer patients, 47%

were 'well-nourished,' 29% were 'moderately malnourished,' and 24% were 'severely malnourished,' with higher mortality in these individuals.[28]

Discrepancies were observed in the nutritional status evaluated by both instruments, 9.1% were considered malnourished according to the BMI, but 37.4% as 'moderately malnourished' and 31.3% as 'severely malnourished' according to PG- SGA.

In a study with 96 elderly individuals, the BMI indicated 29.2% of underweight individuals, while with PG-SGA, the percentage of malnutrition (moderately and severely malnourished) reached 43.8%.[29]

The inconsistent prognosis between the BMI and PG-SGA methods for cancer patients undergoing chemotherapy is due to the presence of edema, body composition assessment, and calculation of involuntary weight loss, underestimating the BMI diagnosis.[30]

One of the limitations of this study was its sample size, which is associated with the inclusion criterion of knowing how to read and write, a factor that was required for the self-applied part of the PG-SGA.

Conclusion

The results of this study showed an incompatibility in the nutritional diagnosis from the BMI and the PG-SGA, due to the high frequency of edema in the participants. Finally, BMI should not be considered as a single indicator of cancer patient evaluation, requiring a complete anthropometric evaluation associated with the PG-SGA.

Collaborations

Milani J participated in the study design and project, and data analysis and interpretation. Pereira EMS and Barbosa MH collaborated with the relevant critical review of its intellectual content. Barichello E collaborated with the study design and project, data analysis and interpretation, and final approval of the version to be published.

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