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Sociodemographic, clinical, and dietary characteristics of overweight adults: a secondary analysis of a population study

Caracterização sociodemográfica, clínica e da alimentação de adultos com excesso de peso: análise secundária de um estudo populacional

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ABSTRACT

Objective
To estimate the prevalence of overweight among Brazilian adults aged 20 to 59, according to sociodemographic characteristics, health-related behaviors, and food consumption.

Methods
A cross-sectional study based on data from a population-based survey in a major metropolitan city in the state of São Paulo, Brazil, conducted between 2015-2016. Prevalences and prevalence ratios were estimated using Poisson regression; food consumption means were estimated using linear regression.

Results
We analyzed data from 855 adults, 61% of whom were overweight. The prevalence of overweight was significantly higher among males, those aged 30 or older, with 8 to 11 years of education, and those who reported eating more than they should. The body mass index was significantly associated with hypertension, diabetes, high cholesterol, waist-to-height ratio, taking weight-loss medications, overeating, and the habit of checking labels. Overweight adults reported eating meat with visible fat and drinking soda more frequently than those not overweight. Overweight adults reported eating significantly more grams of food daily and had a higher intake of energy, total fat, saturated fats, trans fats, carbohydrates, protein, insoluble dietary fiber, sodium, and potassium. Their diets had a higher glycemic load when compared to participants who were not overweight.

Conclusion
Adults with and without overweight differed in their sociodemographic, dietary, and clinical characteristics. Diet quality was similar between both groups, suggesting a need for improving dietary habits in this population regardless of body weight.

Keywords: Body Mass Index. Diet. Obesity. Overweight.

RESUMO

Objetivo
Estimar a prevalência de excesso de peso entre adultos brasileiros, de 20 a 59 anos, segundo características sociodemográficas, de comportamentos relacionados à saúde e quanto ao consumo alimentar.

Métodos
Estudo transversal, de pesquisa de base populacional, em uma cidade metropolitana de São Paulo - Brasil, conduzida entre os anos de 2015 e 2016. Foram estimadas as prevalências e as razões de prevalência por meio da regressão de Poisson, e as médias de consumo alimentar pelo uso da regressão linear.

Resultados
Foram analisados dados referentes à 855 adultos, 61% destes apresentavam sobrepeso. A prevalência de excesso de peso foi significativamente maior entre: homens, com 30 anos ou mais, pessoas que possuíam entre 8 e 11 anos de estudo e entre aqueles que acreditavam comer mais do que deveriam. O índice de massa corporal foi significativamente associado à hipertensão, diabetes, colesterol alto, razão cintura-estatura, uso de medicamentos, comer mais do que deveria e o hábito de checar rótulos. Adultos com excesso de peso ingeriam carnes com gordura e refrigerantes em maior frequência quando comparados à adultos com peso saudável. Adultos com excesso de peso consumiam, significativamente, mais gramas de alimentos por dia e apresentaram maior ingestão de calorias, gorduras totais, saturadas e trans, carboidratos, proteína, fibras insolúveis, sódio e potássio. A dieta deles continha uma maior carga glicêmica quando comparada àqueles com peso saudável.

Conclusão
Adultos com e sem excesso de peso, diferiram quanto às características sociodemográficas, dietéticas e clínicas. A qualidade da dieta foi similar em ambos os grupos, o que sugere a necessidade de melhora dos hábitos alimentares da população, independentemente do peso corporal.

Palavras-chave: *Índice de Massa Corporal. Dieta. Obesidade. Sobrepeso.*

INTRODUCTION

Over 2 billion people around the world currently are either overweight or obese, which places them at risk for various non-communicable chronic diseases, namely, type 2 diabetes, cardiovascular diseases, and certain types of cancer [1,2]. The burden of overweight and obesity is such that about 28 million people die each year from causes related to it [3]. In Brazil, according to the *Vigilância de Fatores de Risco e Proteção para Doenças Crônicas por Inquérito Telefônico* – 2019 (Vigitel, Surveillance for Risk and Protective Factors for Chronic Diseases by Telephone Survey – 2019) 55.4% of Brazilian adults were overweight, defined as a BMI ≥25 kgm^2 [4]. Obesity has also been associated with increased health care and medication costs, as well as disability, amounting to an estimated cost of 2.8% of the global gross domestic product [5,6].

The rising prevalence of obesity in the last few decades is believed to have occurred due to social, economic, and technological changes in our surroundings that contributed to an "obesogenic environment", which favors sedentary behaviors and excessive energy intake [7]. Successful weight management requires limiting one's energy intake through changes in dietary patterns while managing the intake of macronutrients [8]. In contrast, the typical dietary pattern of overweight individuals is characterized by an increased intake of energy, total fat, saturated fat, cholesterol,

sodium, and refined grains, an overall poorer nutritional value [9], and an increased consumption of processed and ultra-processed foods [10].

Given the role of people's dietary habits in the management of body weight, it is of utmost importance to investigate the population's eating patterns to better tailor public health policies aimed at handling the increase in overweight prevalence. Therefore, this study aimed to estimate the prevalence of overweight in adults aged 20 to 59 according to sociodemographic characteristics, health-related behaviors, and food consumption.

METHODS

This is a secondary analysis of data obtained from adults aged 20 to 59 who participated in two cross-sectional population-based surveys *Inquérito de Saúde de Campinas* (ISACamp, Campinas Health Survey) and *Inquérito de Consumo Alimentar e Estado Nutricional* (ISACamp-Nutri, Dietary Consumption and Nutritional Status Survey). These surveys were conducted in Campinas, a major metropolitan city in the state of São Paulo, Brazil, between 2014 and 2016.

The ISACamp survey used a two-stage stratified probabilistic cluster sampling. In the first stage, 70 census sectors were randomly picked. In the second stage, households were selected using a systematic drawing strategy. The minimum sample size was defined as 1,400 adults, considering an estimated proportion of 0.50, a confidence level of 95%, a sampling error between 4% and 5%, and a design effect of 2. To reach this sample size, 1,029 households were selected independently to interview adult residents, considering the possibility of a non-response rate of 22%. More details on the sampling process are described elsewhere [11].

Data from ISACamp-Nutri was collected in a second interview with the same participants from ISACamp. The visits to the households were conducted in different seasons and on different days of the week (including weekends) by a team of trained interviewers to better reflect the variations in food consumption displayed by this population. The reporting of this study followed the Strengthening the Reporting of Observational Studies in Epidemiology recommendations. The study variables are presented below.

Demographic and socioeconomic variables: sex (male or female), age range (20-29; 30-39; 40-49; 50-59), years of formal education (0-7 years; 8-11; 12 or more), and access to private health insurance (no; yes).

Body mass index (BMI): calculated and classified according to World Health Organization guidelines: BMI <18.5 kg/m^2 (underweight); 18.5 to 24,9 kg/m^2 (normal weight); ≥25 kg/m^2 (overweight and obesity) [12]. Study participants were divided into two groups: those not overweight (BMI <25 kg/m^2) and those overweight or obese (≥25 kg/m^2). We did not analyze data from participants with a BMI <18 separately due to the small number of participants in that category (n=10). Data were collected in accordance with the procedures defined by the Brazilian Ministry of Health [13], using reported weight and measured height.

Waist circumference: was measured twice at the midpoint between the lower border of the last pair of floating ribs and the iliac crest [13]. The waist-to-height ratio was calculated using the measurement of waist circumference divided by height, both in centimeters, and then used to classify participants according to cardiovascular risk (lower risk: <0.5; higher risk: ≥0.5) [14].

Comorbidities (self-reported diagnosis): the presence of chronic diseases (*e.g.*, Hypertension [HA], Diabetes [DM], and high cholesterol) was determined using the question: "Has any doctor ever diagnosed you with..."

Health-related behaviors: we surveyed participants' prior or current use of medications to lose weight (no; yes). We measured leisure-time physical activity using the Physical Activity Questionnaire and classified participants as physically active (those performing 150 minutes per week of moderate physical activity or 75 minutes of vigorous physical activity), insufficiently active (those performing less than the threshold defined for being considered physically active) and inactive (those who did not perform any physical activities) [15]. Participants classified as insufficiently active and inactive were grouped for our analyses. We assessed the subjective perception of overeating by asking the question ''Do you think you eat more than you should?'' [no; yes] and asked if participants had the habit of reading food labels (no; yes/sometimes).

Consumption food groups: we employed a non-quantitative Food Frequency Questionnaire to assess the consumption of fruits, raw vegetables, beans, and whole grains (≥5 times/week), soda, sweets, red meat (≤2 times/week), and visible meat fat (with fat; without fat).

Diet Quality Index - Digital Food Guide (DQI-DFG): The DQI-DFG was calculated using information from one 24-hour Dietary Recall (24HR). It is composed of moderation components (sugars and sweets; meats: beef, pork, and processed meat; refined cereals; processed fats) and adequacy components (poultry, fish, and eggs; whole cereals, tubers, and roots; fruits; vegetables; legumes, and oilseeds, milk, and dairy products; oil and fats). The index ranges between 0 and 100 points and is classified as a "low-quality diet" (<40 points), intermediate-quality diet (between 40-70 points), or good-quality diet (>70 points) [16].

Dietary indicators: We used data obtained from one 24HR to estimate diet weight (g), energy (kcal), total, saturated and trans-fat (g), total carbohydrates (g), total, soluble and insoluble dietary fiber (g), total, animal, and vegetal protein (g), added sugar (g), calcium (mg), sodium (mg), potassium (mg), and glycemic load (g), according to procedures described in a previously published study [17]. We used the Multiple-Pass Method to minimize recall bias during the 24HR [18] and a photographic manual to help participants to estimate their portion sizes. Data were entered in the software Nutrition Data System for Research, version 2015 (NCC, University of Minnesota) by trained and supervised dietitians.

The prevalence of overweight was estimated according to sociodemographic variables, behaviors related to health, and food consumption, and differences between groups were verified using the chi-square test, considering significant those with a p-value <0.05. Next, the crude and adjusted prevalence ratios for sex, age, and education and their respective 95% confidence intervals were estimated using multiple Poisson regression. In the analyses, the BMI was considered a dependent variable.

To verify the association between overweight and HA, DM, high cholesterol, and waist-to-height ratio, the following were treated as dependent variables: the habit of reading labels and the use of medications to lose weight. The BMI was treated as an independent variable. Prevalence, crude, and adjusted prevalence ratios (gender, age, and education) and their respective 95% confidence intervals were also calculated.

Multiple linear regression adjusted for underreporting of energy intake was used to verify the association of dietary patterns (dependent variables) between adults with and without overweight or obesity (independent variable). The equation adjustment was proposed by Kelly et al. (2009)[19] physical activity diaries and anthropometric measurements were used. Foods eaten were assigned

to thirty different food groups and analyses were undertaken separately for men and women. The median daily portion size of each food group consumed was calculated. The potential misreporting of dietary energy intake (EI to identify the percentage of underreporting: (energy intake – estimated energy requirement [EER] / EER) x 100. The EER was based on the formula recommended by the Institute of Medicine [20]. The significance level was set as 5%. We analyzed the data using the survey module of Stata version 15.1, which considers weights and sampling design.

The ISACamp (certificate #37303414.4.0000.5404) and ISACamp-Nutri (certificate #26068214.8.0000.5404) studies were approved by the Human Research Ethics Committee of The University of Campinas and the Brazilian National Research Ethics Committee (CEP/CONEP system). This study received approval from the Human Research Ethics Committee of The University of Campinas (certificate nº 06755518.7.0000.5404).

RESULTS

We analyzed data from 855 adults (57.3% female) aged 20 to 59, with an average age of 39.5 (95%CI: 38.3;40.7).

The prevalence of overweight was 60.6% for adults and was significantly higher among male participants, individuals aged 30 years or older, those with 8 to 11 years of study (vs. 12 years or more), and those who believe they eat more than they should. (Table 1).

Table 1 – Prevalences and prevalence ratios (crude and adjusted) of overweight or obesity among adults aged 20 to 59 according to sociodemographic variables, physical activity level and perception of eating more than one should. Campinas (SP), Brazil, 2014-2016.

Variables	n (%)[a]	Overweight/Obesity (BMI ≥25 kg/m^2) n=531		Prevalence ratios (95% CI)	
		%	95% CI	Crude	Adjusted[b]
Sex		*p*<0.0001			
Male (ref)	375 (42.7)	70.4	64.9;75.3	1	1
Female	480 (57.3)	53.3	48.7;57.8	0.76 (0.69;0.84)	0.76 (0.68;0.84)
Total	855 (100.0)	60.6	56.6;64.4		
Age range (in years)		*p*=0.0003			
20 to 29 (ref)	215 (25.2)	45.5	37.4;54.0	1	1
30 to 39	222 (25.5)	63.6	55.7;70.9	1.40 (1.11;1.76)	1.40 (1.13;1.74)
40 to 49	197 (22.5)	65.4	58.0;72.2	1.44 (1.14;1.80)	1.43 (1.15;1.79)
50 to 59	221 (26.8)	67.7	60.2;74.3	1.49 (1.22;1.81)	1.47 (1.20;1.80)
Education		*p*=0.0092			
0 to 7	227 (24.2)	65.4	59.2;71.2	1.22 (1.06;1.39)	1.10 (0.96;1.25)
8 to 11	370 (40.0)	63.6	56.9;69.9	1.18 (1.03;1.36)	1.15 (1.00;1.31)
12 or more (ref)	255 (35.8)	53.8	48.3;59.2	1	1
Health insurance		*p*=0.0072			
No (ref)	479 (52.2)	65.2	60.1;69.9	1	1
Yes	374 (47.8)	55.5	49.9;61.0	0.85 (0.76;0.96)	0.88 (0.77;1.02)
Leisure-time physical activity		*p*=0.0659			
Insufficiently active/Inactive	629 (70.6)	62.9	57.9;67.6	1.15 (0.99;1.33)	1.09 (0.92;1.29)
Active (ref)	226 (29.4)	54.9	48.1;61.6	1	1
Eating more than one should		*p*<0.0001			
Yes	257 (29.8)	80.9	74.2;86.2	1.56 (1.41;1.73)	1.54 (1.40;1.69)
No (ref)	597 (70.1)	51.8	47.3;56.3	1	1

Note: [a]n: number of adults in unweighted sample and percentages in the weighted sample; [b]Adjusted according to sex, age, and education. *p*: Pearson's chi-square *p*-value. BMI: Body Mass Index; CI: Confidence Interval; Ref: Reference category used for comparison.

We found an important relationship between having chronic diseases, anthropometric measurements, and BMI. Being overweight represented an average increase of 39% in the probability of having HA, 128% of having DM, and 55% of having high cholesterol compared to people with a

BMI <25. We also observed that people who are overweight are more likely to have a high risk of developing cardiovascular diseases and to take weight loss drugs. Individuals who reported checking food labels had a lower prevalence of overweight (at the threshold of statistical significance) (Table 2).

Regarding the frequency of food consumption, people who were overweight or obese were more likely to consume soft drinks (PR=1.18) and less likely to remove the visible excess fat before eating meats (PR=0.84) (Table 3).

Table 2 – Prevalences and prevalence ratios (crude and adjusted) of morbidities, waist-to-height ratio, taking weight-loss medications and the habit of reading food labels among adults aged 20 to 59, according to body mass index. Campinas (SP), Brazil, 2014-2016.

BMI (kg/m^2)	Prevalences (95% CI)	Prevalence ratios (95% CI)	
		Crude	Adjusted[a]
Hypertension**	*p*<0.0003		
BMI <25	11.9 (8.7;16.0)	1	1
BMI ≥25	21.1 (17.6;25.1)	1.77 (1.30;2.43)	1.39 (1.01;1.91)
Diabetes**	*p*=0.0037		
BMI <25	2.8 (1.5;5.0)	1	1
BMI ≥25	7.7 (5.6;10.5)	2.78 (1.36;5.65)	2.28 (1.10;4.73)
High Cholesterol**	*p*=0.0044		
BMI <25	9.5 (6.4;13.9)	1	1
BMI ≥25	18.0 (14.4;22.3)	1.89 (1.21;2.95)	1.55 (1.03;2.33)
Waist-to-height ratio**	*p*<0.0001		
BMI <25	35.8 (29.8;42.3)	1	1
BMI ≥25	89.2 (84.9;92.3)	1.39 (1.32;1.46)	1.37 (1.30;1.43)
Taking weight-loss medications**	*p*<0.0001		
BMI <25	2.8 (1.6;4.9)	1	1
BMI ≥25	13.1 (10.1;16.8)	1.10 (1.06;1.14)	1.11 (1.07;1.16)
Habit of reading food labels**	*p*=0.0103		
BMI <25	61.3 (53.9;68.2)	1	1
BMI ≥25	50.4 (44.3;56.5)	0.93 (0.89;0.98)	0.95 (0.90;1.00)

Note: **The probability of presenting the result "yes" for the variables hypertension, diabetes, high cholesterol, use of weight-loss drugs, and habit of reading labels and the result "at risk for cardiovascular disease" for the variable waist-to-height ratio was estimated. [a]Adjusted according to sex, age, and education. *p*: Pearson's chi-square *p*-value. BMI: Body Mass Index; CI: Confidence Interval.

Table 3 – Prevalences and prevalence ratios (crude and adjusted) of overweight or obesity among adults aged 20 to 59, according to food consumption frequency and diet quality classification. Campinas (SP), Brazil, 2014-2016.

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Variables	n (%)[a]	Overweight/Obesity (BMI ≥25 kg/m^2) n= 531		Prevalence ratios (95% CI)	
		%	95% CI	Crude	Adjusted[b]
Fruit		*p*=0.3515			
≥5 times per week (ref)	454 (55.4)	59.0	53.1;64.6	1	1
<5 times per week	401 (44.6)	62.5	57.3;67.5	1.06 (0.95;1.20)	1.05 (0.93;1.19)
Raw vegetables		*p*=0.9055			
≥5 times per week (ref)	338 (41.6)	60.3	53.4;66.8	1	1
<5 times per week	517 (58.4)	60.8	55.9;65.4	1.01 (0.88;1.15)	0.97 (0.85;1.10)
Beans		*p*=0.0571			
≥5 times per week (ref)	606 (68.9)	63.0	58.0;67.8	1	1
<5 times per week	249 (31.1)	55.1	48.8;61.3	0.87 (0.76;1.01)	0.96 (0.83;1.11)
Whole grains		*p*=0.0759			
≥5 times per week (ref)	131 (16.9)	52.2	41.8;62.4	1	1
<5 times per week	724 (83.1)	62.3	58.0;66.4	1.19 (0.96;1.48)	1.17 (0.94;1.45)

Table 3 – Prevalences and prevalence ratios (crude and adjusted) of overweight or obesity among adults aged 20 to 59, according to food consumption frequency and diet quality classification. Campinas (SP), Brazil, 2014-2016.

Variables	n (%)[a]	Overweight/Obesity (BMI ≥25 kg/m²) n= 531		Prevalence ratios (95% CI)	
		%	95% CI	Crude	Adjusted[b]
Soda		*p*=0.0074			
≤2 times per week (ref)	593 (70.3)	57.6	53.0; 62.1	1	1
>2 times per week	262 (29.7)	67.6	61.3; 73.4	1.17 (1.05;1.31)	1.18 (1.07;1.31)
Sweets		*p*=0.2694			
≤2 times per week (ref)	573 (67.0)	62.1	57.2;66.7	1	1
>2 times per week	282 (32.9)	57.4	50.5;64.1	0.92 (0.80;1.07)	0.97 (0.83;1.12)
Red meat		*p*=0.3310			
≤2 times per week (ref)	210 (27.0)	56.3	45.7;66.4	1	1
>2 times per week	644 (73.0)	62.2	57.6;66.5	1.10 (0.89;1.36)	1.12 (0.91;1.38)
Usually eat red meat		*p*=0.0001			
With fat (ref)	426 (47.2)	69.5	63.9;74.6	1	1
Without fat	399 (52.8)	53.9	48.4;59.3	0.78 (0.69;0.88)	0.84 (0.74;0.96)
Diet quality		*p*=0.6943			
Low	294 (34.3)	59.6	52.6;66.3	1	1
Intermediate	533 (62.0)	60.7	55.8;65.3	1.02 (0.88;1.17)	0.97 (0.85;1.12)
High	28 (3.7)	68.1	48.2;83.1	1.14 (0.88;1.48)	1.23 (0.95;1.58)

Note: [a]n: number of adults in unweighted sample and percentages in the weighted sample; [b]Adjusted according to sex, age, and education. BMI: Body Mass Index; CI: Confidence Interval; *p*: Pearson's chi-square *p*-value. Ref: reference category used for comparison.

Table 4 shows that participants with overweight or obesity ate significantly more grams of food daily (≈ 345 g/day), consumed more energy (≈ 209 kcal/day), total fat (≈ 11 g/day), saturated fat (3 g/day), trans-fat (0.5 g/day), carbohydrates (≈ 19 g/day), insoluble dietary fiber (0.8 g/day), total protein (8 g/day), animal protein (≈ 5.4 g/day), vegetable protein (2.6 g/day), sodium (≈ 474 mg/day) and potassium (≈ 105 mg). Their diets also had a higher glycemic load (≈ 19 g/day).

Table 4 – Mean and beta coefficients of nutrient intake among adults aged 20 to 59 with and without overweight or obesity. Campinas (SP), Brazil, 2014-2016.

Variables	BMI <25 kg/m²		β coefficient	
	Mean	(95% CI)	Crude (*p*)	Adjusted (*p*)[a]
Diet weight (g/day)	2718.2	2593.6;2842.7	267.50 (0.002)	344.59 (<0.001)
Energy (kcal/day)	1749.0	1667.8;1830.1	47.62 (0.420)	208.63 (<0.001)
Fat (g/day)	63.6	60.3;67.0	4.15 (0.091)	10.94 (<0.001)
Saturated fat (g/day)	20.3	18.9;21.7	0.67 (0.454)	3.02 (<0.001)
Trans fat (g/day)	2.3	2.0;2.6	0.28 (0.064)	0.53 (0.001)
Carbohydrate (g/day)	217.0	205.2;228.9	1.15 (0.875)	18.64 (<0.001)
Added sugar (g/day)	44.4	38.5;50.3	-5.71 (0.070)	-1.69 (0.504)
Dietary fiber (g/day)	13.5	12.5;14.5	-0.12 (0.825)	0.77 (0.085)
Soluble dietary fiber (g/day)	3.7	3.3;4.0	-0.28 (0.156)	-0.01 (0.968)
Insoluble dietary fiber (g/day)	9.8	9.1;10.5	0.18 (0.666)	0.80 (0.030)
Protein (g/day)	74.1	70.2;78.0	1.88 (0.497)	8.01 (<0.001)
Animal protein (g/day)	49.8	46.6;53.0	0.84 (0.705)	5.38 (0.005)
Vegetable protein (g/day)	24.3	23.0;25.6	1.05 (0.233)	2.63 (<0.001)
Calcium (mg/day)	618.0	557.0;678.9	-83.80 (0.009)	-41.99 (0.122)
Sodium (mg/day)	3114.3	2939.3;3289.4	217.01 (0.095)	474.70 (<0.001)
Potassium (mg/day)	1997.5	1874.8;2120.2	-57.51 (0.443)	105.23 (0.049)
Glycemic load (g/day)	175.9	165.6;186.2	4.18 (0.507)	18.73 (<0.001)

Note: [a]Linear regression coefficient adjusted for underreporting of energy intake. CI: Confidence Interval.

DISCUSSION

This paper details food consumption among adults living in the city of Campinas and highlights the differences between the dietary patterns of overweight or obese individuals and those not overweight. Our results show that 60.6% of participants were overweight or obese, which was associated with a higher intake of energy, total fat, saturated fats, trans-fats, carbohydrates, protein, sodium, potassium, and consuming a diet with a higher glycemic load. Besides that, the quality of the diet of both groups was similar, with most participants being classified as having a diet of intermediate quality.

Younger study participants were less likely to be overweight or obese, whereas participants with 0 to 8 years of education were more likely to be overweight or obese. This is consistent with data from other Brazilian studies showing that adults with fewer years of education have higher percentages of overweight [4]. International studies have pointed to a negative association between years of education and BMI [7,21] and a lower prevalence of overweight and obesity among younger adults [22]. That might be due to younger and more educated people having better access to healthcare services, as well as a better diet, which contributes to a lower percentage of them being overweight, reflecting the impacts of social inequality and health disparities on public health.

In our study, we also observed that obese adults showed higher waist-to-height ratios, as well as higher prevalences of diseases like HA and DM. Ashwell et al. (2012) [23] conducted a review to assess the predictive potential of waist circumference, BMI, and waist-to-height ratio on cardiometabolic risk, which showed waist-to-height ratio as a more reliable measure than the other two. Likewise, Corrêa et al. (2019) [14] also identified waist-to-height ratio as a better predictor of cardiometabolic risks than a combination of BMI and waist circumference in Brazilian elderly and adult individuals. This reinforces the relationship between being overweight, having more fat accumulated around the waist, and developing chronic diseases.

Although more overweight or obese adults reported believing that they do not eat more than they should when compared to individuals at a healthy body weight, most of the former answered negatively to that question. Contrastingly, overweight participants had a higher intake of energy and macronutrients after adjusting for underreporting [19], as this is a common issue when assessing the food consumption of overweight individuals [9].

When questioned about the habit of reading food labels, overweight or obese individuals were less likely to answer positively than those not overweight. The habit of reading labels has been evidenced as an effective way to get informed regarding the nutrition facts of foods, which led the *Agência Nacional de Vigilância Sanitária* (Brazilian Health Regulatory Agency) to approve new norms for food labels in Brazil, with an even clearer and more detailed nutrition facts panel [24]. Balhareth et al. (2019) [7] conducted a systematic review, which showed that the lack of basic nutrition knowledge regarding healthy foods and energy density are major factors associated with overweight. That leads us to hypothesize that if the population shows more interest in reading food labels, they might make better food choices and consequently better manage their body weight.

Although physical activity is well-known to be a major requirement for a healthy lifestyle, and most overweight adults reported higher levels of leisure-time physical inactivity, there was no significant difference when compared to not overweight participants. According to World Health Organization, an individual needs at least 150 minutes a week of moderate-intensity physical activity or 75 minutes of high-intensity physical activity [25]. In Brazil, 48.2% of the adult population did not meet the recommended amounts of physical activity in 2021, only a slight improvement from

the 49.4% who did not meet these guidelines in 2013 [26]. According to Dankel et al. (2017) [27], being inactive and overweight are major risk factors for cardiovascular diseases and several other morbidities. Furthermore, any amount of physical activity is inversely associated with negative health outcomes, whereas being overweight or obese has the opposite effect, especially after being overweight for a longer number of years [27].

Apart from a healthy diet and an active lifestyle, pharmacological treatment can also contribute to weight management. Many drugs can aid weight loss and reduce the risk of obesity-related diseases [28]. However, there are limitations to that, such as the beneficial effects of such drugs on body weight and blood pressure being too small, especially a year after treatment [29], which explains the high number of participants who reported taking these kinds of medication.

These factors are also linked to an ongoing phenomenon called nutritional transition, which describes the progressive reduction in consumption of unprocessed foods in favor of highly processed foods, accompanied by changes in health patterns [10]. Brazil was the first country to propose classifying foods based on their level of processing, promoting unprocessed or minimally processed foods as the foundation of a person's diet. The Dietary Guidelines for the Brazilian Population also encourage making food at home and eating in the company of others [10].

It is worrying that, similarly to our study, national and international studies have demonstrated that people eat insufficient amounts of fruits, vegetables, legumes, and other unprocessed foods [30,31]. In the present study, we identified that overweight or obese individuals consume more fatty meats and soda.

Evidence shows that drinking more sugar-sweetened beverages is associated with obesity and other chronic diseases [32], and placing higher taxes on these products has been shown to help reduce the intake of energy and sugar from these beverages by the population [33,34].

The consumption of these drinks could also potentially be reduced through changes in food labels, limiting their availability in cafeterias, increasing their prices, and promoting the purchase of fruits and vegetables with financial incentives, depending on the targeted group [32]. Other strategies associated with decreased sales of sugar-sweetened beverages include traffic-light labeling, price increases, price discounts on low-calorie beverages, in-store promotion of healthier beverages in supermarkets, and promotion of healthier beverages in vending machines, among other strategies, at different levels of evidence [32].

In our study, overweight or obese adults consumed more high-fat meats and had a higher intake of total, saturated, and trans-fat, as well as protein and energy. Evidence shows that while trans fats are known to increase cardiovascular risk, the effect of saturated fats on cardiovascular health is not as clear. Regardless, substituting saturated fatty acids with polyunsaturated fatty acids seems to reduce cardiovascular risk [35]. Brazilians still spend a lot of money on meat [36] and eat higher quantities of red and processed meat than recommended by the World Cancer Research Fund [37], which contributes to an excessive intake of fats and energy, thus contributing to excessive body weight and the development of chronic diseases [38].

When assessing individual nutrients, we found significantly higher intakes of energy, total, saturated, and trans-fats, carbohydrates, sodium, and potassium, as well as total, animal, and vegetable protein by overweight or obese individuals. Similar results were found by Malinowska et al. (2020) [9], who also identified higher intakes of energy, protein, total and saturated fat, and sodium among overweight or obese individuals.

In our study, overweight or obese individuals consumed diets with a higher glycemic load when compared to participants who were not overweight. The adequate consumption of fiber-rich foods, whole grains, fruits, and vegetables, which are known to impact the glycemic load of a meal, play a central role in human health [39], highlighting the importance of the overall quality of the diet and of consuming less processed foods [10]. However, although several studies have investigated the role of the glycemic index of foods and the glycemic load of meals on chronic diseases, their results are still controversial [39,40].

There was no difference in the quality of the diet between groups of participants, as most of them had an intermediate-quality diet. On the other hand, overweight or obese adults ate greater amounts of food. According to Smethers and Rolls (2018) [8], although reducing energy intake is a key factor for weight loss, improving the quality of the diet is essential for weight management, which highlights the relationship between the quality of the diet and obesity [41]. Furthermore, the Dietary Guidelines for the Brazilian Population considers fresh and minimally processed foods as the foundation of a healthy diet [10] and provides guidance for primary healthcare teams of the Brazilian unified public health system to disseminate these recommendations [42,8].

A recent study examined trends of consumption of different food items in Brazil, comparing data from the National Dietary Surveys 2008-2009 versus 2017-2018. According to that study, the quality of the Brazilian diet is getting worse: while the excessive consumption of ultra-processed remained unchanged, there was a reduction in the consumption of rice, beans, and fruits [43].

Among the strong points of this study, we point out that our data come from a population-based study as well as the use of standardized methods of data collection using software with an extensive database of foods that allowed adding new culinary recipes. Our work also has limitations, including its cross-sectional design, that do not allow for inferring cause and effect. Also, the use of a single 24-hour recall per participant to assess food intake may not reflect usual dietary patterns due to intra-individual variability. On the other hand, our data collection was done on different days of the week, including weekends and different seasons of the year, which allowed us to calculate the estimated average intakes for the study's population [44].

CONCLUSION

These data suggest that overweight and obesity are associated with a higher waist-to-height ratio and with an increased prevalence of cardiometabolic diseases like HA and DM in the population included in our study. Furthermore, survey participants who were overweight or obese consumed soda and ate fatty meats more frequently while consuming significantly more calories and eating meals with a higher glycemic load. It is important to state that, although there were not differences in the quality of the diet between groups of participants, both groups did not have a diet of adequate quality. Therefore, promoting a healthier diet is essential for people with and without overweight or obesity, whether for weight management or the prevention of chronic non-communicable diseases. Our data highlights the need for continual nutritional surveillance of the population and for the promotion of healthier eating habits, which can be achieved by multidisciplinary teams of healthcare professionals in partnership with policymakers and key stakeholders.

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CONTRIBUTORS

SDL CARVALHO performed the literature review, data analysis, and writing of the manuscript. D ASSUMPÇÃO, AA BARROS-FILHO and TM SÃO-JOÃO collaborated with data analysis and interpretation, critical review of the intellectual content, and approved the version for publication. D HAYASHI collaborated with data analysis and interpretation, critical review of the manuscript, and approved the version for publication. ME CORNÉLIO carried out the proposal of the article, literature review, data analysis, and writing of the manuscript.