Nutritional Parameters in Patients with Cancer attended at a Reference Center in the south of Minas Gerais state, Brazil

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Parâmetros Nutricionais em Pacientes Oncológicos atendidos em um Centro de Referência no Sul de Minas Gerais, Brasil

Parámetros Nutricionales en Pacientes Oncológicos asistidos en un Centro de Referencia en el Sur de Minas Gerais, Brasil

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Abstract

Introduction: Nutritional counseling for patients with cancer is very important, because it can prevent nutritional deficiencies and other serious complications. **Objective:** To evaluate the nutritional profile of oncological patients. **Method:** Cross-sectional study, carried out at a reference center in Oncology, Alfenas, Minas Gerais, Brazil. Dietary and anthropometric methods (body mass index [BMI], triceps skinfold [TS], arm circumference [AB], arm muscle circumference [AMC], and percentage of weight loss [PWL]) were used to trace the nutritional profile of 52 oncological patients (n=52) during chemotherapy. Other conditions of health were also evaluated. **Results:** There was a predominance of female sex (63%), and the age group >50 years (40% CI95[%] 27-53.7). The type of cancer correlated with patient's sex (p<0.01). In female sex, the breast cancer had a prevalence of 51%, followed by the uterus cancer (18%). In male sex, the prevalence of prostate cancer was 10%, and, common to both sexes, lung cancer had a prevalence of 15%, being the most prevalent in males (32%). Systemic arterial hypertension was the most reported comorbidity (75%), and motion sickness the most common adverse event (69%). The mean values of the parameters BMI, TS, AB and AMC did not change significantly (p>0.05) at the end of the treatment, but 40% of the patients had a severe PWL, 23% no severe PWL, 4% kept the weight, and 33% presented weight gain. Among the patients evaluated, 48% used nutritional supplements. **Conclusion:** Nutritional counseling should be developed together with oncological patients, since we showed a variable nutritional profile in a heterogeneous sample of patients.

Key words: Cancer; Chemotherapy; Body Mass Index; Hypertension.

Resumo

Introdução: A orientação nutricional é de extrema importância para pacientes oncológicos, prevenindo deficiências nutricionais que podem gerar sérias complicações. **Objetivo:** Avaliar o perfil nutricional de pacientes oncológicos. **Método:** Estudo transversal, realizado em um Centro de Referência em Oncologia de Alfenas - MG. Para traçar o perfil nutricional de 52 pacientes oncológicos (n=52) durante o tratamento quimioterápico, foram utilizados métodos dietéticos e antropométricos (índice de massa corporal [IMC], prega cutânea tricipital [PCT], circunferência do braço [CB], circunferência muscular do braço [CMB] e percentagem da perda de peso [%PP]). Dados gerais de saúde dos pacientes foram também avaliados. **Resultados:** Houve predominância do sexo feminino (63%), faixa etária >50 anos (40% IC95% 27-53,7). O tipo de câncer correlacionou-se ao sexo (p<0,01). No sexo feminino, o de mama teve prevalência de 51%, seguido pelo uterino (18%). No masculino, a prevalência de câncer de próstata foi de 10% e, comum aos dois sexos, o câncer de pulmão, de 15%, sendo o mais prevalente no masculino (32%). Hipertensão arterial sistêmica foi a comorbidade mais reportada (75%) e enjoos, o efeito adverso mais comum (69%). As médias dos parâmetros IMC, PCT, CB e CMB não sofreram alterações significativas (p>0,05) ao final do tratamento, mas 40% dos pacientes tiveram um grave %PP, 23% não grave %PP, 4% mantiveram o peso e 33% apresentaram ganho de peso. Entre os pacientes avaliados, 48% usavam suplementos nutricionais. **Conclusão:** A orientação nutricional deve ser desenvolvida junto aos pacientes oncológicos, desde que se demonstrou um variado perfil nutricional em uma amostra heterogênea de pacientes.

Palavras-chave: Câncer; Quimioterapia; Índice de Massa Corporal; Hipertensão.

Resumen

Introducción: La orientación nutricional es de extrema importancia para los pacientes oncológicos, previniendo deficiencias nutricionales que pueden generar serias complicaciones. **Objetivo:** Evaluar el perfil nutricional de 52 pacientes oncológicos. **Método:** Estudio transversal, realizado en un centro de referencia en Oncología de Alfenas, Minas Gerais, Brasil. Para desenar el perfil nutricional de 52 pacientes oncológicos (n=52) durante la quimioterapia, se utilizaron métodos dietéticos y antropométricos (índice de masa corporal [IMC], pliegue cutáneo tricipital [PCT], circunferencia del brazo [CB], circunferencia muscular del brazo [CMB]) y el porcentaje de la pérdida de peso [% PP]). Se evaluaron también los datos generales de salud de los pacientes. **Resultados:** Hubo predominancia del sexo femenino (63%), y la franja de edad >50 años (40% IC95% 27-53,7). El tipo de cáncer se correlacionó con el sexo (p<0,01). En el sexo femenino, el de mama tuvo prevalencia del 51%, seguido por el uterino (18%). Para el sexo masculino, la prevalencia de cáncer de próstata fue del 10% y, común a los dos sexos, el cáncer de pulmón tuvo una prevalencia del 15%, siendo el más prevalente el sexo masculino (32%). Hipertensión arterial sistémica fue la comorbilidad más reportada (75%), y mareo el efecto adverso más común (69%). Los valores de los parámetros IMC, PCT, CB y CMB no sufrieron cambios significativos (p>0,05) al final del tratamiento, pero el 40% de los pacientes tuvieron una grave % PP, el 23% una no grave % PP, el 4% mantuvieron el peso y el 33% de los evaluados presentaron una ganancia de peso. Entre los pacientes evaluados, 48% usaban suplementos nutricionales. **Conclusión:** La orientación nutricional debe desarrollarse junto a los pacientes oncológicos, una vez que se haya demostrado un variado perfil nutricional en una muestra heterogéneo de pacientes.

Palabras clave: Cáncer; Quimioterapia; Índice de Masa Corporal; Hipertensión.

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INTRODUCTION

Estimates by the World Health Organization (WHO) for 2030 point to 27 million new cancer cases and 75 million persons living with the disease worldwide, with approximately eight million deaths, 70% of which in developing countries. In Brazil, for the two-year period 2018-2019, estimates point to approximately 600 thousand incident cancer cases[1].

According to the Brazilian National Cancer Institute José Alencar Gomes da Silva (INCA), cancer is the term used for a set of more than 100 diseases, all characterized by disordered growth of cells, which invade tissues and organs, potentially reaching other sites in the body in the process known as **metastasis**[1]. Environmental and genetic factors contribute to the genesis of cancer, and treatment strategies include radiotherapy, chemotherapy, and surgery or a combination thereof. Chemotherapeutic agents can cause side effects, including anorexia, nausea, vomiting, stomatitis, diarrhea, and necrotizing enterocolitis, compromising the patient's nutritional status[2,3].

Cancer and the paraneoplastic syndromes, as well as the side effects of chemotherapy and radiotherapy, can cause metabolic alterations, jeopardize food intake, compromise nutritional supply, and thus cause malnutrition in the patient. Nutritional orientation is thus an important non-pharmacological treatment strategy for preventing and minimizing the symptoms arising from the disease and/or treatment[2-9], contributing significantly to health promotion and improvements in quality of life for cancer patients. Therefore, the current study verified the nutritional profile of cancer patients treated at a referral hospital in southern Minas Gerais State, Brazil, aimed at identifying the main nutritional and health alterations during and after antineoplastic chemotherapy.

METHOD

This was a cross-sectional study performed in a cancer referral hospital in Alfenas, southern Minas Gerais State, Brazil. Inclusion criteria were patients of both sexes 18 years and older with a cancer diagnosis and undergoing chemotherapy sessions. Data were collected from September 2017 to February 2018 by researchers trained with a pilot study involving 10% of the final sample size, and the results of the measurements were compared with the kappa statistic (degree of interobserver agreement >0.8). The sample excluded patients with edema, unable to walk, and/or in use of enteral diet.

The study was approved by the Institutional Review Board of Universidade José do Rosário Vellano (Unifenas-Alfenas) under protocol CAAE: 73410817.2.0000.5143, and prior written consent was obtained from patients after reading and clarification of the research objectives and signing a free and informed consent form.

Tracing the nutritional profile used anthropometric and dietary methods. In the anthropometric assessment, the measures used were body mass index (BMI) and triceps skinfold (TSF), which show the reserve body fat; arm circumference (AC), representing the sum of bone, muscle, and fat tissue; and arm muscle circumference (AMC), which indicates the involvement of muscle tissue. Body weight was measured with a digital/electronic anthropometric scale (Ramuza).

Body weight at the start of treatment was obtained from the patient's chart. This allowed obtaining the percent weight loss (%WL), calculated by the formula: current weight – usual weight/usual weight X 100, where significant loss was defined as greater than or equal to 5% weight loss in one month, greater than or equal to 7.5% in three months, or greater than or equal to 10% in six months.

Height was obtained from the patient's medical chart. Data on weight and height were used to calculate BMI, consisting of weight in Kg divided by the square of height in meters. To measure TSF, we first used a fiberglass tape measure (1.5 m, *Worker*) to measure AC, after which we used a clinical skinfold caliper accurate to approximately 1 mm to determine the TSF.

Three measurements were taken on the non-dominant arm, and the final value was the mean of the three. This measurement was then used to calculate AMC. In this anthropometric assessment, classification of nutritional status according to TSF, AC, and AMC followed the guidelines proposed in the literature[10,11]. Data on patients' clinical history were obtained from their medical charts. Blood pressure (BP, mmHg) was measured during follow-up. All parameters were assessed during and after antineoplastic chemotherapy. Due to the different clinical protocols for these treatments, mean treatment time was estimated as 90 days.

The data are presented as absolute values, percentages, and/or mean ± standard deviation (SD). Comparison of means used the Student's t-test for two matched (dependent) samples, with 5% level of significance. Multivariate analysis was used to verify the correlation between variables simultaneously, based on principal components analysis[12]. Fisher's exact test at 5% level of significance was used to assess independence between two qualitative variables. These analyses were performed with the R software (*R Core Team*, 2017). A 95% confidence interval (95%CI) was constructed using the *BioEstat*® software, version 5.0.

RESULTS

Table 1 shows the demographic data and clinical/nutritional conditions in the study sample. There was a predominance of female cancer patients (63%), with a mean age of approximately 56 years. As for type of cancer, among the 33 women evaluated, 17 presented breast cancer (prevalence of 51%), followed by six with uterine cancer (prevalence of 18%). In males, the proportion of prostate tumors was 10%. Among cancers common to both sexes, lung cancer was the most frequent (8 patients, 6 of whom were males), with an overall proportion of 15%, more prevalent in males (32%). The types of cancer differed in relation to sex (p<0.01).

All patients in the sample were undergoing chemotherapy, 53% of whom in biweekly cycles and 47% in weekly cycles. Mean treatment time at the date of data collection was five months. The profile of medications shown in Table 1 refers to chemotherapy plus palliative therapy for the adverse effects of chemotherapy (such as ranitidine for gastric ulcers; diphenhydramine, an antihistamine used to treat allergic reactions; and ondansetron, used to relieve the nausea and vomiting related to chemotherapy) and/or to treat other diseases (e.g., cephalothin, an antibiotic), since only five patients did not present comorbidities.

As for patients' diet, only 1.92% presented dietary restrictions, while 48.08% were using some type of energy supplement (Table 1). Figure 1 shows the results of the anthropometric assessment, including BMI (Figure 1 A), AC (Figure 1 B), classification of AMC (Figure 1 C), adequacy of TSF (Figure 1 D), and %WL (Figure 1 E). According to %WL, 40% of patients showed severe weight loss, 23% non-severe loss, and only 4% maintained their weight during treatment. Thirty-three percent of the patients showed weight gain at the end of the study.

As shown in Table 2, no significant difference was seen between the means during and after treatment for the anthropometric and dietary parameters or for blood pressure (p>0.05). However, in general, Figure 2 shows that these variables are highly correlated with each other; in other words, an increase in one can be due to an increase in the other(s), and vice versa (assessed by multivariate analysis). The data obtained during and at the end of treatment for the anthropometric and dietary parameters showed strong correlation between the variables, and the lines in the same direction indicate that they are directly proportional; that is, an increase in one variable leads to an increase in all the others (Figure 2 A). Importantly, there was a strong correlation between systolic pressure (baseline, during, and at the end of treatment) and these variables, indicating that at higher BMI, blood pressure

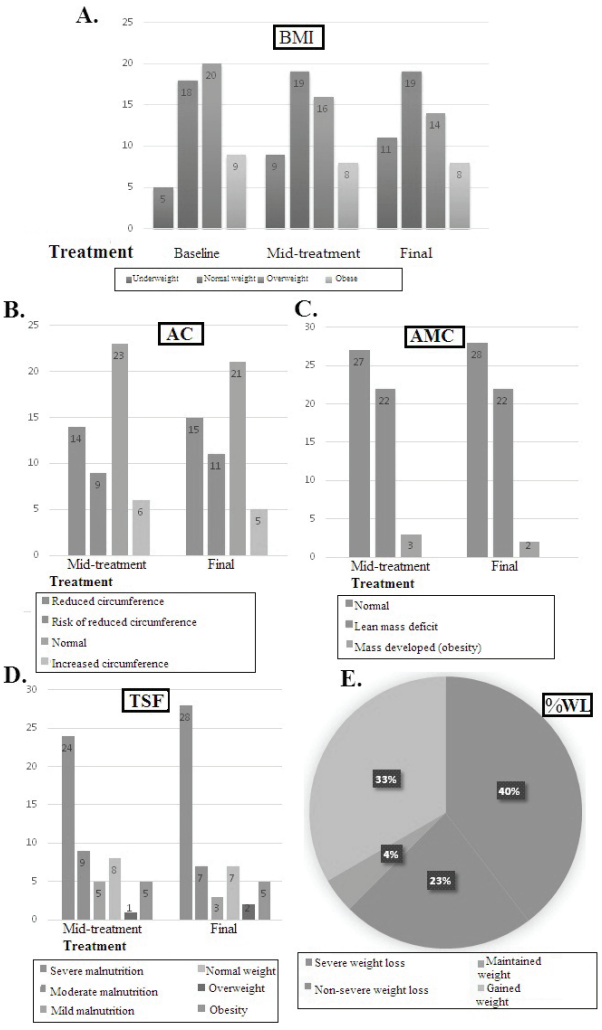

Figure 1. Number of cancer patients according to anthropometric and dietary parameters

A. Distribution of 52 cancer patients assessed for nutritional status according to BMI. B. Distribution of 52 cancer patients assessing according to AC classification. C. Distribution of 52 cancer patients assessed according to AMC classification. D. Distribution of 52 cancer patients assessed according to TSF adequacy. E. Percentage of cancer patients according to weight variation during treatment.

Key: BMI = body mass index; AMC = arm muscle circumference; AC = arm circumference; TSF = tricipital skinfold; %WL= percentage weight loss.
Reference values: BMI (normality) → Age bracket: 19 – 24 (19-24 kg/m²); 25-34 (20-25 kg/m²); 35-44 (21-26 kg/m²); 45-54 (22-27 kg/m²); 55-64 (23-28 kg/m²); >65 (24-29 kg/m²) [classification for elderly (> 60 years): BMI < 22 →underweight; 22-27 → normal weight; >27→ excess weight].

tends to increase, and thus one can expect an increase in all the other variables. The map of observations in Figure 2 B illustrates the distribution of the 52 patients across the four quadrants. Approximately 45% of the patients were in the first and second quadrants on the right (upper and lower, respectively), and 55% were in the quadrants on the left (clockwise, the third and fourth, lower and upper, respectively). This indicates that the target variables were more frequent in 45% of the participants.

Table 1. Demographic data and clinical/nutritional conditions in the sample of cancer patients (n=52) treated at a referral center in southern Minas Gerais State, Brazil, September 2017 to February 2018

Variables / Sex		Male (M) (*n*=19, 37%; IC95% 23.5-49.6)		Female (F) (*n*=33, 63%; IC95% 50.4-76.5)		Total (*n*=52)
		n **(%[B])**	**IC95(%)**	***n*** **(%[B])**	**IC95(%)**	***n*** **(%)**
Age bracket (years)[ns]	18-50	5 (10%)	NA	12 (23%)	11.6-34.5	17 (33%)
	Age bracket (years)[ns]	14 (27%)	14.9-39	21 (40%)	27-53.7	35 (67%)
	Total	19 (37%)		33 (63%)		52 (100%)
Types of cancer**	Breast	0	NA	17 (33%)	19.9-45.4	17 (33%)
	Lung	6 (11%)	2.9-20.2	2 (4%)	NA	8 (15%)
	Rectal	3 (5%)	NA	4 (8%)	NA	7 (13%)
	Uterine	0	NA	5 (10%)	NA	5 (10%)
	Prostate	2 (4%)	NA	0	NA	2 (4%)
	Esophagus	2 (4%)	NA	0	NA	2 (4%)
	Intestine	1 (2%)	NA	1 (2%)	NA	2 (4%)
	Types of cancer**	1 (2%)	NA	1 (2%)	NA	2 (4%)
	Stomach	2 (4%)	NA	0	NA	2 (4%)
	Liver	1 (2%)	NA	1 (2%)	NA	2 (4%)
	Oropharynx	1 (2%)	NA	0	NA	1 (2%)
	Mouth	0	NA	1 (2%)	NA	1 (2%)
	Duodenum	1 (2%)	NA	0	NA	1 (2%)
Side effects[ns]	Constipation	10 (19%)	8.5-29.9	14 (27%)	14.9-39	24 (46%)
	Nausea	12 (23%)	11.6-34.5	24 (46%)	32.6-59.7	36 (69%)
	Diarrhea	2 (4%)	NA	3 (6%)	NA	5 (10%)
	Vomiting	6 (11%)	2.9-20.2	4 (8%)	NA	10 (19%)
	Fever	2 (4%)	NA	0	NA	2 (4%)
Comorbidities[ns]	SAH	16 (31%)	18.2-43.3	23 (44%)	30.7-55.7	39 (75%)
	None	0	NA	5 (10%)	NA	5 (10%)
	DM	0	NA	3 (5%)	NA	3 (5%)
	Depression	0	NA	3 (5%)	NA	3 (5%)
	Side effects[ns]	0	NA	3 (5%)	NA	3 (5%)
	Othe[rA]	1 (2%)	NA	7 (13%)	4.2-22.7	8 (15%)
Medications[ns]	Antiparasitic	0	NA	3 (5%)	NA	3 (5%)
	Capecitabine	0	NA	11 (21%)	10.1-32.3	11 (21%)
	Ranitidine	10 (19%)	8.5-29.9	22 (42%)	28.9-55.7	32 (61%)
	Cyclophosphamide	0	NA	1 (2%)	NA	1 (2%)
	Diphenhydramine	1 (2%)	NA	3 (6%)	NA	4 (8%)
	Gemcitabine	1 (2%)	NA	4 (8%)	NA	5 (10%)
	Comorbidities[ns]	3 (6%)	NA	3 (6%)	NA	6 (12%)
	Etoposide	4 (8%)	NA	2 (4%)	NA	6 (12%)
	Carboplatin	1 (2%)	NA	3 (6%)	NA	4 (8%)
	Fluorouracil	2 (4%)	NA	2 (4%)	NA	4 (8%)
	Oxaliplatin	1 (2%)	NA	1 (2%)	NA	2 (4%)
	Cephalothin	0	NA	1 (2%)	NA	1 (2%)
Dietary restrictions[ns]	Yes	1 (2%)	NA	0	NA	1 (2%)
	No	18 (35%)	21.4-47.5	33 (64%)	50.4-76.5	51 (98%)
	Total	19 (37%)		33 (63%)		52 (100%)
Use of nutritional supplements	Yes	13 (25%)	13.2-36.8	12 (23%)	11.6-34.5	25 (48%)
	No	6 (12%)	2.9-20.2	21 (40%)	27-53.7	27 (52%)
	Total	19 (37%)		33 (63%)		52 (100%)

Key: In relation to the sex variable: **significant at nominal level of 1% (p<0.01); nsnot significant at 5% (p>0.05) according to Fisher's exact test. SAH: systemic arterial hypertension; DM: diabetes mellitus; aothers: hypothyroidism (n=2, F), hepatitis (1, F), bronchitis (1, M), asthma (1, F), cardiopathy (1, F), osteoporosis (1, F), anorexia (1, F). Bpertains to n=52 (total men and women); NA: 95%CI not applicable (NPQ <5).

Table 2. P-values by comparison of means during and after treatment

Comparison=	Mean	Standard deviation	Valor *p*
BMI during	25.33	5.64	0.7486^{ns}
Final BMI	24.98	5.71	
AMC during	22.44	3.49	0.6233^{ns}
Final AMC	22.12	3.29	
AC during		27.63	1.0000^{ns}
Final AC	27.13	4.98	
TSF during	16.58	7.63	0.6007^{ns}
Final TSF	15.79	7.68	
SBP during	120.59	10.54	0.5460^{ns}
Final SBP	119.42	9.16	
DBP during	72.79	10.86	0.7503^{ns}
Final DBP	73.46	10.64	

Key: ^{ns}not significant at 5% (p>0.05), according to Student's t-test. BMI: body mass index; AMC arm muscle circumference; AC: arm circumference; TSF: tricipital skinfold; SBP: systolic blood pressure; DBP: diastolic blood pressure. **Reference values:** BMI (normality) → age bracket: 19-24 (19-24 kg/m²); 25-34 (20-25 kg/m²); 35-44 (21-26 kg/m²); 45-54 (22-27 kg/m²); 55-64 (23-28 kg/m²); >65 (24-29 kg/m²) [classification for elderly (>60 years): BMI <22 → underweight; 22-27→ normal weight; >27→ excess weight]; normal values for SBP ≤140 mmHg and DBP ≤90 mmHg (observation: according to WHO, individuals with systemic hypertension show SBP ≥ 140 mmHg or DBP ≥ 90 mmHg or are on antihypertensive medication).

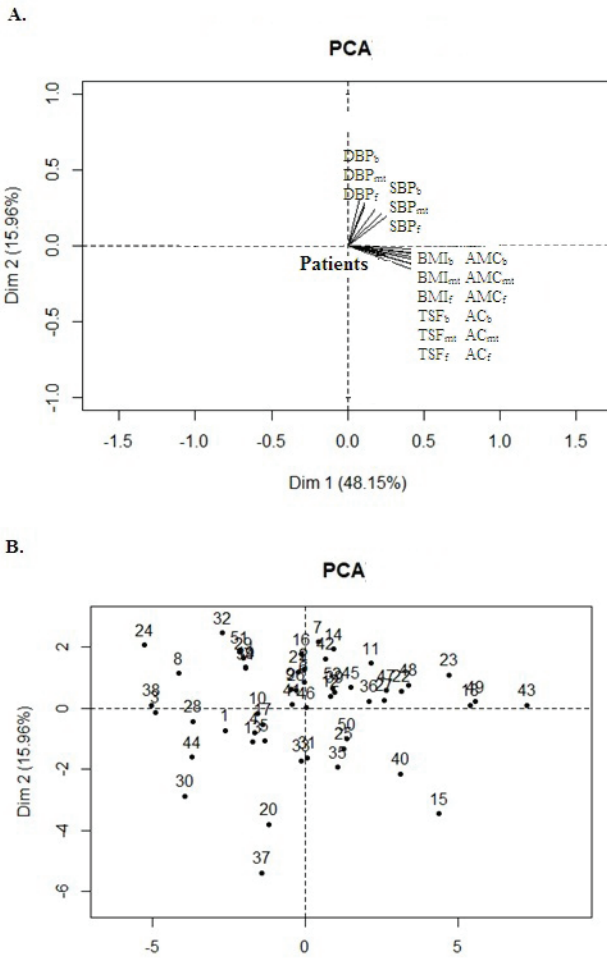

Figure 2. Multivariate statistical maps in the sample of 52 cancer patients.
A. Map showing correlation between target variables. B. Map of observations showing the distribution of 52 participants across four quadrants.
Key: SBPb = baseline systolic blood pressure; SBPmt = mid-treatment systolic blood pressure; SBPf = final systolic blood pressure; DBPb = baseline diastolic blood pressure; DBPmt = mid-treatment diastolic blood pressure; DBPf = final diastolic blood pressure;; BMIb = baseline body mass index; BMImt = mid-treatment body mass index; BMIf = final body mass index; TSFb = baseline tricipital skinfold; TSFmt = mid-treatment tricipital skinfold; TSFf = final tricipital skinfold; AMCb = baseline arm muscle circumference; AMCmt = mid-treatment arm muscle circumference; AMCf = final arm muscle circumference; ACb = baseline arm circumference; ACmt = mid-treatment arm circumference; AMCf = final arm circumference.

DISCUSSION

In the current study, as in Tartari et al.[4], there was a predominance of female cancer patients, the highest proportion of whom had breast cancer, confirming the data reported by INCA[1], showing that next to non-melanoma skin cancer, breast cancer is the most common cancer in women in Brazil and worldwide. Breast cancer increases in incidence after 50 years of age, as shown in the current study, in which the majority of patients were in this age bracket.

This study showed a broad profile of comorbidities, patient-reported adverse effects, and associated pharmacotherapy. Symptoms reported by patients such as constipation, nausea, vomiting, and diarrhea can be related to chemotherapy, according to Marchry et al.[8], and it is common for all cancer patients in chemotherapy to experience at least one of these symptoms. This may compromise the food intake and thus the nutritional status of cancer patients. According to Ravasco[9], the most practical way and usually the most effective way to assist nutritional therapy in cancer patients is the use of oral protein supplements, which play an important role in the presence of abnormal food intake. In the current study, 48% of cancer patients were using oral supplements in order to increase their weight gain and maintain them as well-nourished as possible. According to Meyenfeldt[13], oral food supplements are the best option for early nutritional intervention, which can increase food intake, serving as a simple, natural, and non-invasive method. Argilés[14] also corroborates the importance of nutritional intervention through dietary orientation and use of oral supplements in order to prevent or treat malnutrition, increase the effects of treatment, and improve quality of life for cancer patients.

In general, the more aggressive the cancer treatment, the quicker the associated malnutrition, decreasing the patient's quality of life. As examples, Dias et al.[2] reported that improvement in nutritional status increases the

patient's response to cancer treatment and reduces the side effects, with better adaptation to the rehabilitation program. Furthermore, Scantz et al.[15] and Maio et al.[16] found decreased BMI in few patients they assessed, which may have been due to fluid retention, protein breakdown, and expansion of extracellular fluid, thus masking the patient's real nutritional status. Consistent with Scantz et al.[15] and Maio et al.[16], Azevedo et al.[5] confirmed the prevalence of decreased BMI in few patients, suggesting that cancer patients can present a decrease in cell mass and expansion of other compartments. Still, Pelissaro et al.[16] reported that BMI is an isolated diagnostic parameter with various limitations. In the current study, there were no significant differences in BMI between the periods analyzed. Mean BMI at baseline was 26.3 Kg/m², indicating overweight; halfway through treatment it was 25.3 Kg/m² (classified as overweight); and at the end of treatment it was 24.9 Kg/m² (indicating borderline normal weight). This high baseline BMI may be related to the most prevalent type of cancer, which in this study was breast cancer, since most of the interviewees with overweight and obesity presented breast cancer. Tartari et al.[4] reported an association between weight gain and elevated BMI in breast cancer patients. Kitynec et al.[18] reported that the cause of this weight gain is not clear, but that it may be related to food intake, decreased physical activity, altered baseline metabolic rate, and/or menopause.

The current study showed a 40% rate of severe weight loss in patients in chemotherapy, which could be expected as resulting from side effects of treatment, since 98% of the patients presented gastrointestinal manifestations. These data are consistent with Dias et al.[2], who found 55% prevalence of weight loss, and half of the patients also presented gastrointestinal manifestations and decreased energy intake alongside the weight loss, increasing the risk of malnutrition. There was a considerable percentage of weight gain during treatment, which may also be related to the prevalence of the type of cancer. Still, excess weight can be associated with chronic noncommunicable diseases such as systolic hypertension. Corroborating this fact, as in the study by Del Rio et al.[6], the current study found increased prevalence of hypertension (75%). Adding to these findings, Souza et al.[19] observed that the use of chemotherapeutic agents and adjuvant drugs in cancer treatment increases patient survival but also increases the incidence of hypertension.

The majority of the patients in this study presented normal arm circumference both halfway through treatment and at the end, while 28% were classified as having reduced AC, unlike the study by Tartari et al.[4], in which most of the interviewees presented nutritional risk and risk of malnutrition. TSF measurement showed a 53% prevalence of severe malnutrition both halfway through treatment and at the end, reflecting greater nutritional deficit compared to assessment by BMI, which showed fewer malnourished patients. This difference was also found by Garófolo et al.[20], suggesting that TSF results in a higher percentage of nutritional deficit when compared to BMI. Weight alone does not clearly reflect the body segment affected by the nutritional deficit, as also reported by Ikemori et al.[21]. Analyzing the data on AMC, there was a prevalence of normal AMC both halfway through treatment and at the end, unlike the findings by Lopez & Petrilli et al.[7], who reported that patients showed signs of very severe depletion. In the current study, decreased lean mass was found in 42% of patients both halfway through chemotherapy and at the end.

CONCLUSION

This study found adverse effects from antineoplastic chemotherapy and treatment of comorbidities, which may have influenced the nutritional status of these cancer patients. The nutritional parameters assessed individually here did not show significant alterations during treatment. However, when the data were analyzed jointly, there were variations in weight and nutritional status, also correlated with other health parameters, which is relevant to nutritional interventions (such as the use of supplements and adjustments to diet), aimed at avoiding health problems such as malnutrition and improving the quality of life for cancer patients.

CONTRIBUTIONS

Ana Cláudia Lucas Mezavila Carvalho and Patricia Calori Martins contributed to the study design, data collection, writing of the article, and approval of the final version. Rhanna Bueno Araujo participated in the study design, data collection, writing of the article, and approval of the final version. Cláudio Daniel Cerdeira contributed to the study design, data analysis and interpretation, writing of the article, and approval of the final version. Roberta Bessa Veloso Silva participated in the study design, statistical analysis of the data, writing of the article, and approval of the final version. Gérsika Bitencourt Santos Barros participated in the study design, data collection, writing of the article, and approval of the final version.

CONFLICT OF INTEREST:

None.

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