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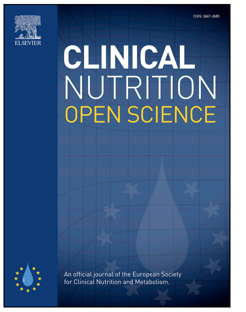

High prevalence of abdominal obesity, inadequate food consumption, and low level of physical activity regardless of body mass index across women

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PII: S2667-2685(23)00003-7

DOI: https://doi.org/10.1016/j.nutos.2023.01.003

Reference: NUTOS 274

To appear in: *Clinical Nutrition Open Science*

Received Date: 22 January 2023

Accepted Date: 22 January 2023

High prevalence of abdominal obesity, inadequate food consumption, and low level of physical activity regardless of body mass index across women

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Abstract

Background: Obesity is a public health concern presenting worldwide relevance. The location of body fat deposition is associated with an increased risk of developing chronic non-communicable diseases with an emphasis on abdominal obesity. This study aimed to evaluate the association between food consumption, physical activity, and abdominal obesity in women from a region in Brazil. **Methods:** Cross-sectional study with 150 women. Anthropometric variables were evaluated. Food consumption was investigated through three 24-hour food records and the frequency of food consumption was assessed by the Food Consumption Marker Form of the Food and Nutrition Surveillance System (SISVAN). Physical activity (PA) was accessed by the International Physical Activity Questionnaire. Data from the food recalls were submitted to Avanutri® software, and the energy variation was corrected by the residual method. Kolmogorov-Smirnov, Student's t-test, and Mann-Whitney/Wilcoxon Two-Sample tests were performed. Prevalence ratios (PR) and respective 95% confidence intervals (CI) were calculated. **Results:** The prevalence of general obesity, abdominal obesity, and less physically active were 33.33%, 82.00%, and 50.67% respectively. Regarding the group, less than 25% consumed cooked vegetables every day, and around 20.0% consumed snacks, sweets, and soft drinks three times or more per week. Vitamins A, C, E, fiber, zinc, and calcium were below the recommendation regarding abdominal obesity or not. Statistically, the abdominal obese group was associated with higher iron intake (PR=0.27; 95%CI=0.08–0.91; $p<0.05$) and cooked vegetables (PR=0.20; 95% CI=0.05-0.89; $p=0.01$) compared to the non-abdominal obese group, however, it remains below the recommendations. **Conclusions:** There is a high prevalence of abdominal obesity in the sample studied. Low consumption of markers of healthy food intake per week, an insufficient micronutrient intake, and a lower level of physical activity were present regardless the abdominal obesity.

Keywords: Abdominal obesity adiposity, Physical activity, Food intake, Macronutrients, Micronutrients

Introduction

The nutritional transition is characterized by a progressive increase in consumption of ultra-processed foods (UPFs), which have a high content of sugar, saturated and trans-fat, and a decrease in consumption of fresh and/or minimally processed foods, especially foods rich in complex carbohydrates and fibers, resulting in inadequate energy and macro/micronutrient intake[1–3]. These unhealthy food choices, in association with physical inactivity/low levels of physical activity, contribute to a higher prevalence of overweight and obesity across Brazilians[4].

In Brazil, 56.2% of women are overweight and 22.6% are obese[5]. It is well-documented that obesity, mainly abdominal obesity, plays a role in different disease development such as metabolic syndrome[6–8], cardiometabolic disease[6,8,9], type 2 diabetes[8], and certain types of cancers[10,11].

In population-based studies, the body mass index (BMI) is widely used for obesity classification purposes[12]. However, BMI measurement does not provide differences in the body components, for example, in which area the adipose tissue is more expressed[13] knowing that abdominal obesity is more inflammatory than overall obesity[9,10,12]. Therefore, it is important to combine the BMI classification with complementary measures of body fat distribution. To illustrate this, the waist circumference (WC) measurement reflects the visceral/abdominal fat content[14]. The WC cut-off points are based on gender, and it has been pointed out as a good parameter to measure abdominal obesity and metabolic disease risk[8].

Unhealthy food consumption, physical inactivity, and socioeconomic environment are also listed as characteristics of nutritional deviations in modern societies[2,5]. Hence, it is important to understand how these causalities are linked and what can be done, in the field of public health, to reduce Chronic Non-Communicable Diseases (CNCDs). Thus, this study aimed to verify if there is an association between abdominal obesity, food consumption, and level of physical activity among women from a central region of Brazil.

Materials and Methods

Study design, ethical aspects, and sample

This is a cross-sectional study, carried out at the Faculty of Nutrition, Federal University of Goiás, from August/2014 to December/2017. It is nested to a cohort entitled "Impact of chemotherapy treatment on body composition, lipid and glycemic profiles of women with breast cancer", however, it included the control group (women without cancer). It was approved by the Ethics and Research Committee of the Federal University of Goiás (protocol number 751.387/2014). All study participants were informed about the research procedures, and they signed the informed consent form.

The sample size calculation was performed using the Epi-InfoTM 2017 software version 7.2.1.0®. In addition, a significance level of 95% and a test power (1-β) of 80% were considered. It was also used, as a primary outcome, the prevalence of obesity among women in Goiânia which is 16.3%[5]. Therefore, the minimum number of participants required was 132 women.

Participants

Inclusion criteria were women aged from 30 to 80 years non-cancer diagnosed (control group) living in the metropolitan region of Goiânia, Goiás. Exclusion criteria were cognitive impairment, psychiatric illnesses, amputation and/or orthopedic problems that compromised their nutritional status and/or any condition which could prevent the anthropometric assessment.

Data collection

The data collection was carried out after the participants' written consent, through a pre-tested and standardized questionnaire (pilot study), applied by trained nutritionists and graduate nutrition students. The adequacy, accuracy, and precision of all anthropometric and body composition measurements were checked using a reference anthropometry standardization technique recommended by Habicht[15].

Measurements

To assess physical activity (PA), women reported their practice according to intensity (low, moderate, and vigorous) and frequency (minutes per day). A short version of the International Physical Activity Questionnaire (IPAQ)[16] was used. Subsequently, those who reached at least 30 minutes of moderate PA for five or more days a week, or at least 20 minutes of vigorous PA for three or more days a week were classified as being more active[16,17].

The weight (kg) was evaluated by a digital scale accurate to 0.1 kg and with a capacity of 150 kg and height (m) by a stadiometer with accuracy of 0.1 cm. BMI was calculated using the ratio of weight by height squared (kg/m²) following the criteria established by the World Health Organization (WHO - BMI ≥30.0 kg/m² indicates general obesity, for adult [12] and >27.0 kg/m², for elderly women[18]). WC was measured at the midpoint between the lowest rib and the iliac crest using an inelastic measuring tape of 1 mm precision; women were classified as having abdominal obesity when WC was ≥80 cm[12].

Food consumption evaluated total energy intake, amount of macro (proteins, carbohydrates, and lipids), and micronutrients (vitamins and minerals) by using the application of three 24-hour food records (R24h) on non-consecutive days and one from the weekend applied by a trained interviewer. The foods/recipes and homemade measures were described per meal and later added to the AVANUTRI® software. The energy intake was based on a Brazilian population study (cut-off point of 1,586kcal for the Central-West region) [19]. The recommendations for macronutrients were based on the first Brazilian food guideline for a healthy food: carbohydrates 55-85%, proteins 10-15%, and lipids 15-30% (saturated polyunsaturated, and monounsaturated fatty acids ≤ 7%, 10%, and 20%, respectively) [20]. The recommendation of micronutrients for women were based on the Institute of Medicine: vitamin A 500µg/d, vitamin C 60mg/d, Vitamin E 12mg/d, Selenium 45µg/d, Zinc 6,8µg/d, Calcium 800 (30-50yrs old) and 1,000 (> 50yrs old) mg/d, Iron 8,1 (30-50yrs old) and 5,0 (> 50yrs old) mg/d [21–23].

The frequency of food consumption was assessed by the Food Consumption Marker Form of the Food and Nutrition Surveillance System (SISVAN)[24]. SISVAN monitors the nutritional status and food intake characteristics of individuals within the Brazilian Public Health System; it is validated and recommended by the Brazilian Ministry of Health [24]. It has ten markers (foods/ foods groups): raw salad vegetables, cooked vegetables, fruits, beans, dairy products, fried foods, processed meats, snacks, sweets, and soft drinks. The frequency of consumption of the markers in the last seven days was reported by the participants[24]. The healthy and unhealthy food consumption were based on the food guideline for the Brazilian population [20]. For a healthy diet, the Brazilian guideline recommends eating at least three portions of fruits, vegetables, and dairies, and one of beans per day. It also recommends avoiding canned and fried foods, and soft drinks. For cakes, candies, desserts, and sweets in general the consumption is recommended to be less than three times per week[20]. For the study proposal we can access data based on SISVAN which reports the consumption of each marker per day for seven days. It was considered healthy food consumption if the participants consumed raw salad vegetables, cooked vegetables, fruits, beans, and dairy products every day.

Statistical analysis

The statistical analysis was performed using STATA® version 12.0. The evaluation of the data collected in the R24h was done using the AVANUTRI® software (Três Rios, Brazil).

Once the energy intake may influence the results of the analyzes, all nutrients evaluated were submitted to the correction of the energy variation according to the residual method of Willett, Howe, and Kushi[25]. For the data distribution, the Kolmogorov-Smirnov test was used, and all the results presented descriptive analysis, mean and standard deviation or median (interquartile range), according to the presence or absence of normal distribution, respectively. Subsequently, the One-Way ANOVA test was applied to correct the micronutrient intake values, in order to determine the intra and inter-individual variability and the total variance of the distribution.

The student's "t" test and Mann-Whitney/Wilcoxon Two-Sample were performed to assess differences between groups. The Prevalence Ratio (PR) was calculated to assess the association between the level of PA, consumption of food markers, quantitative food consumption (energy, micronutrient, and micronutrient intake), and the prevalence of abdominal obesity. Statistical significance was defined as $p<0.05$ (significance level of $\alpha <5.0\%$).

Results

The study has included 150 women. The mean age was 54.07 (±10.42) and 48.93 (±12.22) years for abdominal and non-abdominal obese group, respectively. No significant difference was found for race, marital status, income, and education level (years of schooling) between groups. From all women studied, 82.0% (n=123) met the criteria for abdominal obesity and 33.3% (n=50) presented general obesity.. Approximately a quarter of women reported being more physically active, however, no significant differences emerged between the groups (p=0.37) (Table 1).

Table 2 describes the frequency of consumption of food markers (SISVAN) in the last seven days prior the interview. In general, more than 50% of the women consumed raw salad vegetables, fruits, beans, and dairy products all seven days and less than 25% consumed cooked vegetables every day. The proportion of the consumption one time or more/week of fried foods and processed meat was 32.67% and 41.33%, respectively. For snacks, sweets, and soft drinks of three times or more/week was around 20.0%.

The prevalence values and 95%CI of healthy and unhealthy food consumption, according to the Brazilian guideline, are presented in Table 3. The significant difference observed between groups was for cooked vegetables ($p<0.05$) presenting a higher consumption among the abdominal obese group.

When the mean intake of macro and micronutrients was analyzed, the consumption of energy (total kcal), vitamin A, vitamin C, vitamin E, fiber, zinc, and calcium was below recommendations for both groups studied. There was a significant difference for carbohydrates (%kcal; $p<0.01$), proteins (%kcal; p=0.04), zinc (mg/day; $p<0.01$), and iron (mg/day; $p<0.01$), which the intake was higher for the abdominal obesity group (Table 4).

According to the PR measurement of food consumption markers and the occurrence of abdominal obesity, an association was observed for the consumption of cooked vegetables (PR=0.20; 95% CI=0.05–0.89; p=0.01). In terms of energy (total kcal), macro and micronutrient intake, and the occurrence of abdominal obesity group, the consumption of a single micronutrient, iron, was associated with the proposed outcome (PR=0.27; 95% CI=0.08–0.91; $p<0.05$). It was not possible to obtain PR for zinc, once no participant with abdominal obesity had its inadequate consumption.

Discussion

This study examines the associations between general obesity, abdominal obesity, food consumption, and the level of PA among women. One-third of the sample presented general obesity and four in five women presented abdominal obesity and were classified as less physically active. The consumption of cooked vegetables and the intake of vitamins A, C, and E, fibers, zinc, and calcium were under the recommendation for all groups but not for selenium and iron.

According to the presence or absence of abdominal obesity, our results did not show any statistical difference between the groups for racial, marital, income, and educational status. For levels of PA, our finding shows that only 33.1% of the participants were characterized as more physically active, even though it is very low, it agrees with the percentage of PA practice described in the National Household Sample Survey on sports and PA practices, carried out in Brazil, in 2015 of 27.2%[17]. These proportion still going on among Brazilian women. The last Surveillance System for Risk and Protective Factors for Chronic Diseases by Telephone Survey (VIGITEL)[26] found that just 31.13% self-reported do physical activity.

The present study found that obesity measured by the BMI was associated with a elevate WC, representing 100% of the sample having simultaneously general and abdominal obesity. However, it is important to highlight that 73% of women did not have general obesity but presented abdominal obesity. Evidence shows that WC can increase without changes in BMI[27] as the fatness is located in the central body area. In addition, the abdominal obesity assessed by WC is related to a higher risk of mortality regardless of the BMI categories[28].

Brazil is passing through a nutritional transition from ~70s to current years. This nutritional transition is characterized by changes in some aspects of lifestyle, including a poor diet and a reduced PA practice which causes an imbalance between food consumption and daily caloric expenditure playing a role in the overweight and obesity emerge. For instance, the insertion of women in the work place conducted to a reduction of time available for preparing healthy meals having collaborating to buy ready meals and increasing the consumption of processed foods combined with a reduction of the consumption of fresh foods for all population[3,29].

The present study has shown a significance difference for cooked vegetables between the groups having the abdominal obese group higher consumption compared to non-abdominal obese group (PR=0.20; 95%CI:0.05-0.89; p=0.01), however, both groups are far away from the recommendation of eating every day (seven days per week)[20]. We hypothesized the women probably could have started a healthier lifestyle by changing their diet and practicing physical activity after the obesity diagnosis, however, due to the study type we were unable to assess previous diet and behaviors participants' patterns. These findings are similar to what was presented in a cross-sectional descriptive study, in which the prevalence of recommended food consumption, in relation to the set of healthy or unhealthy foods, was high among women with hypertension and diabetes (n=422; 60.4%) in the southern of Brazil[30].

A cross-sectional study from Salvador, Brazil, with low income and obese women (n=103; 19 to 78 years old), investigated the intake and adequacy of energy, macro and micronutrients. They found an association between abdominal obesity and a dietary pattern with a high intake of proteins and saturated fatty acids, and low consumption of fibers and micronutrients, mainly vitamins A, E, D, and calcium[31]. This study showed that women who presented abdominal obesity also had high protein consumption, despite not having a significant association considering the Prevalence Ratio analysis.

It was also observed that the consumption of vitamins A, C, and E, fibers, zinc, and calcium were below the recommended for both groups studied. The consumption of carbohydrates (%kcal) and proteins (%kcal) was higher in women who presented abdominal obesity, with a significant difference between groups ($p<0.05$), corroborating the Ferraz et al., [31] findings. Iron consumption was higher in the group with abdominal obesity ($p=0.03$). Regarding the analyses of consumption of micro and macronutrients, only the inadequate iron consumption was associated with abdominal obesity (PR=0.27; $_{95\%}$CI = 0.08–0.91; $p<0.05$).

The results of the Household Budget Survey (2017-2018) revealed a high prevalence of inadequate micronutrient intake in adults in Brazil. The prevalence approached 100% for vitamins D and E, it is over 70% for calcium and vitamin A, it is 40% for vitamin C, and around 20% for zinc. The prevalence of inadequacy for iron consumption was only 5%, which can be explained by the increase in the consumption of sausages and processed meats[3,19,32,33]. This scenario agrees with the results found. Regardless of the presence of abdominal obesity, the women in the present study demonstrate inadequate consumption of these micronutrients, except for iron.

Meats are sources of proteins and fats, vitamins, and minerals, especially iron. Some food groups seem to be associated with an increase in WC, such as red meats[34]. Processed foods can contribute to 64% of iron recommendation by the Dietary Guidelines for American through the “enrichment” and/or “fortification” during the food industrialization process by adding at higher nutrient amounts than what can be naturally consumed according to Weaver et al., who has analyzed the NHANES data (2003-2008) [35]. This factor would explain the inadequacy of iron being inversely associated with the development of abdominal obesity in women, in the present study. Therefore, it cannot be inferred that the ingestion of this food group increases the risk for the development of abdominal obesity[36–38]. There is evidence of a possible relation between inadequate consumption of micronutrients, mainly vitamins A, C, D, and E; the minerals calcium, iron, and zinc, and the development of obesity[31,39–42]. However, in the present study, this relationship was found only for mineral iron.

Thus, it is suggested that abdominal obesity is not the result of the consumption only of a single nutrient or food, but of combining several food groups. Taking it into consideration, the first Brazilian food guideline[20] was based on the food pyramid which focus on the nutrient *per si*. Currently, the new Brazilian food guideline[43] innovates the recommendations categorizing foods based on their processed level, the NOVA system[44] which is recognized and cited by uncountable researchers around the world. The NOVA system recognizes the same nutrient source does not mean that it is healthy, for example, fresh meat and processed meat were considered equivalent in the past and it changed in the new recommendation[43].

The analysis of food consumption is seen as a way of verifying possible influences of food on the organism and consequently as a potential factor related to the development of comorbidities. Thus, confirming the importance of this study. As a strength of this study, we highlight the use of instruments that made it possible to assess food consumption quantitatively (macro and micronutrients) and qualitatively (food consumption markers), as well as to determine the level of PA.

The greatest limitation of the present study is related to a non-representative sample as the participants came from a control part of a cohort, selection bias would be introduced. Secondly, due to the study type, we were unable to access the cause-effect of abdominal obesity, physical activity, and diet; and mainly why the abdominal obese group presented, in some variables, better results compared to non-abdominal obese group even without statistical differences and both being distant from the ideal recommendations of macro and micronutrients.

The results showed the high prevalence of general and abdominal obesity in women living in the metropolitan region of Goiânia. This is justified by being less physically active and presenting adequate food consumption due to the low consumption of cooked legumes and vegetables, raw salad, fruits, and dairy products, and insufficient vitamins A, C, E, fibers, zinc, and calcium.

These results are important for public health setting once abdominal obesity is a determining factor for increasing the risk of developing CVD and other NCDs. Therefore, the importance of promoting the practice of regular PA and improving eating patterns is highlighted as strategies to reduce the prevalence of obesity and, consequently, other metabolic disorders.

Acknowledgements

We appreciate the participants of this study and the whole research team of the Federal University of Goias, especially the students who assisted in all phases of the study.

Statement of Authorship

Priscylla Rodrigues Vilella: Conceptualization, Data collection, Methodology, Formal analysis, Writing–Original Draft, Writing–Review & Editing, Visualization. **Elisa Silva Correia:** Conceptualization, Data collection, Methodology, Formal analysis, Writing–Original Draft, Writing–Review & Editing. **Karine Anusca Martins:** Conceptualization, Methodology, Formal analysis, Writing–Review & Editing, Project administration. **Jordana Carolina Marques Godinho-Mota:** Conceptualization, Data collection, Methodology, Writing–Review & Editing, Project administration. **Larissa Vaz-Gonçalves:** Conceptualization, Data collection, Methodology, Writing–Review & Editing, Project administration.

Conflict of Interest Statement and Funding sources

The authors declare that they have no conflict of interest. The first author received a scholarship supported by the Fundação de Amparo à Pesquisa do Estado de Goiás – FAPEG (n. 16397)

Table Legends

Table 1. Sociodemographic, anthropometry, and physical activity variables according to the presence or absence of abdominal obesity. Goiânia-GO, 2017 (n= 150).

Table 2. Frequency of consumption of the Food Consumption Marker Form of the Food and Nutrition Surveillance System (SISVAN). Goiânia-GO. 2017 (n=150).

Table 3. Frequency of markers of healthy and unhealthy foods for the last seven days according to the presence or absence of abdominal obesity following the Brazilian guideline. Goiânia-GO. 2017 (n=150).

Table 4. Comparison of macro and micronutrient mean intake according to the presence or absence of abdominal obesity. Goiânia-GO. 2014-2017 (n=450 food recalls).

Table 5. Prevalence Ratio (PR) of level of physical activity. food consumption markers of seven days. and macro and micronutrient mean intake according to the presence or absence of abdominal obesity. Goiânia-GO. 2014-2017 (n=450 food recalls).

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Table 1. Sociodemographic, anthropometry, and physical activity variables according to the presence or absence of abdominal obesity. Goiânia-GO, 2017 (n= 150).

Variables	Abdominal Obesity						
	Yes (WC≥80 cm)		No (WC<80 cm)		Total		p-value[1]
	n	**%**	**n**	**%**	**n**	**%**	
N	123	82.00	27	18.00	150	100	
Age (years)	54.07 (± 10.42)		48.93 (± 12.22)		-		
Race							
White	43	34.96	12	44.44	55	36.67	0.72
Black	10	8.13	3	11.11	13	8.67	
Brown	58	47.15	11	40.74	69	46.00	
Asian	9	7.32	1	3.70	10	6.67	
Indigenous	3	2.44	0	0.00	3	2.00	
Marital Status							
Married	74	60.16	16	59.26	90	60.00	0.33
Single	18	14.63	7	25.93	25	16.67	
Divorced/Separated	15	12.20	3	11.11	18	12.00	
Widow	16	13.01	1	3.70	17	11.33	
Income (minimum wages[2] per capita)							
< = 1	55	44.72	8	29.63	63	42.00	0.36
1 – 3	49	39.84	13	48.15	62	41.33	
3.1 – 6	9	7.32	1	3.70	10	6.67	
> 6	6	4.88	3	11.11	9	6.00	
Level of Education (years)							
< 5	13	10.57	1	3.70	14	9.33	0.39
5 – 9	29	23.58	5	18.52	34	22.67	
> 9	77	62.60	21	77.78	98	65.33	
Obesity							
Yes (BMI ≥ 30 kg/m^2)	50	40.65	0	0.00	50	33.33	**<0.01**
No (BMI < 30 kg/m^2)	73	59.35	27	100.00	100	66.67	
Level of physical activity							
Less active[3]	90	73.17	22	81.48	112	74.67	0.37
More active[4]	33	26.83	5	18.52	38	25.33	

[1]p-value: Chi-square.
[2]Minimum wages considered according to the data collection by year: 2014 R$ 724.00, 2015 R$ 788.00, 2016 R$ 880.00, and 2017 R$ 937.
[3]Less active: <30 minutes PA moderate/ 5 times per week or <20 minutes PA vigorous/3 times per week[16].
[4]More active: ≥30 minutes PA moderate/ 5 times per week or ≥20 minutes PA vigorous/3 times per week[16].
BMI: body mass index; WC: waist circumference.

Table 2. Frequency of consumption of the Food Consumption Marker Form of the Food and Nutrition Surveillance System (SISVAN). Goiânia-GO. 2017 (n=150).

Markers[1]	Null	01	02	03	04	05	06	Every day
	%	%	%	%	%	%	%	%
Raw Salad Vegetables								
Total	5.33	6.00	10.67	9.33	8.67	6.00	2.67	51.33
With Increased WC	4.07	5.69	10.57	10.57	8.94	4.88	2.44	52.85
Non-increased WC	11.11	7.41	11.11	3.70	7.41	11.11	3.70	44.44
Cooked Vegetables								
Total	16.67	9.33	20.00	16.00	7.33	4.67	1.33	24.67
Increased WC	15.45	8.94	21.14	16.26	5.69	3.25	0.81	28.46
Non-increased WC	22.22	11.11	14.81	14.81	14.81	11.11	3.70	7.41
Fruits								
Total	8.67	4.67	7.33	10.00	8.67	2.67	0.67	57.33
Increased WC	8.13	5.69	7.32	8.13	10.57	2.44	0.00	57.72
Non-increased WC	11.11	0.00	7.41	18.52	0.00	3.70	3.70	55.56
Beans								
Total	4.67	4.00	7.33	4.67	4.00	2.00	0.00	73.33
Increased WC	4.88	3.25	7.32	4.07	2.44	1.63	0.00	76.42
Non-increased WC	3.70	7.41	7.41	7.41	11.11	3.70	0.00	59.26
Dairy products								
Total	20.67	4.67	6.00	8.00	4.00	2.00	0.67	54.00
With Increased WC	20.33	5.69	7.32	6.50	3.25	1.63	0.00	55.28
Without Increased WC	22.22	0.00	0.00	14.81	7.41	3.70	3.70	48.15
Fried foods								
Total	67.33	22.00	6.00	3.33	1.33	0.00	0.00	0.00
With Increased WC	68.29	21.95	6.50	2.44	0.81	0.00	0.00	0.00
Without Increased WC	62.96	22.22	3.70	7.41	3.70	0.00	0.00	0.00
Processed Meats								
Total	58.67	25.33	8.67	5.33	1.33	0.67	0.00	0.00
With Increased WC	59.35	26.02	8.13	4.07	1.63	0.81	0.00	0.00
Without Increased WC	55.56	22.22	11.11	11.11	0.00	0.00	0.00	0.00
Snacks								
Total	36.00	18.00	18.00	8.00	3.33	3.33	0.67	12.67
With Increased WC	34.96	17.07	17.89	8.13	4.07	4.07	0.81	13.01
Without Increased WC	40.74	22.22	18.52	7.41	0.00	0.00	0.00	11.11
Sweets								
Total	46.00	23.33	10.67	6.00	4.00	1.33	0.00	8.67
With Increased WC	47.97	22.76	10.57	6.50	3.25	0.81	0.00	8.13
Without Increased WC	14.49	20.00	18.75	11.11	33.33	50.00	0.00	23.08
Soft drinks								
Total	40.00	25.33	14.67	8.67	2.00	1.33	1.33	6.67
With Increased WC	39.84	26.83	13.82	7.32	2.44	1.63	0.81	7.32
Without Increased WC	40.74	18.52	18.52	14.81	0.00	0.00	3.70	3.70

[1]It is represented by how many times per week the markers were consumed in the last seven days prior the interview: null (no consumption), 01 time/week, 02 times/week, 03 times/week, 04 times/week, 05 times/week, 06 times/week, and every day.
Healthy diet: raw salad vegetables, cooked vegetables, fruits, beans, and dairy products every day[20].
WC: waist circumference.

Table 3. Frequency of markers of healthy and unhealthy foods for the last seven days according to the presence or absence of abdominal obesity following the Brazilian guideline. Goiânia-GO. 2017 (n=150).

Markers	Abdominal Obesity				p-value[1]
	Yes (WC≥80 cm) (n=123)		No (WC<80 cm) (n=27)		
	P (%)	$CI_{95\%}$	P (%)	$CI_{95\%}$	
Raw Salad Vegetables[2]	52.85	43.64 - 61.91	44.44	25.48 - 64.67	0.39
Cooked Vegetables[2]	28.46	20.69 - 37.29	7.41	0.91 - 24.29	**0.02**
Fruits[2]	57.72	48.49 - 66.58	55.56	35.33 - 74.52	0.88
Beans[2]	78.05	69.69 - 85.01	62.96	42.37 - 80.60	0.10
Dairy products[2]	55.28	46.06 - 64.25	48.15	28.67 - 68.05	0.50
Fried foods[3]	90.24	83.58 - 94.86	85.19	66.27 - 95.81	0.49
Processed Meats[3]	85.37	77.86 - 91.09	77.78	57.74 - 91.38	0.33
Snacks[3]	52.03	42.84 - 61.12	62.96	42.37 - 80.60	0.39
Sweets[3]	70.73	61.85 - 78.59	62.96	42.37 - 80.60	0.42
Soft drinks[3]	66.67	57.60 - 74.91	59.26	38.80 - 77.61	0.46

[1]p-value: Chi-square.
[2]Considered a healthy food consumption if the participants consumed seven days/week[20].
[3]Considered an unhealthy food consumption if the participants consumed three days or more/week[20].
CI: confidence interval; WC: waist circumference.

Table 4. Comparison of macro and micronutrient mean intake according to the presence or absence of abdominal obesity. Goiânia-GO. 2014-2017 (n=450 food recalls).

Nutrientes[1.2]	Abdominal Obesity		p-value
	Yes (WC≥80 cm) (n=123)	No (WC<80 cm) (n=27)	
Energy (kcal)	1468.60 ± 420.30	1570.33 ± 515.99	0.29[3]
Carbohydrates (%kcal)	54.44 (49.95 - 58.04)	49.38 (45.15 - 53.75)	**<0.01[4]**
Proteins (%kcal)	16.93 (15.01 - 19.43)	15.49 (14.47 - 18.39)	**0.04[3]**
Lipids (%kcal)	27.19 (24.66 - 30.45)	26.59 (23.03 - 30.44)	0.71[4]
Saturated fatty acids (g)	11.57 (9.56 – 13.43)	12.60 (10.48 – 15.51)	0.14[4]
Polyunsaturated fatty acids (g)	5.18 (3.79 – 7.51)	4.22 (3.29 – 7.66)	0.46[4]
Monounsaturated fatty acids (g)	9.88 (7.35 – 12.45)	10.32 (6.58 – 12.59)	0.96[3]
Fibers (g/day)	12.84 (10.23 – 16.92)	11.80 (8.84– 16.17)	0.17[3]
Vitamin A (µg/day)	394.07 (202.22– 702.68)	284.56 (284.56– 583.68)	0.38[4]
Vitamin C (mg/day)	53.17 (29.21 – 101.22)	38.33 (21.99 – 78.18)	0.80[3]
Vitamin E (mg/day)	8.97 (6.21 – 11.69)	7.62 (4.48 – 9.69)	0.07[4]
Selenium (µg/day)	46.22 (38.73 – 58.01)	48.86 (31.89 – 63.40)	0.23[3]
Zinc (mg/day)	6.05 (4.35 - 8.02)	5.17 (3.65 - 6.28)	**0.01[3]**
Calcium (mg/day)	428.65 (319.21 - 579.74)	502.84 (389.17 - 657.08)	0.25[3]
Iron (mg/day)	11.16 (9.48 - 22.29)	9.76 (7.92 - 10.78)	**<0.01[4]**

[1] Data presented as mean ± standard deviation or median (interquartile range).
[2] Nutrients were adjusted by energy according to the residual method[25].
[3] Student's t test for dependent samples.
[4] Wilcoxon's test.
WC: waist circumference.

Table 5. Prevalence Ratio (PR) of level of physical activity. food consumption markers of seven days. and macro and micronutrient mean intake according to the presence or absence of abdominal obesity. Goiânia-GO. 2014-2017 (n=450 food recalls).

Variables	RP[1]	CI[2] 95%	p-value[3]
Level of physical activity[5]			
More active	1.00		0.37
Less active	0.61	0.22 – 0.77	
Food Markers	**PR[1]**	**CI[2] 95%**	**p-value[3]**
Raw Salad Vegetables			
>6x/week	1.00		0.43
≤6x/week	0.71	0.31-1.65	
Cooked Vegetables			
>6x/week	1.00		
≤6x/ week	0.20	0.05-0.89	**0.01**[4]
Fruits			
>6x/week	1.00		
≤6x/week	0.92	0.40-2.12	0.84
Beans			
>4x/week	1.00		
≤4x/week	0.48	0.20-1.16	0.10
Dairy products			
>6x/week	1.00		
≤6x/week	0.75	0.33-1.73	0.50
Fried food			
<2x/week	1.00		
2-7x/week	0.62	0.18-2.10	0.32[4]
Proceessed meat			
<2x/semana	1.00		
2-7x/semana	0.60	0.21-1.69	0.33
Snacks			
<2x/week	1.00		
2-7x/week	1.57	0.66-3.69	0.30
Sweets			
<2x/week	1.00		
2-7x/week	0.70	0.29-1.68	0.43
Soft drinks			
<2x/week	1.00		
2-7x/week	0.73	0.31-1.71	0.46
Nutrients	**PR[1]**	**CI[2] 95%**	**p-value[4]**
Energy intake			
≤1568Kcal	1.00		
>1568Kcal	0.760	0.32 - 1.81	0.54
Carbohydrates			
≤75%kcal	1.00		
>75%kcal	-	-	1.00
Proteins			
≤15%kcal	1.00		
>15%kcal	2.13	0.89 - 5.09	0.08

Lipids			
≤30%kcal	1.00		
>30%kcal	1.02	0.41 - 2.54	0.96
Saturated fatty acids			
≤7%kcal	1.00		
>7%kcal	1.04	0.45 - 2.39	0.92
Polyunsaturated fatty acids			
≤10%kcal	1.00		
>10%kcal	0.21	0.01 - 3.52	0.33
Monounsaturated fatty acids			
≤20%kcal	1.00		
>20%kcal	-	-	1.00
Fibers			
≥20g	1.00		
<20g	-	-	0.45
Vitamin A			
≥500mg/dia	1.00		
<500mg/dia	0.60	0.25 - 1.43	0.25
Vitamin C			
≥60mg	1.00		
<60mg	0.49	0.20 - 1.20	0.11
Vitamin E			
≥12mg	1.00		
<12mg	0.42	0.12 - 1.51	0.18
Selenium			
≥45 µg	1.00		
<45 µg	1.11	0.48 - 2.58	0.80
Calcium			
≥800/<1000 mg/day	1.00		
<800/<1000 mg/day	-	-	1.00
Iron			
≥8.1/<5.0 mg/day	1.00		
<8.1/<5.0 mg/day	0.27	0.08 - 0.91	**0.03**

[1] PR: Prevalence Ratio;.
[2] CI: confidence interval.
[3] p-value: Chi-square.
[4] p-value: exact Fisher test.
[5] Less active: <30 minutes PA moderate/5 times per week or <20 minutes PA vigorous/3 times per week and More active: ≥30 minutes PA moderate/5 times per week or ≥20 minutes PA vigorous/3 times per week[16].
Cut-off point based on a Brazilian population-based study[19].
Cut-off point for macronutrients were based on the first Brazilian food guideline[20].
Cut-off points for vitamins and minerals were based on the Institute of Medicine recommendations[21–23].