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Research Article

Evaluation of the purchase of food products by adults with obesity and the degree of food processing

Avaliação dos produtos alimentícios adquiridos por adultos com obesidade e o grau de processamento dos alimentos

Evaluación de productos alimenticios comprados por adultos con obesidad y grado de procesamiento de alimentos

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ABSTRACT

Introduction: The increase in obesity is related to changes in the pattern of acquisition and consumption of ultra-processed food products to the detriment of fresh and minimally processed foods. The objective of the present study was to investigate the prevalence of obesity in a small city and to evaluate the food products acquired by individuals with obesity according to the degree of processing. **Methods:** Analytical cross-sectional study divided into two stages. In the first stage, a Body Mass Index (BMI) of 533 individuals was investigated. 60 individuals were selected for the second stage, in which determinants of the nutritional profile were investigated, such as the acquisition of food and expenditure on food. **Results:** In the first stage, a prevalence of 30.39% of obesity was found. In the second stage, there was no significant difference between the acquisition of food by the degree of processing. More than 18% of respondents reported skipping breakfast and almost 22% reported having lunch at work. There were no differences in total spending, by place of purchase and in the proportion of spending on food in relation to family income and obesity categories. **Conclusions:** The prevalence of obesity in the studied district is high, considering its population. We suggest that this prevalence may be influenced by the acquisition of ultra-processed foods, food outside the home and omission of breakfast.

Keywords: Obesity; Primary care; Health promotion; Food assistance.

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RESUMO

Introdução: O aumento da obesidade está relacionado a mudanças no padrão de aquisição e de consumo de produtos alimentícios ultraprocessados em detrimento de alimentos *in natura* e minimamente processados. O objetivo do presente estudo foi investigar a prevalência de obesidade em um território adstrito à Unidade Básica de Saúde, em município de pequeno porte, e avaliar os produtos alimentícios adquiridos pelos indivíduos com obesidade de acordo com o grau de processamento. **Métodos:** Estudo analítico transversal dividido em duas etapas. Na primeira, foi investigado o índice de massa corporal (IMC) de 533 indivíduos da cidade de pequeno porte. Selecionou-se 60 indivíduos para a segunda etapa, em que foram investigados determinantes do perfil nutricional, tais como aquisição de alimentos e gasto com alimentação. **Resultados:** Na primeira etapa, foi encontrada a prevalência de 30,39% de obesidade. Na segunda, não houve diferença significativa na aquisição de alimentos por grau de processamento. No entanto, chama atenção a quantidade adquirida de processados e ultraprocessados. Mais de 18% dos entrevistados relataram omitir o café da manhã e quase 22% disseram almoçar no trabalho. Não houve diferenças nos gastos totais, por local de compra e na proporção de gastos com alimentação em relação à renda familiar e às categorias de obesidade. **Conclusões:** A prevalência de obesidade no distrito estudado é alta, tendo em vista sua população. Sugerimos que essa prevalência possa ser influenciada pela aquisição de ultraprocessados, pela alimentação fora do lar e pela omissão do café da manhã.

Palavras-chave: Obesidade; Atenção básica; Promoção da Saúde; Assistência alimentar.

RESUMEN

Introducción: El aumento de la obesidad está relacionado con cambios en el patrón de adquisición y consumo de alimentos ultra procesados en detrimento de los alimentos in natura y mínimamente procesados. El presente estudio tuvo como objetivo investigar la prevalencia de la obesidad en un territorio adscrito a la Unidad Básica de Salud, en un pequeño municipio, y evaluar los productos alimenticios adquiridos por personas con obesidad según el grado de elaboración. **Métodos:** Estudio analítico transversal dividido en dos etapas. En la primera etapa se investigó el Índice de Masa Corporal de 533 individuos de una pequeña localidad. Sesenta individuos fueron seleccionados para la segunda etapa, en la que se investigaron determinantes del perfil nutricional, como compra de alimentos y gasto en alimentos. **Resultados:** En la primera etapa se encontró una prevalencia del 30,39% de obesidad. En la segunda etapa, no hubo diferencia significativa entre la adquisición de alimentos por el grado de procesamiento. Sin embargo, llama la atención la cantidad de productos procesados y ultra procesados. Más del 18% de los encuestados informó que se saltó el desayuno y casi el 22% informó que almorzó en el trabajo. No hubo diferencias en los gastos totales, por lugar de compra y en la proporción de gastos en alimentación con relación a la renta familiar y categorías de obesidad. **Conclusiones:** La prevalencia de obesidad en el distrito estudiado es alta, considerando su población. Sugerimos que esta prevalencia puede estar influenciada por la compra de alimentos ultra procesados, comer fuera de casa y saltarse el desayuno.

Palabras-clave: Obesidad; Atención primaria; Promoción de la salud; Asistencia alimentaria.

INTRODUCTION

The changes in diet caused by the nutritional transition that took place in recent years in Brazil are driven by changes in food production, distribution, purchase, and consumption systems. The social, economic, and cultural changes that took place in this period caused the epidemiological transition, with an increase in the incidence and prevalence of non-communicable chronic diseases (NCD).[1]

Obesity is part of NCD with a multifactorial cause and involves environmental and genetic aspects, with damage to the health of individuals. Currently, obesity is a public health problem, since 40% of the entire world population is overweight, three times more than 40 years ago.[2] In Brazil, the prevalence of obesity is 34% in adults and 8% in children.[3]

The rapid increase in obesity is mainly related to changes in the population's eating pattern, which favors ultra-processed products, with high levels of sodium, sugar and saturated fats, to the detriment of homemade preparations and *in natura* or minimally processed foods. Foods based on ultra-processed foods, including sugary drinks and fast food, contain a high concentration of these critical substances and are high in energy density.[4]

It is known that food choices are not determined entirely by physiological or nutritional needs, but also by the influence of environmental factors such as accessibility, availability, advertising, and price of

food. However, most of these environmental influences are largely favorable to the consumption of ultra-processed foods to the detriment of in natura and minimally processed foods.[5]

The detailed record of the purchase of food by more than 55,000 Brazilian families, carried out by the Consumer Expenditure Survey (*Pesquisa de Orçamentos Familiares* – POF) 2008–2009, made it possible to estimate the price of the main food groups consumed in Brazil according to the nature, purpose, and intensity of their processing.[6] The average value of ultra-processed foods was higher than that verified for the set of other foods in all social classes.[7] However, the relationship between obesity and food acquisition, according to the degree of processing in the production, remains unknown.

It is believed that there is a spatial correlation between overweight, food insecurity, the quality of food purchased, and social development in different Brazilian geographic spaces. Therefore, the objective of this study was to evaluate the food products purchased by individuals with obesity in a territory attached to the Basic Health Unit (*Unidade Básica de Saúde* – UBS) in a small municipality, according to the degree of processing.

METHODS

Cross-sectional analytical study, part of the matrix project "Matrixing of Health Promotion Actions in the Obesity Care Line". The research was conducted in two stages, both in the area attached to the UBS, which has 2,059 families living in a small-population municipality. It is 120 km from the state capital of Goiás, located in the central-west region of the state and had an estimated population of 33,817 inhabitants in 2019. Its economy is characterized by commerce and dairy production, which constitute the dairy local productive arrangement (LPA) dairy in the municipality. The municipality's human development index is 0.731, placing it 32nd in the ranking of the 246 municipalities in Goiás.[3]

The first stage was carried out in 2018 and consisted of collecting the weight and height of young adults aged 18 to 59 years. The sample size calculation of this first stage was performed using the EpiInfoTM 7 software, with an absolute error of 5% and a confidence level of 95%, which resulted in a sample of 324 randomly selected families and 533 individuals evaluated.

For the collection of anthropometric data, a portable Welmy® scale was used with a capacity of 200 kg and 50 g division and a measuring tape, which was fixed to a wall without a level baseboard at a height of 50 cm from the floor, after the plumb line test was performed. Based on the data collected, the body mass index (BMI) was calculated for the classification of nutritional status according to the criteria of the World Health Organization (WHO).[8]

In the second stage, a subsample of 60 obese individuals from different households was randomly selected. Those with a BMI >30 kg/m², aged between 18 and 59 years, of both genders, were included.

Family food consumption was investigated using a research instrument validated to be used in the Multicentric Study of Food Consumption carried out by the Ministry of Health, in partnership with several universities in the country and a State Department of Health.[9] This is a methodology that includes the survey of socioeconomic data to recognize the determinants of the nutritional profile, such as number of people per household, family income, and food expenses. The food and nutritional consumption survey also includes information regarding the characterization of the family, food purchase, housing conditions, food and nutrition programs and a list of 118 foods related to family consumption.[10] The NOVA classification of the purchased food was carried out.[7]

Descriptive data analysis was presented in absolute and relative frequencies or in mean and standard deviation. To verify the normality of the data, the Shapiro-Wilk test was performed and then nonparametric statistics were applied to compare the continuous variables, specifically the Mann-Whitney and Kruskal-

Wallis tests. The Nemenyi test was used for significant variables, for the differentiation that is presented in lowercase letters flanked by their means in the tables. Additionally, the χ^2 or Fisher's Exact test was performed to examine the homogeneity of the groups in relation to the proportions. The significance level used for all tests was 5%. The Stata® software, version 14.0, was used in this analysis.

The project was approved by the Ethics and Research Committee of *Hospital das Clínicas*, Universidade Federal de Goiás, under protocol number 2.359.875. With support from the National Council for Scientific and Technological Development (*Conselho Nacional de Desenvolvimento Científico e Tecnológico* – CNPq), process number 408472/2017-0. All research participants signed the Informed Consent.

RESULTS

First stage

A total of 533 individuals participated in the study, of which 61.54% were female. The mean age of the participants was 40.69 years (standard deviation – SD=11.41), with 40.78 years for females (SD=11.43) and 40.49 (SD=11.42) years for males.

The prevalence of obesity was 30.39%. The classification of nutritional status in percentages is detailed in Figure 1. The distribution of individuals classified according to nutritional status with obesity (red

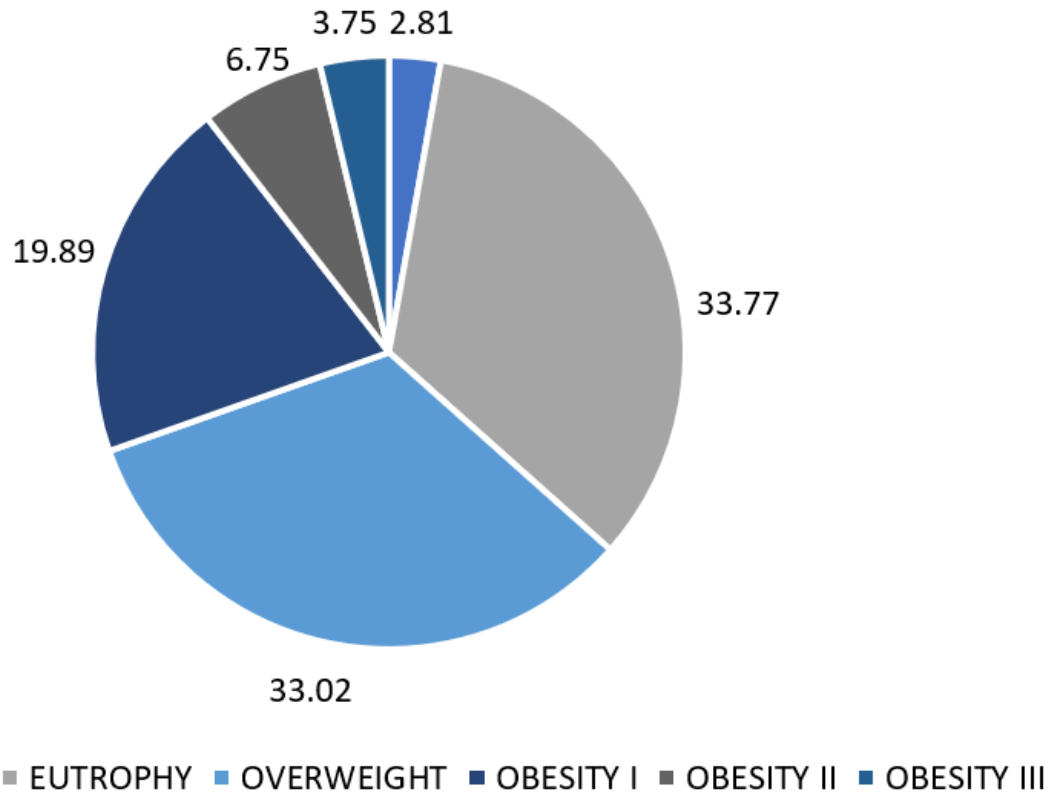


Figure 1. Classification of nutritional status assessed by body mass index in residents of a small town in the interior of Goiás, 2018, n=533.

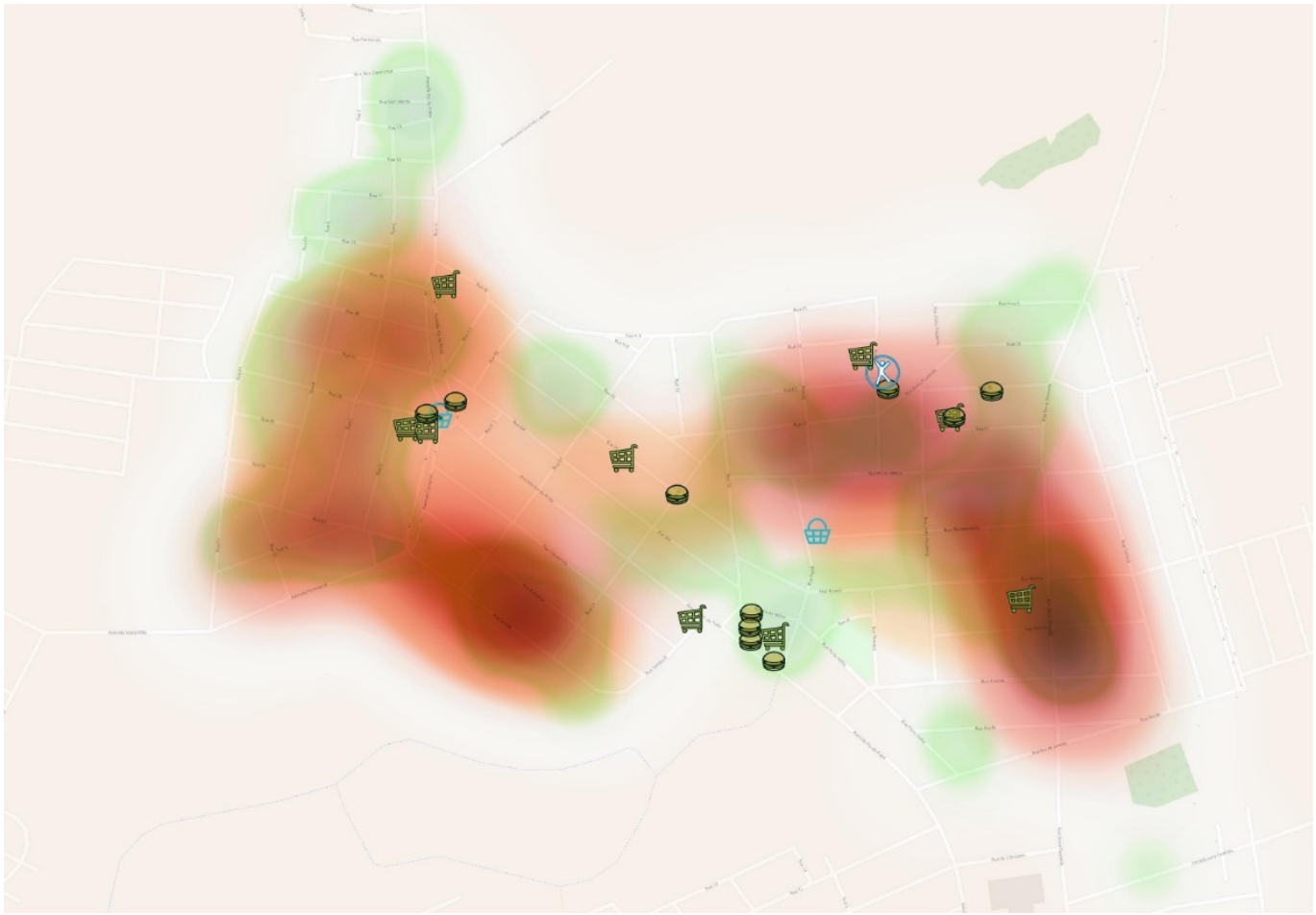
color) and without obesity (green color) in the restricted area studied are highlighted in the map in Figure 2. Fast-foods, fairs, markets and outdoor gym were also located on the map.

The participants' mean BMI was 27.49 kg/m² (SD=6.13), with 27.71 kg/m² for females (SD=6.13) and 27.14 kg/m² (SD=6.12) for males, with no significant difference (p=0.482). However, when assessing the classification of nutritional status according to gender, it was observed that men had a higher prevalence of overweight and grade I obesity, and women, a higher prevalence of grade II and III obesity (p=0.046) (Figure 3).

Regarding nutritional status and age, there was a difference in the proportion of classifications between age groups, for example, with a higher frequency of eutrophic individuals in the age group 18–29 years (48.2%) to the detriment of the proportion of individuals with grade II obesity (0.9%) in the same age group, as can be seen in Figure 4 (p=0.010).

Second stage

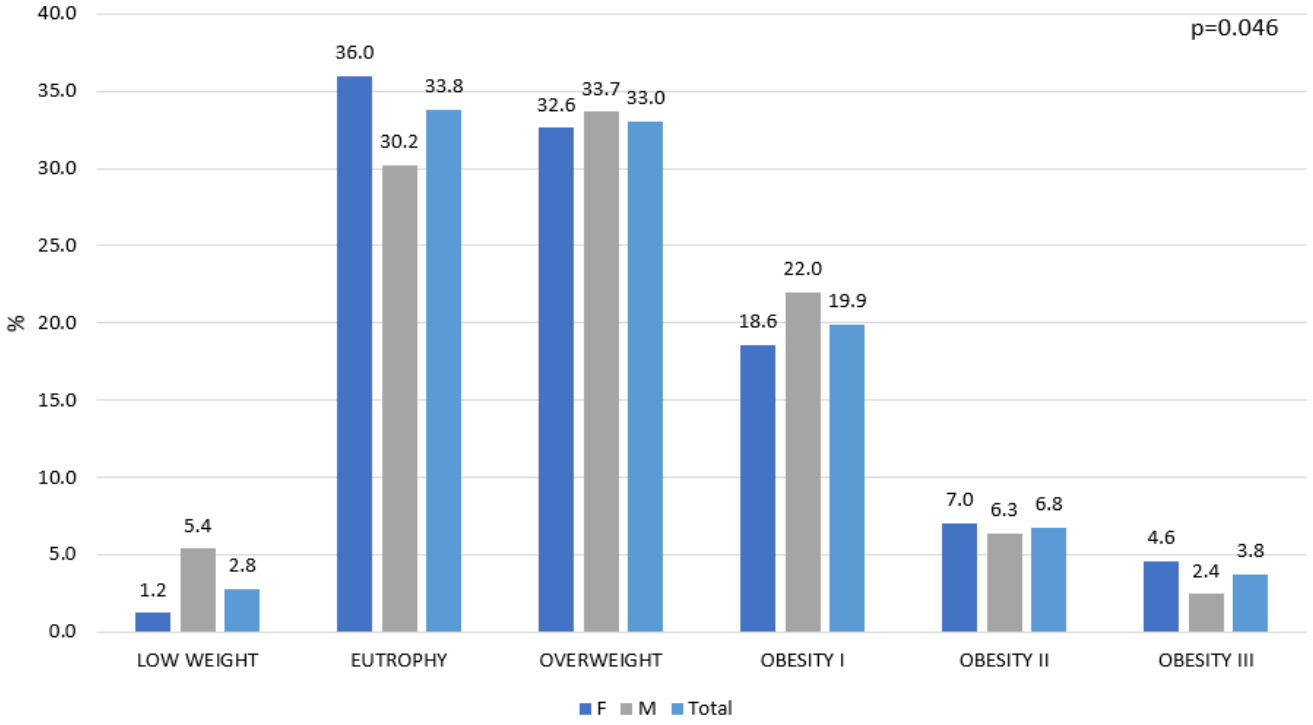
The mean age of the subsample of obese individuals (n=60) was 44.39 years (SD=9.15), and 73% were female. Table 1 presents the socioeconomic and demographic characterization.



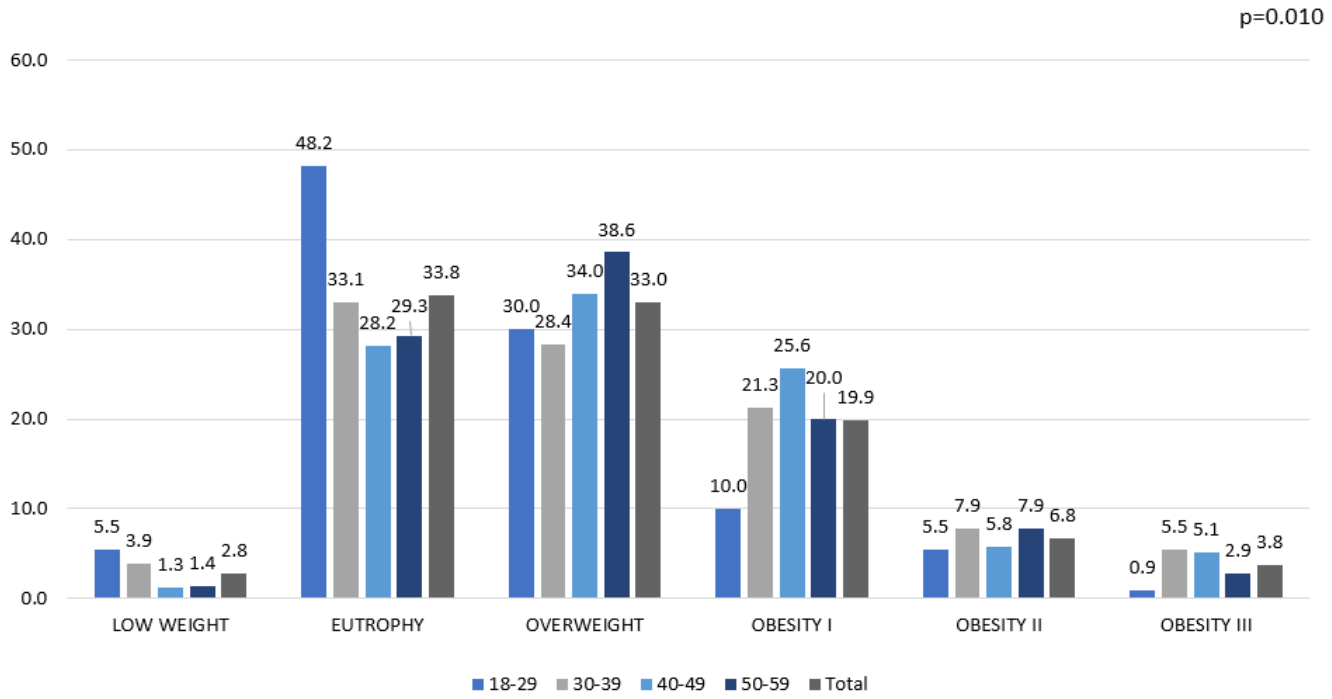
The coordinate grid and the geographic reference system were omitted from the map, in order to preserve the spatialization of the places of interest.

Figure 2. Dispersion of individuals by nutritional status assessed by body mass index in residents of a small town in the interior of Goiás, 2018 (n=533).

Of the 60 participants in the subsample studied, 40.00% were illiterate or had incomplete elementary education, 25.00% had complete elementary school or incomplete middle school, 18.33% had complete middle school or incomplete high school education, 17.67% had complete high school or incomplete



F: female; M: male; p-value obtained by Fisher's exact test, with a 5% significance level.
Figure 3. Relationship between nutritional status and gender in residents of a small town in the interior of Goiás, 2018 (n=533).



p-value obtained by Fisher's exact test, with a 5% significance level.
Figure 4. Relationship between nutritional status and age categories in residents of a small town in the interior of Goiás, 2018 (n=533).

higher education, and 5.00% had complete high school education. On average, family environments had 1.63 people who worked (SD=0.97; median=2; interquartile range — IQ=1–2). The mean monthly family income was R$ 2,580.70 (SD=0.1667.49; median=2,024.00; IQ=1,497.00–3,000.00). The monthly *per capita* family income mean was R$ 891.75 (SD=634.46; median=748.50; IQ=500.00–1,000.00). The score of the Brazilian Association of Research Companies (*Associação Brasileira de Empresas de Pesquisa* – ABEP), on average, was 24.20 (SD=7.89; median=23; IQ=18.50–28.50), and the most common classes, in descending order, C (61.66%), followed by B (23.33%), D (13.33%), and A (1.67%).

Table 1. Anthropometric characterization of a subsample with obese individuals residing in a small municipality in the state of Goiás, 2018 (n=60).

	Mean	Standard deviation	Median	Interquartile range
Weight (kg)	91.53	17.44	89.37	78.82–99.45
Height (m)	1.61	0.09	1.59	1.54–1.66
Body Mass Index (kg/m²)	35.34	4.94	34.43	31.69–37.97

Table 2. Characterization of the place of consumption of meals of a subsample of individuals with obesity residing in a medium-sized municipality in the state of Goiás, 2018 (n=60).

	n	%
Breakfast		
Does not have it	11	18.33
At home	29	48.33
At work, but brings it from home	2	3.34
At work	15	25.00
Restaurant/diner/cafeteria	3	5.00
Morning snack		
Does not have it	48	80.00
At home	10	16.67
At work	2	3.33
Lunch		
At home	45	75.00
At work, but brings it from home	2	3.33
At work	13	21.67
Afternoon snack		
Does not have it	30	50.85
At home	21	35.59
At work, but brings it from home	2	3.39
At work	6	10.17
Dinner or night snack		
Does not have it	3	5.00
At home	56	93.33
At work, but brings it from home	1	1.67
Supper		
Does not have it	48	80.00
At home	12	20.00

As for donations, only 3.33% (n=2) of the interviewees said they received them, and in both cases in the form of a basic food basket, which was consumed by all family members. As for government benefits, 16.67% (n=10) said they received them; Bolsa Família prevailed, with nine out of ten mentions, and there was only one reported Citizen's Income. The mean value of the benefit was R$ 140.80 (SD=45.33; median=126.50; IQ=112.00–172.00).

Of the participants in this stage, the mean weight was 91.53 kg (SD=17.44) and the BMI was 35.34 kg/m² (SD=4.94). Meals were mostly held at home. In addition, over 18% of respondents reported skipping breakfast and nearly 22% reported having lunch at work (Table 2).

The NOVA classification was used to evaluate the purchased foods, and there was no significant difference between the consumption of fresh, minimally processed, processed, and ultra-processed foods among obese individuals. However, the acquisition of processed and ultra-processed food products by these individuals in their dietary routine stands out (Table 3). There were no differences in total expenditures by place of purchase and in the proportion of expenditures on food in relation to family income and obesity categories p>0.05 (Table 4).

DISCUSSÃO

It should be noted that the present study is the first to carry out exploratory research in a health area, with the investigation of nutritional status, shopping profile and access to food, as well as the presence of social facilities in the region. The NOVA classification was also carried out,[7] which states that the foods or food products purchased are classified according to their degree of processing into four categories.

Table 3. Family consumption in grams of unprepared foods classified by NOVA by obesity categories of residents in a small municipality in the state of Goiás, 2018 (n=60).

	Total	Obesity I 30 (52.63%)	Obesity II 20 (35.09%)	Obesity III 7 (12.28%)	p-value
In natura/minimally processed	109.05±54.16	109.70±57.77	110.81±55.31	100.94±35.61	0.988
Cooking ingredients	10.56±5.60	10.71±5.87	10.50±5.57	9.56±5.14	0.984
Processed	7.23±3.94	7.34±3.94	7.66±4.24	5.50±3.03	0.477
Ultra-processed	24.68±22.90	26.33±21.61	24.66±27.85	16.94±11.10	0.678

Data presented as mean±standard deviation of the mean; p-value obtained by Kruskal-Wallis test, with 5% significance level.

Table 4. Food expenditure by place of purchase of food/meals of a subsample of obese individuals residing in a small municipality in the state of Goiás, 2018 (n=60).

	Mean	Standard deviation	Minimum-Maximum
Total spend (R$)	753.07	483.80	220–2,000.00
Total supermarket spend (R$)	531.60	254.13	150.00–1,500.00
Total farmer's market spend (R$)	120.37	91.42	20.00–400.00
Total producer spend (R$)	155.83	140.66	15.00–500.00
Total green grocery spend (R$)	120.00	28.28	100.00–140.00
Total butchery spend (R$)	216.23	132.42	40.00–600.00
Total bakery spend (R$)	81.87	82.80	10.00–450.00
Total deli spend (R$)	59.75	28.79	30.00–108.00
Expenditure on food in relation to family income (%)	45.47	21.52	15.50–100.00

We suggest that the high prevalence of obesity observed may be related to the consumption of ultra-processed food products.

The prevalence of obesity found in the present study was higher than in Manaus (23.4%), the city that had the highest prevalence among the 26 Brazilian capitals.[11] In a study carried out in 2002, in another medium-sized municipality in the same state, a 16% prevalence of obesity was found, especially among women.[12]

The high prevalence of obesity in the city could be explained by the access to food. Two areas with higher concentrations of obese individuals can be seen on the map. These two areas do not coincide with the largest agglomerations of establishments that sell fast food snacks. However, the reduced geographic area of the municipality facilitates access to these establishments throughout the region represented. In addition, there is a predominance of establishments that offer fast food snacks to the detriment of street/farmer's markets and markets.

A cross-sectional study on the determinants of obesity in 3,883 North American participants identified that food purchase behavior varies according to the type of commerce that exists close to the place of residence and the distance to the primary food store. Respondents living in rural areas make smaller purchases more often. In multivariate analyses, residing in rural areas or small cities and suburban areas was significantly associated with higher BMI and lower intake of fruits and vegetables.[13] This result suggests that distance and commuting issues interfere with eating behavior and, consequently, with nutritional status.[13]

Research with three months of intervention showed that the use of methods to individualize dietary interventions, such as considering consumer behavior in grocery shopping and the socioeconomic status of individuals, can overcome common limitations to encourage a healthy and viable lifestyle.[14]

A cross-sectional Brazilian study that investigated the association of food environment variables with high BMI of 1,139 individuals identified that living near a convenience store was associated with higher BMI and greater probability of being overweight and obese. In contrast, living near a restaurant was associated with a lower BMI and a lower likelihood of being overweight and obese. In addition, participants who lived near fruit stores had a lower BMI and were less likely to be overweight.[15]

In a national expenditure survey, the purchase of ready-to-eat meals away from home was 46%. The places with the highest frequency of food consumption outside the home were cafeteria (16.9%) and restaurant (16.4%), while fruit store (1.2%) had the lowest frequency. Sweets, snacks, and soft drinks were the most purchased foods in most places.[16]

Eating away from home could justify the high prevalence found in the present study in relation to national data.[11] In addition to eating away from home, skipping breakfast, as found in the research, is an eating habit associated with overweight and obesity, as well as to other complications such as systemic arterial hypertension, diabetes mellitus, and cardiovascular diseases.[17] This relationship between skipping breakfast and obesity seems to be justified by changes in serum insulin, total cholesterol, and their fractions.[18] Furthermore, in mice, these habits have been shown to predispose to an inability to enter the day/night cycle, which could cause disruption of the circadian rhythm.[19]

Food environment study shows that the home provides physical and social context for most eating behaviors. The dimensions of the food environment, related to the place where food is disposed, the presence of TV in the food area, and purchasing practices are related to overweight and obesity.[20]

The shopping profile evaluated in the present investigation reflects the consumption profile of Brazilians, in which fresh or minimally processed foods represent more than 60% of the diet,[21] and the

prevalence of consumption of ultra-processed foods is 21%.[4] Although obesity in its worsening levels did not show a difference in consumption between the processing categories, the purchase of ultra-processed products should be avoided[22] or consumption should be kept close to zero.[23]

The consumption of ultra-processed food products reflects on a diet with high energy density, given the high content of sugar, saturated fat, and trans fat that these food products contain.[24] Diets with high energy density compromise the ability of the human body to regulate energy balance, increasing the risk of excessive weight gain. However, studies already carried out in Brazil indicate significant associations of consumption of ultra-processed foods with metabolic syndrome in adolescents,[25] with dyslipidemia in children,[26] and with obesity at all ages.[4]

The main limitation of the present study is the lack of investigation of food consumption. Although the purchase of food and food products is an indicator of consumption, it was not possible to identify the amounts of food consumed according to the degree of processing. Furthermore, *in natura* or minimally processed foods in excessive amounts can also cause excess weight.[23] Therefore, the assessment of the quantities consumed would reflect a more accurate analysis. Although obesity is an NCD with a multifactorial etiology, its main cause can be attributed to the deregulation of energy balance, with food consumption greater than energy expenditure.[27] Thus, it was not possible to establish an association between obesity and food consumption. according to the degree of processing. Another limitation of the present study was that it did not control the use of medications that may contribute to weight gain.[28]

We conclude that the prevalence of obesity in the studied district is high, considering its population. We suggest that this prevalence may be influenced by the purchase of ultra-processed food products, eating away from home, and skipping breakfast. However, further research is needed to investigate other aspects of food consumption and the level of physical activity of the obese population in this region. We also suggest the importance of creating and implementing an obesity care line in the UBS of the studied area, articulated with the health care network, with the definition of the attributions of the unit's workers, as this is usually the user's first entry point in the Unified Health System (*Sistema Único de Saúde* – SUS). The investigation of a representative population in the territory is highlighted here as a strength of the study.

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CONFLICT OF INTERESTS

Nothing to declare.

AUTHORS' CONTRIBUTIONS

CSAS: Writing – original draft, Visualization. ATVSF: Writing – review & editing, Visualization. ALMS: Writing – review & editing, Investigation. RMS: Formal analysis, Data curation, Writing – review

& editing, Software, Validation, Visualization. IHCFM: Project administration, Conceptualization, Writing – review & editing, Methodology, Resources, Supervision, Visualization. LMS: Project administration, Conceptualization, Writing – review & editing, Funding acquisition, Resources, Supervision, Visualization.

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