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Energy and nutrient intake in ostomy patients and correlations with anthropometric variables: results from a reference hospital in the State of Pernambuco, Brazil

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ABSTRACT – **Background** – Studies that assess the food intake and nutritional status of ostomy patients are scarce in the literature. However, such individuals have symptoms in the postoperative period that determine changes in the intake of calories and nutrients as well as anthropometric variables. **Objective** – Estimate the energy and nutrient intake of ostomy patients and determine correlations with anthropometric variables. **Methods** – A cross-sectional study was conducted with ostomy individuals in outpatient follow-up at a reference hospital for postoperative ostomy surgery in the city of Recife, Brazil. Demographic, socioeconomic, clinical, anthropometric, and dietary data were collected through interviews and from patient charts. Statistical analyses were performed with the aid of the Statistical Package for the Social Sciences, version 13.0 for Windows, with the level of significance set at 5% ($P \leq 0.05$). **Results** – The sample was composed of 100 individuals (54% males) with a mean age of 55.1±15.4 years. Colostomy patients predominated (82%) and had a greater frequency of excess weight compared to ileostomy patients (86.36% versus 13.64%). Median intake was below the Estimated Average Requirements, especially for vitamins A, C, and E. Significant inverse correlations were found between carbohydrate intake and both arm circumference and triceps skinfold ($P=0.0302$ for each) and a positive correlation was found between protein intake and arm muscle circumference ($P=0.0158$) in male patients. **Conclusion** – The present study found significant correlations between macronutrient intake and anthropometric variables indicative of reserves of lean and adipose mass. Moreover, intake was below the recommended values according to sex and age group, especially with regards to vitamins.

Keywords – Ostomy; food intake; nutrients; anthropometry.

INTRODUCTION

The word ostomy has a Greek origin (*stóma*) and is a temporary or definitive opening connecting the bowels to the external environment. Intestinal ostomies are performed for the clinical control of pathological conditions that interfere with normal intestinal transit, such as neoplasms, trauma, congenital abnormalities, inflammatory diseases, and obstructions[1,2]. There are two types of intestinal ostomies (ileostomy and colostomy), which respectively consist of an anastomosis of the ileal or colic segment to the anterior abdominal wall[1].

According to the Brazilian Healthcare Guide for Ostomy Patients[3], which has been available for public consultation since May of 2019, there are few epidemiological data on the number of individuals with ostomies. An estimated 207 thousand individuals had intestinal or urinary collector bags in Brazil in 2018[3]. The northeastern region of the country has approximately 17 thousand ostomy patients and the state of Pernambuco has the support of the Pernambuco Ostomy Patient Association, with approximately 2000 active patients registered[4].

Nutritional follow-up of ostomy patients is fundamental, as changes in eating habits may occur imposed by symptoms secondary to the surgical intervention and there may be important changes in the digestion and absorption of specific nutrients, with a consequent effect on the nutritional status of these individuals[1,2]. Moreover, inflammation associated with the base disease contributes to the loss of nutrients, especially antioxidants, which are important to metabolic modulation and organic homeostasis[5].

Adequate food intake and meeting the individual nutritional needs of ostomy patients can prevent the nutrient deficits often found in this population. The main deficiencies are related to the loss of proteins, carbohydrates, fats, vitamins A, C, D, E, and B12, folic acid, zinc, magnesium, calcium, selenium, iron, and some electrolytes, such as sodium and potassium[6,1,2].

Studies that assess the food intake and nutritional status of ostomy patients are scarce in the literature. Therefore, the aim of the present investigation was to estimate the energy and nutrient intake in ostomy patients and determine associations with anthropometric variables.

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METHODS

A cross-sectional study was conducted between April and October 2017 at the ostomy outpatient clinic of Barão de Lucena Hospital, which is a reference center for the postoperative period of ostomies in the city of Recife, Brazil.

The sample size was calculated using the Epi-Info program, version 7.2, considering a population of 2000 ostomy patients registered at the hospital, an 80% confidence interval, and a maximum acceptable error of ten percentage points. In the pilot study, the prevalence of irregular calorie consumption in ostomy patients was 43.3%, considering, as a reference, the recommendations proposed by the ACERTO Project (acceleration of total post-operative recovery)[7]. Thus, the minimum sample size was determined to be 90 patients, to which 10% was added to compensate for possible dropouts. Sampling was non-probabilistic but involved the random selection of patients for the study.

The following were the inclusion criteria for participation in the study: having undergone intestinal ostomy more than 30 days earlier; age 18 years or older; and physical capacity to undergo the anthropometric evaluations. Patients with edema, anasarca, amputated limbs, neurological disease, genetic syndromes, or metabolic disease and those not able to provide information were excluded.

This study received approval from the institutional review board of the Center for Health Sciences of the Federal University of Pernambuco (certificate number: 65856117.60000.5282) in accordance with Resolution 466/12 of the National Board of Health. All volunteers received clarifications regarding the objectives and procedures and agreed to participate by signing a statement of informed consent.

Demographic (sex and age), socioeconomic, clinical, anthropometric, and dietary data were collected using a questionnaire administered in interview form as well as direct collection from patient charts.

Socioeconomic status was determined using the Brazilian Economic Classification Criteria recommended by the *Associação Brasileira de Empresas de Pesquisa* (ABEP) [Brazilian Association of Research Firms][8], which are used to classify individuals in Classes A to E. For the purposes of analysis, this variable was dichotomized as high/middle class (categories A1, A2, B1, B2, and C1) and low class (categories C2, D, and E).

Data on clinical conditions were collected either from patient charts or self-reports. Information was obtained on the type of ostomy (ileostomy or colostomy), time of stoma-forming surgery, reason for surgery, and category of ostomy bag (temporary or permanent).

The anthropometric characteristics of interest were weight, height, body mass index (BMI), arm circumference (AC), triceps skinfold (TSF), and arm muscle circumference (AMC). Weight and height were measured using the method proposed by Lohman et al.[9]. Nutritional status based on the BMI was categorized using the values indicated by the World Health Organization (WHO) for adults[10] and the Pan American Health Organization (PAHO) for older people[11]. For statistical purposes, this variable was dichotomized as without excess weight (BMI ≤24.9 kg/m^2 for adults and <28 kg/m^2 for older people) or with excess weight (BMI ≥25 kg/m^2 for adults and ≥28 kg/m^2 for older people).

AC was measured using a non-elastic metric tape on the dominant arm with the volunteer in the standing position, arm relaxed, and the measurement made at the midpoint between the most distal point of the acromion and the most distal part of the olecranon. AC was measured with the arm flexed toward the thorax, forming a 90º angle[9]. TSF was measured using a scientific adipometer (CESCORF®) on the non-dominant arm following the methods described by Lohman et al.[9] AC and TSF were used to calculate AMC using the following formula (Blackburn, 1977): AMC (cm) = AC (cm) – π x [TSF (mm) ÷ 10]. AC, TSF, and AMC were compared to the reference standards recommended by Frisancho[12].

Food intake was obtained using the 24-hour recall method. The intake of calories, macronutrients (carbohydrates, proteins, and lipids) and micronutrients (vitamins A, C, E, zinc, and selenium) was estimated using the Brazilian Food Composition Table[13]. The percentage distribution of nutrient intake was determined and the values were compared to the estimated average requirements (EAR) for sex and age group[14].

Statistical analysis was conducted with the aid of the Statistical Package for the Social Sciences (SPSS, version 13.0 for Windows). The Kolmogorov-Smirnov test was used to determine the normality of continuous variables. The description of proportions was followed by 95% confidence intervals (CI) and the overlapping of respective 95% CIs was considered indicative of significant differences. The macronutrient and micronutrient intake were analyzed as continuous variables. The intake of the nutrients of interest was adjusted for total calorie intake based on the residuals of the regression model. For such, the absolute intake of nutrients was considered the dependent variable and total calorie intake was considered the independent variable[15]. The Student's *t*-test was used to determine differences between means. Spearman's correlation coefficients were calculated for the determination of correlations between nutrient intake adjusted for calorie intake and the anthropometric variables. The level of significance was set at 5% ($P \leq 0.05$).

RESULTS

The sample was composed of 100 individuals. Mean age was 55.1±15.4 years. A total of 54% (n=54; 95%CI: 43.7–64.0) were men and 58% (n=58; 95%CI: 47.7–67.8) belonged to the low socioeconomic class.

Regarding aspects of the ostomies, there was a predominance of individuals with colostomy (82%; n=82; 95%CI: 73.0–88.9) and a permanent bag (52%; n=52; 95%CI: 41.7–62.1). The main reasons for having undergone the surgical procedure were colorectal cancer (66%; n=66; 95%CI: 55.8–75.2), trauma and obstruction (24%; n=24; 95%CI: 16.0–33.5), and diverticulitis (10%; n=10; 95%CI: 4.9–17.6). TABLE 1 displays the sociodemographic and clinical characteristics of the sample according to type of ostomy.

Colostomy patients had a higher frequency of excess weight based on BMI than ileostomy patients (86.36% vs 13.64%). The majority of colostomy patients had important percentages of different nutritional diagnoses according to the other anthropometric variables (TABLE 2).

Mean calorie intake was 1651.6±416.7 kcal and 1754.1±510.0 kcal among the ileostomy and colostomy patients, respectively (P=0.428). The percentages regarding the intake of macronutrients as well as the vitamins and minerals of interest (adjusted for calorie intake) and EAR reference values are displayed in TABLE 3 stratified by sex. The main nutrients with median intake below the EAR values were vitamins A and E in both sexes and vitamin C in the male sex.

TABLE 1. Characterization of sample according to type of ostomy. Recife, Brazil, 2017.

Variables	Ileostomy (N=18)			Colostomy (N=82)		
	N	%	95%CI	N	%	95%CI
Sex						
Male	10	18.52	10.1–31.4	44	81.48	68.5–89.8
Female	8	17.39	8.7–31.4	38	82.61	68.5–91.2
Age group						
≥18 years	10	18.52	10.1–31.4	44	81.48	68.5–98.8
≥60 years	8	17.39	8.7–31.4	38	82.61	68.5–91.2
Economic status						
High/Middle	8	19.05	9.6–34.1	34	80.95	65.8–90.3
Low	10	17.24	9.4–29.4	48	82.76	70.5–90.5
Ostomy status						
Temporary	7	14.58	6.9–27.93	41	85.42	72.0–93.0
Permanent	11	21.15	11.9–34.6	41	78.85	65.3–88.0
Time of ostomy						
<2 years	10	20.8	10.5–35.0	38	79.2	65.0–89.5
2–5 years	5	17.2	5.8–35.8	24	82.8	64.2–94.2
>5 years	3	13.0	2.8–33.6	20	87.0	66.4–97.2

CI: confidence interval.

TABLE 2. Classification of anthropometric indicators according to type of ostomy, Recife, Brazil, 2017.

Variables	Ileostomy			Colostomy		
	N	%	95%CI	N	%	95%CI
BMI						
Without excess weight	12	21.43	12.4–34.3	44	78.57	65.6–87.5
With excess weight	6	13.64	6.1–27.6	38	86.36	72.3–93.8
AC						
Malnourished	4	12.9	4.7–30.3	27	87.1	69.6–95.2
Eutrophic	12	22.22	12.9–35.4	42	77.78	64.5–87.0
Excess weight	2	13.33	3.1–42.2	13	86.67	57.7–96.8
AMC						
Malnourished	8	18.6	9.4–33.4	35	81.4	66.5–90.5
Eutrophic	10	17.54	9.5–29.9	47	82.46	70.0–90.4
TSF						
Malnourished	7	24.14	11.6–43.3	22	75.86	56.6–88.3
Eutrophic	2	9.52	2.2–32.3	19	90.48	67.6–97.7
Excess weight	9	18	9.4–31.4	41	82	68.5–90.5

CI: confidence interval; BMI: body mass index; AC: arm circumference; AMC: arm muscle circumference; TSF: triceps skinfold.

TABLE 3. Reference values and percentiles of intake of macronutrients and micronutrients adjusted for calorie intake in ostomy patients. Recife, Brazil, 2017.

Nutrients	EAR	Percentiles		
		25	50	75
Male sex				
Carbohydrates	100 (g/day)	205.5	234.3	255.0
Proteins*	0.66 (g/kg/day)	83.4	93.6	104.2
Lipids	–	35.3	46.1	55.4
Zinc	9.4 (mg/day)	6.1	8.8	13.0
Selenium	45 (µg/day)	9.7	31.6	50.3
Vitamin A	625 (µg/day)	59.5	135.7	489.0
Vitamin C	75 (mg/day)	19.4	30.7	67.4
Vitamin E	12 (mg/day)	3.1	6.2	13.2
Female sex				
Carbohydrates	100 (g/day)	222.6	238.2	262.5
Proteins*	0.66 (g/kg/day)	74.2	86.2	96.5
Lipids	–	35.7	45.7	50.1
Zinc	6.8 (mg/day)	6.4	8.2	10.5
Selenium	45 (µg/day)	15.2	30.4	48.8
Vitamin A	500 (µg/day)	93.1	166.8	339.2
Vitamin C	60 (mg/day)	18.9	68.2	97.8
Vitamin E	12 (mg/day)	5.2	6.8	13.8

EAR: estimated average requirements/institute of medicine (Padovani, 2006).
*Protein requirements (EAR) presented in g/kg. Protein percentiles values presented in g/day.

In the investigation of correlations between macronutrients and anthropometric variables, significant negative correlations were found between carbohydrate intake and both AC and TSF and a positive correlation was found between protein intake and AMC among the men (TABLES 4 and 5). No significant correlations were found between micronutrient intake (adjusted for calorie intake) and the anthropometric variables analyzed (data not shown in tables).

DISCUSSION

The scientific literature offers little evidence on the food intake and nutritional status of ostomy patients. However, this population is reported to reduce the consumption of essential foods in terms of energy and nutrients and often practices fasting in order to participate in social situations with fewer symptoms. Therefore, nutritional guidance ensuring empowerment and independence in food choices is essential for these patients[16,17].

The ostomy patients in the present study had median intake values below the EAR according to sex and age group, especially with regards to vitamins A, C, and E. In contrast, Barbosa et al.[18] found that ostomy patients had a diet involving the regular consumption of fruits and vegetables, which are the main sources of micronutrients.

TABLE 4. Correlation between anthropometric variables and intake of macronutrients adjusted for calorie intake in male ostomy patients. Recife, Brazil, 2017.

Macronutrients	Anthropometric indicators							
	BMI		AC		AMC		TSF	
	rho	*P*	rho	*P*	rho	*P*	rho	*P*
Ileostomy								
Carbohydrates	-0.2848	0.4250	-0.6809	0.0302*	-0.3939	0.2600	-0.6809	0.0302*
Proteins	0.1758	0.6272	0.4012	0.2505	0.7333	0.0158*	-0.4268	0.2186
Fats	0.4303	0.2145	0.1824	0.6141	0.2000	0.5796	-0.0427	0.9068
Colostomy								
Carbohydrates	-0.0643	0.6782	-0.0670	0.6658	0.0509	0.7429	-0.2298	0.1335
Proteins	-0.0679	0.6613	-0.0136	0.9301	0.0574	0.7111	-0.2374	0.1208
Fats	-0.0047	0.9757	0.1228	0.4271	0.0034	0.9826	0.2552	0.0945

Spearman's correlation. *$P \leq 0.05$; BMI: body mass index; AC: arm circumference; AMC: arm muscle circumference; TSF: triceps skinfold.

TABLE 5. Correlation between anthropometric variables and intake of macronutrients adjusted for calorie intake in female ostomy patients. Recife, Brazil, 2017.

Macronutrients	Anthropometric indicators							
	BMI		AC		AMC		TSF	
	rho	*P*	rho	*P*	rho	*P*	rho	*P*
Ileostomy								
Carbohydrates	0.3810	0.3518	-0.1667	0.6932	-0.4286	0.2894	0.0000	1.0000
Proteins	0.3571	0.3851	-0.3810	0.3518	-0.5000	0.2070	-0.1464	0.7294
Fats	0.2619	0.5309	0.4286	0.2894	0.3095	0.4556	0.4392	0.2763
Colostomy								
Carbohydrates	0.1522	0.3616	0.1336	0.4239	0.1749	0.2937	-0.0195	0.9073
Proteins	-0.2209	0.1825	-0.2752	0.0945	-0.1748	0.2940	-0.2175	0.1897
Fats	0.0620	0.1865	0.1407	0.3994	0.0402	0.8108	0.1865	0.2622

Spearman's correlation. *$P \leq 0.05$; BMI: body mass index; AC: arm circumference; AMC: arm muscle circumference; TSF: triceps skinfold.

The reduction in the intake of fat-soluble vitamins, such as vitamins A and E, may occur as a response to the reduction in the consumption of dietary fat in order to control the consistency and frequency of bowel movements. Barbosa et al.[18] found similar behavior in a group of ostomy patients, reporting the non-inclusion of foods rich in fats in their daily meals.

The low intake of micronutrients is one of the most reported public health problems in the Brazilian population as a whole[19-21]. In the study conducted by Tureck et al.[21] with data from 33,459 participants of the National Dietary Survey (INA), which was a module of the 2008–2009 Family Budget Survey[22] the intake of vitamins A, C, and especially E was below the dietary recommendations in 72 to 95% of individuals.

The inverse correlations found between carbohydrate intake and both AC and TSF in the present study may be explained by the occurrence of reverse causality, which is common in cross-sectional studies, in which a single moment in the natural history of an outcome is analyzed. Dietary composition, use of some medications and misreporting of food consumption or portion sizes due to memory lapses of respondent can also interfere in this relationship. On the other hand, the correlation between AMC and protein intake in men was an interesting finding, given the importance of the use of this anthropometric variable as a simple, fast indicator of lean mass[23,24] which is associated with the adequate intake of proteins, especially in older people[25]. One should bear in mind that the mean age of the individuals analyzed in the present study approaches the minimum age established for the older population. Aging is a risk factor for the development of cancer, which is one of the main reasons for undergoing an ostomy procedure[26]. Moreover, older people account for the majority of new cases and deaths due to cancer, which underscores the need for special attention for this group and its particular characteristics, such as the loss of lean mass[25-27].

Ferreira et al.[28] described a similar result to the findings of the present investigation with regards to the distribution of sex among the participants, reporting a predominance of the male sex (55.6%) among ostomy patients. The sex of the ostomy patients can exert an influence on adaptation to the postoperative period. Women tend to require a shorter rehabilitation period, but exhibit higher levels of depression and fear in the period prior to the surgical intervention[29]. Men, especially those who develop sexual impotence, require a longer period before returning to normal activities and experiencing an improvement in quality of life and have greater difficulties in terms of self-care due to physical, psycho-emotional, and/or social problems in the postoperative period[30].

With regards to socioeconomic status, there is evidence that social and economic inequalities exert considerable influence on the living conditions of individuals and constitute risk factors for a number of diseases, including different types of cancer[31]. In a study conducted by Moraes et al.[1] 47.1% of ileostomy patients earned less than two times the Brazilian monthly minimum wage. The authors state that low income can directly interfere with care for the stoma and hinder the clinical and nutritional follow-up of these patients. In the present study, low income was identified in approximately half of the sample. This may be related to the setting of the study, as public hospitals attract a larger proportion of low-income patients[1].

Colostomy patients predominated in the present sample. Integrative reviews conducted by Cunha, Ferreira, and Backes[32] and Miranda et al.[33] confirmed that colostomy procedures are more common than ileostomies (84.1 vs 15.7%) due to the high prevalence of individuals with colorectal cancer, who often need colostomy bags as part of clinical management for the control of intestinal symptoms. According to the National Cancer Institute[34], colorectal cancer was the second most common type of cancer in Brazil in 2020, with 40,990 new cases described, affecting 20,520 men and 20,470 women.

Diverse risk factors are involved in the development of colorectal cancer, such as an advanced age, genetics, a lifestyle involving a diet rich in fat, refined carbohydrates, and animal protein, a low level of physical activity, and obesity[35]. In a study by Sousa, Santos, and Graça[36], colorectal cancer was one of the main reasons for having undergone the colostomy procedure, which is in agreement with the findings of the present investigation.

No significant difference was found in the proportion of temporary and permanent bags in the present study. Likewise, Silva et al.[37] reported a 51.24% rate of permanent ostomy bags and a 48.76% rate of temporary bags. The main determinant of this aspect is the clinical diagnosis. Permanent bags are associated with colorectal and urogenital cancer and temporary bags are associated with trauma[37].

The analysis of the anthropometric data in the present study revealed a high frequency of overweight among the colostomy patients. This may be explained by the fact that obesity is an independent predictor of colorectal cancer, which is the main reason for the need for a colostomy[38]. Excess weight in these patients is a worrisome factor, as it is related to complications, such as retraction, prolapse, and parastomal hernia[39].

Nonetheless, individuals in the ideal range according to the AC and AMC predominated in the present sample. A similar finding was described in the study by Attolini and Gallon[40], who reported that adequacy in terms of these indictors may have been due to late adaptations of the ostomies, leading to less impairment in terms of food intake as well as the absence of nutritional and absorptive disorders, minimal metabolic changes, and the absence of obstructive factors or a hormonal effect. Such aspects may also explain the large number of individuals with excess weight according to BMI in the present investigation. Furthermore, it is important to emphasize that time of stoma-forming surgery can lead to possible organic adaptations and contribute to maintenance or weight gain.

This study has limitations that should be considered when interpreting the results. The cross-sectional design does not enable the establishment of cause-and-effect relationships. The use of only one 24-hour recall does not take into account intrapersonal variation in nutrient intake. However, this bias was minimized by the adjustment for energy intake and the simple comparison of intake with the EAR references. The sample size may be a limiting factor for the extrapolation of the findings. Nonetheless, the present study was able to demonstrate the clinical, nutritional, and dietary profile of a sample of ostomy outpatients at a reference hospital in the state of Pernambuco, Brazil and could contribute to decision making in the clinical setting for this population.

CONCLUSION

In the present study, the intake of carbohydrates and proteins was significantly correlated with anthropometric indicators (AC, TSF, and AMC) in a sample of ostomy patients at a reference hospital. The nutritional status of the majority of individual was indicative of excess weight, especially the colostomy patients, and nutrient intake was below dietary recommendations, especially for vitamins A, C, and E. Further studies are needed with other designs and representative samples correlating nutritional status and nutrient intake to assist in improving the clinical-nutritional status and quality of life of patients following ostomy procedures.

Authors' contribution

Domingos Júnior IR: study design, execution of study, interpretation of data, and drafting of manuscript. Andrade MIS: study design, data analysis, interpretation of data, editing of manuscript, and approval of final version. Santiago ERC: study design, data analysis, interpretation of data, editing of manuscript, and approval of final version. Barbosa LS: study design, data collection, execution of study, and approval of final version. Dourado KF: study design, interpretation of data, editing of manuscript, and approval of final version.

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RESUMO – **Contexto** – Estudos que avaliam o consumo alimentar e o estado nutricional de pacientes ostomizados são escassos na literatura, entretanto, sabe-se que tais indivíduos cursam com sintomatologia que determinam modificações na ingestão calórica e de nutrientes, bem como nos parâmetros antropométricos durante o pós-operatório. **Objetivo** – Estimar a ingestão de energia e nutrientes em pacientes ostomizados e verificar sua relação com variáveis antropométricas. **Métodos** – Estudo transversal, realizado com grupo de indivíduos ostomizados em acompanhamento ambulatorial em um hospital de referência para pós-operatório de ostomias em Recife – Pernambuco. Foram obtidos dados demográficos, socioeconômicos, clínicos, antropométricos e dietéticos por meio de entrevistas e coleta direta nos prontuários. As análises estatísticas foram realizadas no software *Statistical Package for the Social Sciences* versão 13.0 para Windows, adotando-se o valor de 5% para verificação de significância estatística ($P \leq 0,05$). **Resultados** – A amostra foi composta por 100 indivíduos, sendo 54% do sexo masculino, com média de idade de 55,1±15,4 anos. O grupo foi caracterizado por um predomínio de pacientes colostomizados (82%; n=82), os quais apresentaram maiores frequências de excesso de peso, quando comparados àqueles com ileostomia (86,36% vs 13,64%). Foram identificadas medianas de ingestão abaixo dos valores recomendados pelos requisitos médios estimados principalmente para as vitaminas A, C e E. Houve correlação inversa significante entre o consumo de carboidratos com a circunferência do braço e a prega cutânea tricipital ($P=0,0302$), e correlação positiva entre o consumo de proteínas e a circunferência muscular do braço ($P=0,0158$) nos pacientes do sexo masculino. **Conclusão** – O presente estudo encontrou relação significante entre o consumo de macronutrientes e variáveis antropométricas indicativas de reservas de massa magra e adiposa. A ingestão, principalmente de vitaminas, foi abaixo dos valores preconizados segundo o sexo e a faixa etária.

Palavras-chave – Ostomia; consumo alimentar; nutrientes; antropometria.

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