Nutritional and Functional Evaluation in Oncology and Clinical Outcome in Patients in the City of Caxias do Sul/RS

doi: https://doi.org/10.32635/2176-9745.RBC.2020v66n2.996

Avaliação Nutricional e Funcional em Oncologia e Desfecho Clínico em Pacientes da Cidade de Caxias do Sul/RS

Evaluación Nutricional y Funcional en Oncología y Resultados Clínicos en Pacientes de la Ciudad de Caxias do Sul/RS

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Abstract

Introduction: Malnutrition is frequent in cancer patients, impairing functionality and increasing mortality. **Objective:** Perform nutritional and functional assessment of patients undergoing chemotherapy and, after 6 months, evaluate the clinical outcome. **Method:** Observational epidemiological study, with longitudinal design, derived from a cohort followed for 6 months, formed by cancer patients undergoing chemotherapy treatment. Nutritional assessment was performed using the Body Mass Index (malnutrition; eutrophy; overweight; obesity) and the Patient-Generated Subjective Global Assessment (well nourished; moderate malnutrition or suspected malnutrition; severe malnutrition). Functional assessment was performed using manual dynamometry (adequate muscle strength; muscle weakness). The chi-square test was used to compare categorical variables and Poisson regression to identify the prevalence ratios and 95% confidence intervals. **Results:** Of the 208 investigated, 55.3% were elderly. There was a significant difference in the results of the nutritional assessment methods (p≤0.0001). Also, most patients with muscle weakness were not malnourished (p=0.013; p≤0.001). After 6 months, 68.4% of deaths were in malnourished patients (p≤0.0001). Advanced age (p=0.018; p=0.010) and muscle weakness (p=0.039; p=0.002) were associated with malnutrition. **Conclusion:** Most patients were not malnourished, although most of them had reduced functional capacity. Nutritional assessment methods differed from each other. After 6 months, patients who died had 2 times more chance of malnutrition.

Key words: Neoplasms/drug therapy; Nutritional Status; Malnutrition; Muscle Strength Dynamometer.

Resumo

Introdução: A desnutrição é frequente em pacientes oncológicos, prejudicando a funcionalidade e aumentando a mortalidade. **Objetivo:** Avaliação nutricional e funcional de pacientes em tratamento quimioterápico e, após seis meses, avaliar o desfecho clínico. **Método:** Estudo epidemiológico observacional, com delineamento longitudinal, derivado de uma coorte acompanhada por seis meses, composta por pacientes oncológicos em tratamento quimioterápico. Realizou-se a avaliação nutricional pelo índice de massa corporal (desnutrição; eutrofia; sobrepeso; obesidade) e pela avaliação subjetiva global produzida pelo paciente (bem nutrido; desnutrição moderada ou suspeita de desnutrição; desnutrido grave). A avaliação funcional foi realizada por meio da dinamometria manual (adequada força muscular; fraqueza muscular). Utilizou-se o teste de qui-quadrado para comparação de variáveis categóricas e a regressão de Poisson para identificar as razões de prevalência e intervalos de confiança em 95%. **Resultados:** Dos 208 investigados, 55,3% eram idosos e 52,4% do sexo feminino. Verificou-se diferença significativa nos resultados dos métodos de avaliação nutricional (p≤0,0001). A maioria dos pacientes com fraqueza muscular não estava com desnutrição (p=0,013; p≤0,001). Após seis meses, 68,4% dos óbitos foram em pacientes desnutridos (p≤0,0001). Idade avançada (p=0,018; p=0,010) e fraqueza muscular (p=0,039; p=0,002) foram associadas à desnutrição. **Conclusão:** A maioria dos pacientes não estava desnutrida, embora grande parte apresentou capacidade funcional reduzida. Os métodos de avaliação nutricional diferiram entre si. Após seis meses, pacientes que foram a óbito tinham duas vezes mais chance de desnutrição.

Palavras-chave: Neoplasias/tratamento farmacológico; Estado Nutricional; Desnutrição; Dinamômetro de Força Muscular.

Resumen

Introducción: La desnutrición es común en pacientes con cáncer, afecta la funcionalidad y aumenta la mortalidad. **Objetivo:** Evaluación nutricional y funcional de los pacientes sometidos a quimioterapia y, después de seis meses, evaluar el resultado clínico. **Método:** Estudio epidemiológico observacional, con diseño longitudinal, derivado de una cohorte seguida durante seis meses, compuesta por pacientes con cáncer sometidos a tratamiento de quimioterapia. La evaluación nutricional se realizó utilizando el índice de masa corporal (desnutrición; eutrofia; sobrepeso; obesidad) y la evaluación subjetiva global producida por el paciente (bien alimentada; desnutrición moderada o sospecha de desnutrición; desnutrición severa). La evaluación funcional se realizó mediante dinamometría manual (fuerza muscular adecuada; debilidad muscular). La prueba de chi-cuadrado se utilizó para comparar las variables categóricas y la regresión de Poisson para identificar las razones de prevalencia y los intervalos de confianza del 95%. **Resultados:** De los 208 investigados, el 55,3% eran ancianos. Hubo una diferencia significativa en los resultados de los métodos de evaluación nutricional (p≤0,0001). La mayoría de los pacientes con debilidad muscular no estaban desnutridos (p=0,013; p≤0,001). Después de seis meses, el 68.4% de las muertes fueron en pacientes desnutridos (p≤0,0001). La edad avanzada (p=0,018; p=0,010) y la debilidad muscular (p=0,039; p=0,002) se asociaron con la desnutrición. **Conclusión:** La mayoría de los pacientes no estaban desnutridos, aunque la mayoría de ellos tenían una capacidad funcional reducida. Los métodos de evaluación nutricional fueron diferentes. Después de seis meses, los pacientes que murieron tenían dos veces más posibilidades de desnutrición.

Palabras clave: Neoplasias/tratamiento farmacológico; Estado Nutricional; Desnutrición; Dinamómetro de Fuerza Muscular.

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INTRODUCTION

Cancer is one of the major causes of death by chronic non-communicable diseases in the world. Therefore, it became a public health problem and currently, the second main cause of death in the developed countries[1]. Demographical changes in the last decades predict that in 2030, 27 million new cases of this disease will occur and 75 million individuals living with it[2].

This disease usually causes a series of severe metabolic modifications as protein hypercatabolism, provoking a change of the patient's nutritional status which, for multifactorial reasons, may compromise the treatment and quality of life, making it more susceptible to malnourishment and tumor evolution[2,3].

Changes of the nutritional status in oncologic patients affect negatively all the phases of the treatment since the most common modifications are muscle mass depletion, weight loss and consequently, malnourishment[4,5]. Innumerous factors are related to weight loss and nutritional compromise as reduction of appetite, nausea, vomit, diarrhea, early satiety, cachexia, psychological distress and treatment side effects[4-10].

The consequences of the tumor have been associated to direct depletion of muscle reservoir, poor response to the treatment, increase of toxicity of chemotherapics and reduction of survival[4-6,9,11]. In addition, it is known that malnourishment compromises the treatment and influences the worsening of the symptoms. Consequently, patients with this burden have increased risk of surgical complications, high risk of discontinuing the required chemotherapic treatment, lower survival rates and reduction of the functional capacity, favoring extended hospitalization and hospital costs[11-15].

To help the nutritional diagnosis of the patient with cancer, different methods can be applied as the Patient-Generated Subject Global Assessment (PG-SGA)[2] and the hand grip strength (HGS)[2,16], also utilized to evaluate the functionality[16-18].

Functional capacity is assessed through manual dynamometer, a low cost, simple and fast method. In addition, manual dynamometer identifies the patient's functional muscle status, required for a trustworthy diagnosis, helping to evaluate the risk of malnourishment with higher odds of complications. Consequently, the use of manual dynamometer complements the nutritional assessment, measuring the functional capacity of the individuals in a more concrete and realistic manner[17,19].

Based in this, the objective of the present study was to perform the nutritional and functional assessment of oncologic patients of a school-hospital in the city of Caxias do Sul/RS in treatment with chemotherapics and evaluate its outcome after six months.

METHOD

An observational, epidemiologic, longitudinal design study was conducted with a cohort followed up for six months beginning from January to February 2019 in a school hospital in the city of Caxias do Sul. The sample was obtained by convenience with individuals with oncologic diagnosis, both genders, age equal or older than 19 years in outpatient chemotherapy treatment at the moment data were collected. Patients with any intellectual and motor impairment, pregnant and puerperal women were not included in the study.

After six months, the patients charts were evaluated for clinical outcome where the continuation of the oncologic treatment, discharge after cure, discharge from chemotherapy even without cure and death were investigated. Thus, after the six-months period evaluation, short term mortality is identified[20].

Data were collected upon approval by the Institutional Review Board (IRB) of both institutions involved, approval numbers 2,571,056 and 2,726,138. The study is part of a project titled: "Nutritional risk and symptoms associated to the location of the tumor in oncologic patients in chemotherapic treatment". All the procedures complied with Resolution 466 dated December 12, 2012 of the National Health Council[21]. The participants were informed about the objective of the study and confidentiality of the data and later they signed the Informed Consent Form.

The following variables of demographic aspects and health history were investigated and collected directly from the patient's chart: age (collected continuously and categorized in adults – 19 to 59 years – and older adults – ≥60 years), gender (female, male) and cancer diagnosis (prostate, lung, hematologic, breast, melanoma, bladder, gastrointestinal tract, head and neck, ovary, other).

The assessment of the nutritional outcome was based in the PG-SGA, which is a questionnaire validated and translated[22], divided in two parts. The first part consisting of self-applied questions addresses weight changes and food intake, cancer-related symptoms and changes of the functional capacity. The second part responded by the professional applying the questionnaire comprehends questions relying in diagnosis-based factors that increase the metabolic demand. In the end of the evaluation, the classification was: (A) well-nourished; (B) moderate malnutrition or suspected malnutrition; (C) severe malnutrition.

Weight and height used for identification of the body mass index (BMI) (weight in kilograms/height in meters^2)

were obtained from PG-SGA responses and classified according to the World Health Organization (WHO) and the Ministry of Health[23,24]. Based in these information, the dependent variable BMI was categorized in: malnutrition (<18.5 kg/m² for adults; <22.0 kg/m² for older adults), eutrophy (from 18.5 to 24.9kg/m² for adults; from 22.0 to 26.9 kg/m² for older adults), overweight (from 25.0 to 29.9 kg/m² for adults; ≥27 kg/m² for older adults) and obesity (≥30.0 kg/m² for adults).

The HGS was measured through manual dynamometer – hydraulic dynamometer SAEHAN® – to evaluate the functional capacity and estimate the functional status of the skeletal muscle. The patients performed the test seated with the elbow bent at 90º, forearm and wrist in neutral position. The participants were instructed to make three maximum isometric contractions with short pause between each other. After three measures of each hand (dominant and non-dominant) were obtained and divided by three, mean measure was reached. According to the *European Working Group on Sarcopenia in Older People* (EWGSOP), the minimum reference value of HGS is 16 kg/f and of 27 kg/f for women and men, respectively[25]. Muscle weakness was considered for value below these results. HGS measured through manual dynamometer is a method utilized for functional assessment of the patients, because it is a prognosis marker, however, must be used together with other methods for better result[5,17,18].

Data were tabulated and analyzed through the software Statistical Package for the Social Sciences® (SPSS), version 25.0. The normality of the variables was verified through the Shapiro-Wilk test, categorical and non-parametric distributions for the outcomes analyzed. The qualitative variables were described through absolute and relative frequencies. In order to identify the relation in the proportions observed between nutritional status and exposure variables, it was applied the chi-square test. To identify the prevalence ratios (PR) and its respective confidence intervals in 95% (CI 95%), it was performed raw analysis. Later, it was performed Poisson regression using the backwards technique because it is a method that includes, in the regression model, the variables with level of significance of until 20% (≤0.20) in the raw analysis. It was considered level of significance of 5% (p≤0.05) for all the tests.

RESULTS

The sample consisted of 208 individuals in chemotherapic treatment, being 44.7% adults, 55.3% older adults and 52.4% females. In relation to oncologic diagnosis, 29.3% of the individuals were diagnosed with onco-hematological disease and 13.9% with breast cancer. According to HGS, 50.0% of the individuals evaluated presented muscle weakness. After six months, most of the sample continued in chemotherapic treatment (67.3%) and the cases of death occurred in 9.1% of the participants (Table 1).

Pursuant to PG-SGA, for nutritional status, 23.1% of the individuals presented moderate malnutrition or suspected malnutrition and 4.8%, severe malnutrition (data not presented in the tables). However, according to the results identified by BMI, 10.6% were malnourished, 38.0% with overweight and 7.7% with obesity (Table 2).

Table 1. Description of the demographic variables and clinical history in individuals with oncologic diagnosis in outpatient chemotherapy treatment of a school-hospital in Caxias do Sul/RS. 2019 (n=208)

Variables of Exposure	n (%)
Age	
Adults (19 to 59 years)	93 (44.7)
Older adults (≥60 years)	115 (55.3)
Gender	
Female	109 (52.4)
Male	99 (47.6)
Cancer Diagnosis	
Prostate	14 (6.7)
Lung	18 (8.7)
Hematologic	61 (29.3)
Breast	29 (13.9)
Melanoma	9 (4.3)
Bladder	13 (6.3)
GIT	28 (13.5)
Head and neck	13 (6.3)
Ovary	8 (3.8)
Other	15 (7.2)
HGS	
Normal muscle strength	104 (50.0)
Muscle weakness	104 (50.0)
Outcome after 6 months	
Oncologic treatment	140 (67.3)
Discharged, cured	14 (6.7)
Discharged from Ct, without cure	35 (16.8)
Death	19 (9.1)

Captions: RS=Rio Grande do Sul. GIT=gastrointestinal tract. HGS=hand grip strength. Ct=Chemotherapy.

Table 2 shows the comparison between the nutritional status according to PG-SGA and BMI in the sample investigated. It was verified that the results between the two methods were significantly different (p≤0.0001), where, according to BMI, 6.3% of the obese, 12.7% of patients with overweight and 28.6% of the eutrophic individuals were classified with moderate malnutrition or suspected malnutrition according to PG-SGA.

For demographic variables and clinical history in relation to nutritional status and age (p≤0.001), where, among older adults, 29.6% presented moderate malnutrition or suspected malnutrition and 7.8%, severe malnutrition. Furthermore, 83.9% of the adults were classified as well-nourished. In addition, it was observed significant difference between HGS and nutritional status (p≤0.001), and of the participants with muscle weakness, 34.6% and 6.7% were with moderate malnourishment or with suspected malnourishment and severe malnourishment, respectively. Still, among those with normal muscular strength, 85.6% were well-nourished (Table 3).

Regarding the outcome after six months and nutritional status according to PG-SGA, it was verified significant difference between the proportions observed (p≤0.001), where 57.1% of the interviewees who were discharged and were cured were well-nourished. The cases of deaths revealed 52.6% moderately malnourished or with suspected malnourishment and 15.8% with severe malnourishment (Table 3).

Table 2. Description of the nutritional status according to PG-SGA, BMI in individuals with oncologic diagnosis in outpatient chemotherapy treatment in a school hospital in Caxias do Sul/RS. 2019 (n=208))

Variables of exposure	n (%)	Well nourished n=150	Moderate malnourishment or suspected malnourishment n=48	Severely malnourished n=10	p-value*
BMI					**≤0.0001**
Obesity	16 (7.7)	15 (93.8)	1 (6.3)	0 (0.0)	
Overweight	79 (38.0)	69 (87.3)	10 (12.7)	0 (0.0)	
Eutrophy	91 (43.8)	64 (70.3)	26 (28.6)	1 (1.1)	
Malnutrition	22 (10.6)	2 (9.1)	11 (50.0)	9 (40.9)	

Captions: RS=Rio Grande do Sul. PG-SGA=Patient-Generated Subject Global Assessment. BMI=Body Mass Index. *Chi-square test for heterogeneity. Values in bold are statistically significant (p≤0.05).

Table 3. Description of demographical variables and clinical history in relation to PG-SGA nutritional status in individuals with oncologic diagnosis in outpatient oncologic treatment of a school-hospital in Caxias do Sul/RS. 2019 (n=208)

Variables of exposure	n (%)	Well nourished n=150	Moderate malnourishment or suspected malnourishment n=48	Severe malnourishment n=10	p-value
Age					**≤0.001**
Adults	93 (44.7)	78 (83.9)	14 (15.1)	1 (1.1)	
Older adults	115 (55.3)	72 (62.6)	34 (29.6)	9 (7.8)	
HGS					**≤0.001**
Normal MS	104 (50.0)	89 (85.6)	12 (11.5)	3 (2.9)	
Muscle weakness	104 (50.0)	61 (58.7)	36 (34.6)	7 (6.7)	
Outcome after 6 months					**≤0.001**
Oncologic treatment	140 (67.3)	110 (78.6)	24 (17.1)	6 (4.3)	
Discharged, cured	14 (6.7)	8 (57.1)	5 (35.7)	1 (7.1)	
Discharge from Ct, without cure	35 (16.8)	26 (74.3)	9 (25.7)	0 (0.0)	
Death	19 (9.1)	6 (31.6)	10 (52.6)	3 (15.8)	

Captions: RS=Rio Grande do Sul. PG-SGA=Patient Generated Subjective Global Assessment. HGS=Hand Grip Strength. MS=Muscle strength. Ct=Chemotherapy. *Chi-square test for heterogeneity. Values in bold are statistically significant (p≤0.05).

Table 4 describes the demographical variables and clinical history in relation to nutritional status according to BMI divided in two groups without malnourishment and malnourished. Similar proportions were observed between nutritional status and age (p=0.004), where 83.5% of the older adults and 96.8% of the adults were classified without malnourishment. Similar proportions (p=0.013) were verified between nutritional status and HGS where 95.2% of the individuals with normal muscle strength and 83.7% with muscle weakness were without malnourishment.

When adjusted PR was calculated to verify the relation between the presence of malnutrition and variables of exposure, an association between malnutrition per BMI, age and HGS was found. Thus, older adults presented fourfold likelihood of malnourishment when compared to adults (PR: 4.37; CI95% 1.29-14.76; p=0.018) and the presence of muscle weakness in relation to normal muscle strength increased twofold the likelihood of malnutrition

Still in table 5, after the adjusted analysis, it was observed association between malnutrition identified by PG-SGA with age, HGS and outcome after six months. Thus, older adults presented 95% more odds of malnourishment when compared to adults (PR: 1.95; CI 95% 1.17-3.23; p=0.010) and, in comparison with normal muscle strength, those with muscle weakness still presented twofold more odds of malnourishment (PR: 2.31; CI95% 1.35-3.95; p=0.002). Regarding outcome after six months, it was observed that those discharged and cured (PR: 2.17; CI95% 1.15-4.08; p=0.001) as well as those who died (PR: 2.25; CI95% 1.49-3.40; p=0.001), presented twofold more odds of malnutrition.

DISCUSSION

The objective of the study was to perform nutritional and functional assessment of oncologic patients of a school hospital in the city of Caxias do Sul/RS, in chemotherapy treatment and, after six months, evaluate their outcomes, identifying differences of the proportions between outcomes and variables of exposure in the population investigated. The study analyzes revealed the predominance of patients with cancer in the age-range above 60 years old, that is, older adults (55.3%), data that were estimated in other studies[14,19]. Furthermore, this predominance is justified because with the advance of age, the capacity of cell recovery diminishes[26]. Predominance of females (52.4%) found in the present study was already described by other authors[9,14] and can be explained because of higher female life expectancy and higher male mortality rate[27].

In relation to the location of the tumors, this study showed high prevalence of the oncohematologic disease (29.3%) and of breast cancer (13.9%). Corroborating these findings, Silva et al.[28] identified 24.0% of participants with hematologic cancer. According to the data of the National Cancer Institute José Alencar Gomes da Silva (INCA)[29], for 2020-2022, in Brazil, 4,890 new cases in

Table 4. Description of the demographic variables and clinical history of nutritional status according to BMI in individuals with oncologic diagnosis in outpatient chemotherapic treatment of a school-hospital in Caxias do Sul/RS. 2019 (n=208)

Variables of exposure	n (%)	Without malnutrition (n=186)	Malnutrition (n=22)	p-value*
Age				**0.004**
Adults	93 (44.7)	90 (96.8)	3 (3.2)	
Older adults	115 (55.3)	96 (83.5)	19 (16.5)	
HGS				**0.013**
Normal HGS	104 (50.0)	99 (95.2)	5 (4.8)	
Muscle weakness	104 (50.0)	87 (83.7)	17 (16.3)	
Outcome after 6 months				0.387
Oncologic treatment	140 (67.3)	128 (91.4)	12 (8.6)	
Discharged, cured	14 (6.7)	12 (85.70)	2 (14.3)	
Discharged from Ct, without cure	35 (16.8)	31 (88.6)	4 (11.4)	
Death	19 (9.1)	15 (78.9)	4 (21.1)	

Captions: RS=Rio Grande do Sul. BMI=Body Mass Index. HGS=Hand grip strength. Ct=Chemotherapy. *Chi-square test for heterogeneity. Values in bold are statistically significant (p≤0.05).

Table 5. Description of demographical variables and clinical history in relation to malnourishment according to BMI and PG-SGA in individuals with oncologic treatment in outpatient chemotherapic treatment of a school hospital of Caxias do Sul/RS. 2019 (n=208)

Variables of exposure	Malnutrition BMI Raw PR (CI 95%)	Malnutrition BMI Adjusted PR (CI 95%)	PG-SGA Malnutrition Raw PR (CI 95%)	PG-SGA Malnutrition Adjusted PR (CI 95%)
Age				
Adults	1	1	1	1
Older adults	5.12 (1.56-16.77)	4.37 (1.29-14.76)	2.31 (1.37-3.90)	1.95 (1.17-3.23)
p-value	**0.007**	**0.018**	**0.002**	**0.010**
HGS				
Normal MS	1	1	1	1
Muscle weakness	3.40 (1.30-8.87)	2.80 (1.05-7.45)	2.86 (1.70-4.82)	2.31 (1.35-3.95)
p-value	**0.012**	**0.039**	**≤0.0001**	**0.002**
Outcome after 6 months				
Oncologic treatment	1		1	1
Discharge, cured	1.66 (0.41-6.71)		2.00 (1.01-3.96)	2.17 (1.15-4.08)
Discharge of Ct, without cure	1.33 (045-3.88)		1.20 (0.63-2.29)	1.21 (0.70-2.20)
Death	2.45 (0.81-6.84)		3.19 (2.05-4.96)	2.25 (1.49-3.40)
p-value	0.378		**≤0.0001**	**0.001**

Captions: RS=Rio Grande do Sul. BMI = Body Mass Index. PG-SGA=Patient Generated Subjective Global Assessment. PR=Prevalence Ratio. CI=Confidence Interval. HGS=Hand grip strength. MS=Muscle Strength. Ct=Chemotherapy. PG-SGA Malnutrition=Includes "moderate malnutrition or suspected malnutrition" and "severe malnourished". Raw analysis to identify prevalence ratio and confidence intervals in 95%. Analysis adjusted through Poisson regression. Level of significance of 5%. Values in bold are statistically significant (p≤0.05).

women and 5,920 new cases in men are estimated for leukemia, and for non-Hodgkin lymphoma, 5,450 new cases in women and 6,580 new cases in men and, yet, for Hodgkin lymphoma, 1,050 new cases in women and 1,590 new cases in men[29]. For breast cancer, according to the 2020-2022 estimate, 66,000 new cases are anticipated in Brazil, being the second most incident cancer[29]. Similar data of this study were observed in the study of Marshall et al.[14] where among the most investigated cancer locations, breast cancer was the most frequent (ranging from 19.6% to 21.5% in the period of the study). The high frequency of breast cancer possibly occurred because of the progress of the access to diagnosis as, for instance, the periodic screening mammography to detect this disease in older women[30].

In relation to muscle functioning, 50.0% of the individuals with cancer had muscle weakness, similar findings of the study of Valente et al.[19], where 50.0% and 40.0% of the investigated presented inadequate HGS, characterizing muscle weakness. Additionally, according to study performed with individuals with lung cancer, 57.0% of the interviewees had muscle weakness[31]. In a study with neuroendocrine cancers, muscle weakness was identified in 25.0% of the participants[7], results lower than the present study. According to Willemsen et al.[5], 23.0% of the patients with cancer in treatment had loss of muscle mass, more toxicity from the treatment, demanded more unplanned hospitalization and unfavorable prognosis. In addition, studies identified that muscle strength measured by manual dynamometry was influenced by the treatment, reducing significantly[5,6]. Thus, it is believed that the muscle functionality identified is influenced and harmed during the treatment, increasing the prevalence of muscle weakness, reducing the possibility of favorable prognosis.

The nutritional status per BMI verified the prevalence of malnutrition of 10.6%. According to studies[7,14], the prevalence of malnutrition according to BMI ranges from 9.6% to 13.4%, approximated results of the present study. However, it was observed that, overweight patients in the beginning of the treatment, together with chemotherapy, had more weight loss and reduction of the functional capacity during the treatment[9]. Based in the results obtained, it is suggested that the use of BMI, although utilized frequently and considered a method to evaluate the nutritional status, appears to present data that fail to allow the proper follow up of the nutritional status in oncologic patients.

The evaluation of the nutritional status through PG-SGA identified the prevalence of moderate malnutrition or suspected malnutrition (231%), and severe malnutrition

(4.8%). According to Valente et al.[19] 30% of the investigated by PG-SGA were moderately malnourished and 30.0%, severely malnourished. In individuals with lung cancer, 73.0% were moderately malnourished and 8.0%, severely malnourished[31]. Nationally, the prevalence of malnutrition was nearly 63.0%[10,32]. Based in the data of the literature, the findings of this study are lower than the identified. In addition, it is known that for individuals with cancer, the prevalence of malnutrition tends to increase during the treatment[9]. According to a study, the prevalence of malnutrition increased nearly 9.0% after the first cycle of the chemotherapic treatment[6]. Therefore, it is relevant to assess the nutritional status in this population by different diagnosis methods, because it is a parameter that permits to visualize the prognosis of the patient[14], and implement adequate nutritional strategies for better results with the treatment and improving the quality of life.

Examining the nutritional status, it stands out the difference of the results among the methods evaluated where, per BMI, eutrophic individuals (28.6%) and with overweight (12.7%) were moderately malnourished, and according to PG-SGA, with suspected malnourishment. Associations between the results of PG-SGA and BMI have already been identified[14]. Nevertheless, discrepancies between the two methods were described by Silva et al.[33], who presented as one of the motives, more specificity of PG-SGA for malnutrition diagnosis in oncologic individuals. Corroborating these findings, in some studies[18,34], the PG-SGA method was more trustworthy and specific for nutritional status of these patients. Thus, BMI, it must be emphasized, fails to present trustworthy results of the nutritional status of oncologic patients in chemotherapic treatment.

For malnourishment with age, older adults presented more odds of malnutrition either by BMI or PG-SGA. Malnutrition was associated to advanced age in a multicentric study conducted in Australia[14], where the prevalence of malnutrition ranged from 28.7% to 34.9%, similar to the identified in this study. However, even higher results have been described by Santos et al.[35], who found a range from 34.4% to 58.4% of malnutrition in individuals older than 60 years. In addition to normal causes of malnourishment in patients with neoplasms, older adults still suffer with loss of dentition, dry mouth, lack of natural appetite with ageing, poor ambulation and depression[36]. Therefore, it is suggested that advanced age in oncologic patients in chemotherapeutic treatment is a risk factor for the appearance of malnutrition affecting the prognosis of the disease negatively[14].

Studies indicate that the depletion of the nutritional status and muscle weakness, regardless of the causes, influence the diagnosis and patients' survival[5,9,14]. In this study, the participants with muscle weakness had more odds of being malnourished according to PG-SGA. Reinforcing the findings of this survey, studies observed correlations and associations between muscle weakness measured by HGS and PG-SGA results; thus, as lower the HGS, higher are the odds of malnutrition[19,31,37]. In addition, in a follow up study, it was verified that HGS was affected by the treatment, the prevalence of muscle weakness was 17.0% in the beginning of the treatment, raising to 31.0% in the end of the treatment[9]. Therefore, it is believed that muscle weakness is a risk factor for malnutrition in the sample investigated. Furthermore, it is suggested that muscle weakness, together with the evaluation of the nutritional status, is considered an effective marker to follow up the nutritional evolution during the chemotherapic treatment.

The consequences of nutritional deficit are related to the clinical evolution of this individual with more risk of postoperative complications, poor quality of life, increase of morbimortality, of hospitalization time and high cost to the health system[38]. Examining PG-SGA in relation to the outcome analyzed after six months for death, 52.0% of the individuals were moderately malnourished or suspicion of malnourishment and 15.8% were severely malnourished. In addition, in this study, the patients who died after six months of evaluation had twofold more odds of malnourishment. Corroborating these findings, according to the study, the relative risk of death in six months for patients with severe malnourishment was 1.8 higher than for patients without malnourishment[20]. Yet, the survival in six months of severely malnourished individuals was lower compared to patients without malnourishment[20]. In addition, malnourished individuals had higher mortality rate in one year, regardless of age or duration of the treatment[11]. According to Orell et al.[9], the survival in five years of well-nourished individuals was 70.0% and 43.0% for those with basal malnourishment. In the same study, while evaluating the median survival, for well-nourished individuals, the survival was 50 months, but for those malnourished, survival was only 38 months[9]. Nearly 20% of the deaths of oncologic patients occurred because of complications from malnourishment and not the disease itself[17]. Thus, it is believed that the early identification of malnourishment or risk of malnourishment in oncologic patients in chemotherapic treatment, in addition to ensuring the visualization of the prognosis of the disease, favors the creation of strategies to contain the depletion of the nutritional status and afford extended survival to the patients.

Studies indicate that anorexia resulting from inappetence, treatment-related unexpected gastrointestinal symptoms, exhaustion, cachexia among other influence the

poor nutritional intake and, consequently, are associated with weight loss and malnutrition[7,9,10]. However, these factors were not analyzed in the present study, it is believed that they may have influenced the nutritional status of the participants during the treatment.

The heterogeneity of the population studied, the evaluation of the body composition where it was not verified the percent of the muscle mass and the absence of data about the disease staging are limitations of the study and may have been biases.

However, it must be mentioned that the present study counted with a substantial sample, being possible to collect a large amount of relevant information, the PG-SGA was applied and HGS was measured for all the participants. Both the nutritional evaluation and the measure of muscle functionality are golden-standard, non-invasive, fast and simple methods complementing each other and favoring the aimed association and more accurate diagnosis[2,5,16-18].

CONCLUSION

The conclusion is that most of the investigated in the present study were not malnourished, but it was observed high prevalence of muscle weakness. In the end of the study, of the individuals whose outcome was death, more than 68% were malnourished. The risk factors identified for malnourishment were age and muscle weakness.

Therefore, it is essential a more comprehensive nutritional evaluation for early detection of nutritional risk. In addition, it is clear the necessity of more studies that can identify the factors associated to malnourishment, muscle weakness and clinical outcomes during the treatment.

CONTRIBUTIONS

Ana Luísa Zanella Maurina contributed for the conception and design of the study, gathering, analysis and interpretation of the data and wording. Rafaela Santi Dell'Osbel contributed for the analysis and interpretation of the results, wording and critical review. Joana Zanotti contributed for the conception and design of the study, analysis, interpretation of the data and critical review. All the authors approved the final version to be published.

DECLARATION OF CONFLICT OF INTERESTS

There is no conflict of interests to declare.

FUNDING SOURCES

None.

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Recebido em 18/4/2020
Aprovado em 14/5/2020