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Consumption of sugary drinks and body image of adolescents in the Covid-19 Pandemic

Sarah Carolina Lopes*
Tayane Soares Miranda*
Yasmim Almeida Matos*
Maria Eduarda Jesus Santos*
Thalita Azevedo Cabral**
Frederico Souzalima Caldoncelli Franco*

Abstract

The social isolation promoted by the COVID-19 pandemic changed the behavior of the population, especially teenagers who, with the closing of schools, started to stay at home. In this context, the consumption of sugary foods and beverages increased, which may lead to changes in the composition and body image of these young people. This study evaluated the consumption of sugary drinks, body image, and nutritional status of adolescents before and during the COVID-19 pandemic. It was a quali-quantitative study, which evaluated 62 students from 13 to 18 years old in the city of Canaã-MG. The consumption of sugary drinks (volume and frequency) was investigated using the dietary recall form, the 9-image silhouette scale for body image, and anthropometric parameters for measuring nutritional status. The results show that most students were eutrophic and reported changing their consumption of types of beverages, frequency, and volume consumed. Natural juice and common soft drinks were the most consumed beverages before and during the pandemic. They also reported a high rate of body dissatisfaction due to thinness, which was reduced during the pandemic. The reason for this dissatisfaction was related to health and aesthetics, with girls exhibiting greater changes in body dissatisfaction between the period before and during the pandemic. Anthropometric parameters confirmed the high rate of body dissatisfaction among students, when compared to their classification by nutritional status. It is concluded that during the pandemic, students changed their consumption of beverages and their perception of their body image.

Keywords: Body Dissatisfaction. Carbonated beverages. Body mass index. Students. Coronavirus.

INTRODUCTION

In March 2020, the World Health Organization (WHO) announced that the COVID-19 outbreak had achieved troubling numbers and reached pandemic levels[1]. In Brazil, the first case of coronavirus (Sars-COV-2) was registered on February 25, 2020, evolving into the first wave between April and May 2020. The coronavirus spread with great speed and aggressiveness[2], reaching its second wave in November 2020. The high dissemination associated with the stagnation of hospital structures, discontinuity in vaccination, and slowness in controlling the pandemic[3] led Brazil, on May 13, 2021, to

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*Instituto Federal do Sudeste de Minas Gerais – IFSEMG. Rio Pomba/MG, Brasil.
**Centro Universitário Governador Ozanam Coelho – UNIFAGOC. Ubá/MG, Brasil.
E-mail: frederico.franco@ifsudestemg.edu.br

account for 15,433,989 confirmed cases and 430,417 deaths[4].

This pandemic has brought about major changes in people's lives[5] and, to avoid contamination by the virus, strategies such as the use of alcohol gel for hand hygiene and masks, confinement at home and social distancing[1] have been used, as well as closing schools[4]. Thus, physical inactivity, sedentary behavior, and food consumption tended to increase due to confinement, which can impact the health and quality of life of students[5,6]. This new situation has indicated a need to assess the impact of social isolation on adolescents who have changed their academic routines.

Adolescence is a critical stage in the lives of young people because pubertal changes trigger inappropriate habits such as high consumption of ultra-processed foods and sugary drinks. Sugary drinks such as soft drinks have approximately 12% sugar and are considered an empty calorie source[7]. Its consumption increased by 525% in Brazil in the last 30 years[8], suggesting that this increase in consumption could increase overweightness, obesity, and the risk of cardiovascular disease[9-11], among other chronic non-communicable diseases[10,12,13].

Obese adolescents tend to be obese adults[14] and develop cardiovascular disorders[15,16] due to inadequate eating habits[9,15]. Nutritional status and obesity risk can be determined by anthropometric parameters such as body weight[15,17]. Considering that the control of body weight has been a major problem during the pandemic due to confinement at home[18] and weight gain similar to that which occurs during school holidays for adolescents, due to increased physical inactivity and food consumption[19], such behavioral changes can alter the perception of body image in adolescents during the COVID-19 pandemic.

The culture of body image in the media advocates that women must be thin as a synonym for competence, success, and sexual attraction, and men must be strong and athletic[10,17,20]. Body profiles that clash with this stereotyped culture promote body image disorders[20,21] and cause body dissatisfaction[22], which can be enhanced in adolescents during the COVID-19 pandemic due to the possible behavioral changes developed during this period.

Considering that Brazil is currently an epicenter of new cases and deaths of COVID-19 in the world[4] and that comorbidities such as diabetes and obesity, developed by inadequate eating habits[23], increase the severity of the coronavirus infection[11,24], it becomes important to know the consumption habits of adolescents to prevent the severity of this disease. In this context, the present study evaluated the consumption of sugary drinks before and during the COVID-19 pandemic, associated with the body image and nutritional status of adolescents in the interior of Minas Gerais.

METHODOLOGY

This study is characterized as a qualitative-quantitative, cross-sectional, observational, and comparative study, with a convenience sample collection and was composed of students aged 13 to 18 years, enrolled in middle school and high school in the city of Canaã, MG. Canãa, MG is located in the forest zone of Minas Gerais, has 4628 inhabitants and has two middle schools and one high school, all under

state management[25]. All students from the 3 schools were invited to participate in the study through an invitation issued by the Municipal Department of Education. The study was carried out between August and December 2020, when students were taking classes in the Not In-Person Study Regime established by the state government. Data collection took place through a face-to-face meeting supported by the biosafety rules of the "Minas Consciente Plan" adhered to by the Municipal Health Department, where anthropometric measurements were obtained and questionnaires on food frequency and body image were completed.

The Ethics Committee for Research with Human Beings of the Federal Institute of the Southeast of Minas Gerais (IFSEMG) approved the project and the Informed Consent/Assent Forms (ICF/IAF), under opinion: 4.297.092, according to resolution CNS 466/12 of the Ministry of Health, that were signed by the participants or guardian before the beginning of the experiment.

Sample characterization forms, frequency of consumption of sugary drinks, and body image were applied individually and were coded to ensure the confidentiality of those evaluated. Individual over 13 years old and under 19 years old and those enrolled in a school in Canaã, MG were used as inclusion criteria. Adolescents who reported having metabolic disorders, anorexia, bulimia, or special needs were excluded from the study. For socioeconomic and demographic variables, sex, age, education, place of residence, number of people living in their house, and family income were analyzed.

To determine the consumption of sugary drinks, a form of consumption frequency of sugary drinks, adapted from Franco *et al.*[26], was applied. The retrospective food consumption form consisted of 5 questions to determine the consumption before and during the COVID-19 pandemic of sugary, non-alcoholic beverages, which beverage the student consumed the most, its frequency and volume, as well as the reasons why they consumed the beverages during the pandemic.

The students' body image was determined by the 9-image silhouette scale, according to Stunkard and validated for Brazilian adolescents[21,22,26-28]. A form with 3 questions was applied, in which the student chose the silhouette image that best characterized their real body image before the COVID-19 pandemic (Real BI Prior) and real body image during the pandemic (Real BI During), as well as the silhouette they would like to have, ideal body image (Ideal BI). The body image BEFORE was defined by the equation: Real BI Prior – Ideal BI; while the body image DURING was measured by the equation: Real BI During – Ideal BI. Body images were classified as "satisfied" when the value of this equation was zero, "dissatisfied due to overweight" when the result of the equation was positive, and "dissatisfied due to thinness" when the result was negative[16,26]. Eutrophic students who reported body image "dissatisfied by thinness" and overweight students who reported being "satisfied" were considered an underestimation of body image. Overestimation was defined by eutrophic students who reported having "overweight or obesity" in their body image[26].

The assessment of anthropometric parameters was performed during the face-to-face meeting, where body weight and height were measured to determine the BMI, fat-free mass, fat percentage, and baseline metabolic rate (BMR)[28]. Body weight was measured on a digital scale with a capacity of 150kg (SONGHE-TOOLS, model SH0550) and 10g precision. Height was measured with

a portable stadiometer (CESCORF, model NswRo7MHlaI) with 0.1cm precision. BMI was calculated by dividing weight by height squared to obtain the Z score according to age and sex (BMI/age), using the World Health Organization (WHO) Anthroplus software[29]. According to the Z score, the individuals were classified as underweight (Z score < -2), eutrophic (-2 ≤ Z score < 1), overweight (1 ≤ Z score < 2) and obese (Z score ≥ 2)[20,26,29].

The measurements of fat-free mass, fat percentage, and BMR were evaluated using a tetrapolar bioelectrical impedance device (BIODYNAMICS, model 450). For these assessments, students were instructed to follow a control protocol for the consumption of liquids, coffee, alcoholic beverages, and laxatives and diuretics. Fat-free mass was determined by the equation: 0.61RI + 0.25BM + 1.31, where RI is height (cm2)/ Stamina (Ω), and BM is body mass (kg). Body fat was determined by the difference between body mass and fat-free mass, which is presented as a percentage of body mass[28].

Descriptive statistics were used to analyze the data, presenting them according to measurements of frequency, mean, and standard deviation. Soon after, the Kolmogarov-Smirnov test was used to assess the normality of the data and the Levene test for the homogeneity of variance. Student's t test or analysis of variance (ANOVA) followed by Tukey's test were used to associate quantitative variables. Qualitative variables were associated by the Chi-squared test. Sigma Stat 3.0 software (Systat Software Inc., USA) was used at a 5% probability level for the analyses.

RESULTS

Table 1 presents the characterization of the sample of this study, which evaluated 62 students, mostly girls aged 15 to 16 years old, attending high school, rural residents, with 4 to 7 people in their house, and family income of up to 2 minimum wages. The eutrophic nutritional status predominated among girls (89.8%) and boys (76.9%), as well as in all ages, education level, place of residence, and family income. No student reported a metabolic dysfunction to be excluded from the study. There was no association between the studied variables (gender, age, education, place of residence, number of people living in the house, and family income) with the categories of nutritional status.

The consumption of beverages according to the nutritional status of students is shown in Table 2. Most students reported consuming natural juices, regular sodas, sweetened coffee, dairy drinks, and artificial juices, which was predominantly consumed among eutrophic students. There was no difference in the distribution of beverage consumption between the categories of nutritional status.

Students reported differences in their patterns of beverage consumption before and during the COVID-19 pandemic concerning their most consumed beverage, frequency, and volume of consumption (Table 2). During the pandemic, consumption of natural juice was reduced, increasing the intake of sweetened coffee and artificial juice (P<0.001). The frequency of ingestion

was high where the consumption was more than 7x/week as opposed to consumption of 2 to 5x/week (P=0.002). As for the volume consumed, an increase in the consumption of 300ml beverages was identified as a substitute for 100 and 200ml beverages (P <0.001).

Sweetened natural juice was the most consumed beverage at 6 to 7 times/week in a volume of 200ml, both before and during the COVID-19 pandemic, and these beverages were consumed due to their pleasant taste. It was also reported that 33.9% of students did not change their eating habits; however, 45.2% increased their consumption of food at meals, 35.5% the number of daily meals, and 27.4% the consumption of fast food.

True silhouette scale values showed an increased self-perception of body image during the pandemic compared to the period before COVIV-19 (3.84 vs. 3.38, P < 0.001). When equating these values with those of the ideal silhouette scale and determining the classification of body image, it was observed that dissatisfaction due to thinness decreased from the period before and during the pandemic (-0.37 vs. 0.08, P <0.001).

Table 3 shows the frequency of body image stratified by nutritional status before and during the COVID-19 pandemic. There was no association between the classifications of nutritional status (eutrophic, overweight, and obesity) with the categories of body image in the moments before and during the pandemic. However, before the pandemic, it was observed that 27.5% of students correctly estimated their body image when calculating BMI/age (eutrophic-satisfied and overweight-obese), and these percentages increased to 40.4% during the pandemic. Before the pandemic, underestimation of body image (thin: eutrophic, overweight and obese; satisfied: overweight and obese) was reported by 54.8% of students, which was reduced to 33.8% during the pandemic. 17.7% of students overestimated (eutrophic-overweight) their body image before the pandemic, which increased to 25.8% during the pandemic.

These results were influenced by the behavior of the eutrophic girls in the study who migrated from the perception of dissatisfied due to thinness before the pandemic to satisfied or dissatisfied due to overweight during the pandemic. It was also verified that the main reasons for body dissatisfaction were related to health and aesthetics.

Table 4 compares the anthropometric parameters between the nutritional status and body image of students during the pandemic. In all anthropometric parameters there was no significant difference between the body image categories (P >0.05) within the nutritional status categories. The underestimation of body image was identified through the parameters weight, BMI, fat-free mass, % of fat, and BMR in students dissatisfied due to thinness and in satisfied students. On the other hand, the overestimation of body image was verified in the parameters for weight, BMI, fat-free mass, % of fat, and BMR in eutrophic students who declared being dissatisfied due to overweight.

Table 1– Characterization of the sample, according to nutritional status, in students from Canaã, MG, Brazil (2020).

Variable	Calculated BMI/Age % (n)				
	Total	Eutrophic	Overweight	Obese	
	% (n)	87.1 (54)	9.7 (06)	3.2 (02)	P
SEX					
Male	21.0 (13)	76.9 (10)	15.4 (02)	7.7 (01)	0.723
Female	79.0 (49)	89.8 (44)	8.2 (04)	2.0 (01)	
AGE (years)					
13-14	29.0 (18)	94.4 (17)	-	5.6 (01)	
15-16	43.6 (27)	85.2 (23)	11.1 (03)	3.7 (01)	0.863
17-18	27.4 (17)	82.4 (14)	17.6 (03)	-	
EDUCATION					
Middle School	46.7 (29)	86.2 (25)	10.3 (03)	3.5 (01)	0.981
Hight School	53.3 (33)	87.9 (29)	9.1 (03)	3.0 (01)	
PLACE OF RESIDENCE					
Urban	48.4 (30)	83.3 (25)	10.0 (03)	6.7 (02)	0.327
Rural	51.6 (32)	90.6 (29)	9.4 (03)	-	
NUMBER OF PEOPLE WHO RESIDE AT HOME					
1 to 3 people	37.1 (23)	91.3 (21)	8.7 (02)	-	0,525
4 to 7 people	62.9 (39)	84.6 (33)	10.3 (04)	5.1 (02)	
FAMILY INCOME					
Up to 2 MW	74.2 (46)	87.0 (40)	8.7 (04)	4.3 (02)	
From 2 to 4 MW	22.6 (14)	92.9 (13)	7.1 (01)	-	0,335
From 4 to 10 MW	3.2 (02)	50.0 (01)	50.0 (01)	-	

Legend: Data in % of individuals in the variable category. MW: minimum wage. P value (Chi-squared test for P < 0.05).

Table 2 – Consumption of non-alcoholic sugary beverages before and during the COVID-19 pandemic, according to nutritional status, in students from Canaã, MG, Brazil (2020).

Variable		BMI/AGE (%(n))				
		Total	Eutrophic	Overweight	Obese	
		(n=62)	(n=54)	(n=06)	(n=02)	P**
CONSUMPTION OF SUGARY BEVERAGES						
Sweetened natural juice	88.7 (55)	89.1 (49)	7.3 (04)	3.6 (02)	3,6 (02)	
Regular soda	80.6 (50)	86.0 (43)	10.0 (05)	4.0 (02)	4,0 (02)	
Sweetened coffee	80.6 (50)	88.0 (44)	10.0 (05)	2.0 (01)	2,0 (01)	
Dairy drinks	75.8 (47)	87.2 (41)	8.5 (04)	4.3 (02)	4,3 (02)	1.000
Artificial juice	71.0 (44)	86.4 (38)	9.1 (04)	4.6 (02)	4,6 (02)	
Chocolate milk	62.9 (39)	87.2 (34)	7.7 (03)	5.1 (02)	5,1 (02)	
Zero sugar soda	19.4 (12)	75.0 (09)	16.7 (02)	8.3 (01)	8,3 (01)	
MOST CONSUMED DRINK						
BEFORE	Sweetened natural juice	35.5 (22)	91.0 (20)	4.5 (01)	4.5 (01)	
	Regular soda	21.0 (13)	69.2 (09)	23.1 (03)	7.7 (01)	
	Sweetened coffee	14.5 (09)	88.9 (08)	11.1 (01)	-	0.725
	Artificial juice	9.7 (06)	83.3 (05)	16.7 (01)	-	
	Others	19.3 (12)	100 (12)	-	-	

to be continued...

... continuation table 2

Variable		BMI/AGE (%(n))				
		Total (n=62)	Eutrophic (n=54)	Overweight (n=06)	Obese (n=02)	P**
	Sweetened natural juice	27.4 (17)	94.1 (16)	5.9 (01)	-	
	Regular soda	19.4 (12)	75.0 (09)	16.7 (02)	8.3 (01)	0.855
DURING	Sweetened coffee	17.7 (11)	100 (11)	-	-	
* P <0.001	Artificial juice	14.5 (09)	77.8 (07)	11.1 (01)	11.1 (01)	
	Others	20.9 (13)	84.6 (11)	15.4 (02)	-	
FREQUENCY OF CONSUMPTION						
	Up to 1x/week	16.1 (10)	60.0 (06)	30.0 (03)	10.0 (01)	
BEFORE	2 to 5x/week	29.0 (18)	88.9 (16)	5.6 (01)	5.6 (01)	
	6 to 7x/ week	37.1 (23)	91.3 (21)	8.7 (02)	-	0.143
	More than 7x/week	17.7 (11)	100 (11)	-	-	
	Up to 1x/ week	21.0 (13)	84.6 (11)	7.7 (01)	7.7 (01)	
DURING	2 to 5x/ week	16.1 (10)	80.0 (08)	20.0 (02)	-	0.049
* P = 0.002	6 to 7x/ week	38.7 (24)	95.8 (23)	4.2 (01)	-	
	More than 7x/ week	24.2 (15)	80.0 (12)	13.3 (02)	6.7 (01)	
VOLUME CONSUMED						
	Up to 100 ml	22.6 (14)	92.9 (13)	7.1 (01)	-	
	200 ml	51.6 (32)	87.5 (28)	9.4 (03)	3.1 (01)	
BEFORE	300 ml	14.5 (09)	88.9 (08)	11.1 (01)	-	0.046
	400 ml	8.1 (05)	80.0 (04)	20.0 (01)	-	
	500 ml or more	3.2 (02)	50.0 (01)	-	50.0 (01)	
DURING	Up to 100 ml	16.1 (10)	100 (10)	-	-	0.413
* P <0.001	200 ml	46.8 (29)	89.7 (26)	6.9 (02)	3.4 (01)	
	300 ml	24.2 (15)	80.0 (12)	20.0 (03)	-	
	400 ml	9.7 (06)	66.7 (04)	16.7 (01)	16.7 (01)	
	500 ml or more	3.2 (02)	100 (02)	-	-	
REASON FOR CONSUMPTION						
Pleasant taste	90.3 (56)	85.7 (48)	10.7 (06)	3.6 (02)	3,6 (02)	
Practicality	21.0 (13)	69.2 (09)	30.8 (04)	-	-	0.616
Nutritional Value and Affordable Price	13.0 (08)	87.5 (07)	12.5 (01)	-	-	

Legend: Data in percentage and number of individuals in the variable category. *BEFORE vs. DURING; **Between BMI/Age categories. P value < 0.05 (Chi-squared test).

Table 3 – Evaluation of body image before and during the COVID-19 pandemic, according to nutritional status, in students from Canaã, MG, Brazil (2020).

Time	Body Image	Calculated BMI/Age %(n)			
		Eutrophic	Overweight	Obese	p
Total of Individuals (n=62)					
BEFORE	Thinness	48.4 (30)	1.6 (01)	1.6 (01)	
	Pleased	**21.0 (13)**	1.6 (01)	1.6 (01)	0.109
	Overweight	17.7 (11)	**6.5 (04)**	-	
DURING	Thinness	29.0 (18)	1.6 (01)	1.6 (01)	
	Pleased	**32.3 (20)**	-	1.6 (01)	0.081
	Overweight	25.8 (16)	**8.1 (05)**	-	
Boys (n=13)					
BEFORE	Thinness	53.8 (07)	-	-	
	Pleased	**7.7 (01)**	-	-	0.420
	Overweight	30.8 (04)	**7.7 (01)**	-	
DURING	Thinness	46.2 (06)	-	-	
	Pleased	**7.7 (01)**	-	-	0.532
	Overweight	38.4 (05)	**7.7 (01)**	-	
Garotas (n=49)					
BEFORE	Thinness	47.0 (23)	2.0 (01)	2.0 (01)	
	Pleased	**24.6 (12)**	2.0 (01)	2.0 (01)	0.196
	Overweight	14.3 (07)	**6.1 (03)**	-	
DURING	Thinness	24.5 (12)	2.0 (01)	2.0 (01)	
	Pleased	**38.8 (19)**	-	2.0 (01)	0.107
	Overweight	22.5 (11)	**8.2 (04)**	-	
Reason for Dissatisfaction (n=62)					
Health		25.8 (16)	4.8 (03)	1.6 (01)	
Aesthetics		14.5 (09)	1.6 (01)	-	
Self esteem		9.7 (06)	3.2 (02)	-	0.608
Improve Daily Activity		4.8 (03)	-	-	
There is no dissatisfaction		32.3 (20)	-	1.6 (01)	

Legend: Data in percentage and number of individuals in the variable category. Before (BI Prior – Ideal BI); During (BI During –Ideal BI). P-value (Chi-squares test for P <0.05).

Underestimation, Overestimation.

Table 4 – Anthropometric parameters, according to nutritional status and body image, in students from Canaã, MG, Brazil (2020).

Body image	Calculated BMI/Age %(n)		
	Eutrophic	Overweight	Obese
	87.1 (54)	**9.7 (06)**	**3.2 (02)**
Weight (kg)			
Thinness	50.4±8.9^{aA}	67.0±0.0a^{AB}	109.0±0.0^{B}
Pleased	**49.5±6.8^{aA}**	-	72.5±0.0^{B}
Overweight	50.6±8.1^{aA}	**69.6±12.7^{aB}**	-
Stature (m)			
Thinness	1.66±0.08^{aA}	1.66±0.0^{aA}	1.73±0.0^{A}
Pleased	**1.61±0.07^{aA}**	-	1.61±0.0^{A}
Overweight	1.63±0.08^{aA}	**1.67±0.12^{aA}**	-
BMI (kg/m2)			
Thinness	18.2±2.3^{aA}	24.3±0.0^{aAB}	36.4±0.0^{B}
Pleased	**19.1±1.8^{aA}**	-	28.0±0.0^{B}
Overweight	19.0±2.6^{aA}	**24.6±1.2^{aB}**	-
Fat Free Body Mass (kg)			
Thinness	41.7±8.9^{aA}	44.7±0.0^{aA}	74.0±0.0^{B}
Pleased	**38.6±6.2^{aA}**	-	49.8±0.0^{B}
Overweight	39.0±6.2^{aA}	**50.5±12.8^{aB}**	-
Body Fat (%)			
Thinness	20.2±6.8^{aA}	33.3±0.0^{aB}	32.1±0.0^{B}
Pleased	**22.1±5.9^{aA}**	-	32.1±0.0^{B}
Overweight	20.4±6.8^{aA}	**27.9±6.3^{aB}**	-
Basal Metabolic Rate (kcal)			
Thinness	1300.5±277.1^{aA}	1395.0±0.0^{aA}	2300.0±0.0^{B}
Pleased	**1204.4±193.8^{aA}**	-	1554.0±0.0^{B}
Overweight	1215.4±191.9^{aA}	**1577.0±399.6^{aB}**	-

Legend: BMI/Age: body mass index according to age. BMI: body mass index (Weight/Height2). Values in Mean±SD. Means in the same column followed by lowercase letters and on the same row followed by different uppercase letters differ from each other according to One Way Anova analysis with a post-hoc Tukey test or Student's t test (P <0.05).

DISCUSSION

The present study evaluated the consumption of sugary drinks, body image, and nutritional status, before and during the COVID-19 pandemic, in adolescents in a city in the interior of Minas Gerais. The main results showed that most students were eutrophic and reported changing their consumption of beverage types, their frequency, and

the volume ingested during the COVID-19 pandemic, where natural juice and common soda were the most consumed beverages in both periods. They also reported a high rate of body dissatisfaction due to thinness, which was reduced during the pandemic. The reason for body dissatisfaction was related to health and aesthetics. Among adolescents, girls exhibited greater changes in body dissatisfaction between the period before and during the pandemic. Anthropometric parameters confirmed the high rate of body dissatisfaction among students, when compared to their classification according to nutritional status.

The results of this investigation showed that more than 70.0% of those evaluated mentioned drinking sugary drinks such as sweetened natural juice, regular soda, sweetened coffee, dairy drinks, and artificial juice. Similar results were found in 88.1% of adolescents aged 15 to 17 years old from a Federal Institute in Minas Gerais, who exhibited a higher consumption of soft drinks and artificial juice[26]; in overweight adolescents aged 12 to 19 years old in São Paulo, who consumed more soft drinks, coffee, and teas14; and among adolescents aged 11 to 17 years old from 5 Brazilian capitals, who reported a higher intake of soft drinks and artificial juice[30]. Carbohydrates in sugary drinks promote a lesser sense of satiety than solid carbohydrates, resulting in increased daily energy intake and, consequently, increasing the susceptibility to become overweight[14]. Previous studies mentioned that high sugar content in beverages can increase blood glucose levels, promoting weight gain and insulin resistance, thus, increasing the risk of obesity and diabetes[30,31]. This mechanism could aggravate the appearance of pathologies, as well as body dissatisfaction in adolescents.

The consumption of artificial juice and sweetened coffee increased during the pandemic and subsequently reduced in the intake of natural juices, dairy drinks, and regular soft drinks. The higher consumption of artificial juice can be explained by the findings of Adams *et al.*[11], who discovered that during the pandemic, consumers started to buy cheaper products, due to the reduction in purchasing power. Moreover, Bracele and Vaccaro[24] observed the replacement of in natura products with products that have a longer shelf life and are non-perishable, as they reduce the number of visits to supermarkets in the pandemic. Coffee consumption, on the other hand, may have increased because the city of Canãa, MG predominantly rural residence (59.8%) and is inserted in a region of family-run coffee farms[25]. In this context, coffee would be a product that is more available to families at this time of financial recession.

The frequency of consumption of sugary drinks during the pandemic increased from 2-5x/week to more than 7x/week, and the volume consumed increased from 100-200ml to 300ml. It was also verified that the reason why students consumed these beverages would be related to their pleasant taste. Franco *et al.*[26] reported that adolescents from a Federal Institute consumed sugary drinks 2-5 times/week before the pandemic, for the same reasons. Pietrobelli *et al.*[19] also showed that Italian adolescents also increased their consumption of sugary drinks during the pandemic. Authors report that the intake of sugary drinks above 226ml/day are likely related to an increase in BMI and body dissatisfaction disorders[14,31,32], which could increase the susceptibility to alter their body composition and promote obesity[14].

Nirici *et al.*[33] reported that although social isolation promotes greater physical inactivity, this alone would not regulate appetite, but would be influenced by actions of humoral and psychological mechanisms associated with mental activities that could increase appetite and the desire to eat. Furthermore, Glabska *et al.*[18] identified in Polish adolescents that sensory appeal was one of the indicators of higher consumption during the pandemic, with sweetness being one of the factors that stimulates brain dopaminergic neurotransmitters, which could increase energy consumption. Moreover, Santos *et al.*[34] and May and Dus[35] stated that the sweet taste is an innate human desire that provides palatability and pleasure in the desire to eat and is the main determinant of changes in taste sensitivity which influences food preferences and choices. This would justify the increased consumption of sugary drinks during the pandemic.

Additionally, changes in dietary patterns during the pandemic were observed in American[11,36] and Italian[24] families, verifying an increase in the consumption of non-perishable and higher calorie processed foods, due to social isolation which reduced the number of trips to supermarkets. The authors suggest that dietary inadequacy with increased consumption of calories through sugar-rich and fatty foods, associated with reduced intake of in natura foods, could compromise the health of consumers, increasing the risk of overweight and obesity[30-32].

The present study showed that adolescents consumed sugary drinks in greater volume and frequency during the pandemic. Ruiz-Roso *et al.*[37], studying South American and European adolescents, found that Brazilians exhibited a greater consumption of ultra-processed foods during the pandemic. Adams *et al.*[11] justified this dietary change due to the closing of schools and the fact that adolescents stayed at home longer. The authors also reported that families with lower purchasing power suffered a greater impact concerning dietary patterns, as they depend more on school meals. Glabska *et al.*[18] showed that food prices have been one of the most important indicators in the choice and purchase of food in the pandemic. In the present study, it was observed that 74.2% of the students' families had a family income of up to 2 minimum wages, demonstrating a lower purchasing power, which exposes these families to greater vulnerability to food insecurity during the pandemic. Such findings, associated with the greater frequency and volume of consumption of sugary drinks during the pandemic, could impact the body composition of these adolescents, promoting disorders such as dissatisfaction with their body image.

Before the pandemic, it was observed that students reported a high rate of dissatisfaction with their body image, predominantly dissatisfaction due to being thin, despite the majority being classified as eutrophic. It is noteworthy that almost 80.0% of students were female, who are usually more influenced by the beauty media in having thin and slender bodies[17,20,27], wishing to be thinner than they really are. Petroski *et al.*[21] state that girls with body image dissatisfaction demonstrate low self-esteem, triggering feelings of insecurity, devaluation, and inferiority, which can promote eating and behavioral disorders arising from aesthetic and health aspects. In this study, the reasons for body dissatisfaction were also health and aesthetics, suggesting that girls could be more vulnerable to developing

their respective disorders.

During the pandemic, body dissatisfaction reduced among adolescents, distributed in dissatisfaction due to thinness and overweight. It was also observed, predominantly in girls, that the silhouette scale increased from before and during the period examined, thus, reducing body dissatisfaction. Previous studies show that girls are more dissatisfied with their body image16 and less active than boys[37], making them more vulnerable to behavioral changes. In the present study, a girl with a BMI/age considered obese was observed expressing body dissatisfaction due to thinness (Table 3). Body image disorders like this one, as well as body underestimation and overestimation, should be monitored and treated by nutritionists in public policy health service programs in the city.

The unexpected result of the high rate of dissatisfaction due to thinness before and during the pandemic resulted in the high rate of underestimation and low rate of overestimation of body image during the COVID-19 pandemic. The increase in overestimation during the pandemic may be related to the higher volume and frequency of consumption of sugary drinks identified in this study, which is also mentioned by other authors[10,13,26]; in addition to the possible reduction in the levels of physical activity promoted by staying at home.

As for underestimation, Brito *et al.*[17] identified an index of 17.4% of underestimation in girls aged 11 to 16 years old in a school in Paraná, but they did not identify as being dissatisfied due to thinness, which confirms the concern with the high levels of body dissatisfaction due to thinness of the present study. Adolescents who see themselves outside the ideal aesthetics advocated by the media culture, get depressed when they do not meet the standards of social beauty. Because they do not know the biopsychosocial and morphological changes of puberty, these young people transform the negative feeling of body dissatisfaction into a psychological barrier, inhibiting them from adopting healthy eating habits[17,20,22]. Furthermore, the confinement promoted by the COVID-19 pandemic may have altered a series of stressful factors, such as prolonged time of social isolation, fear of contamination, frustration and boredom, a lack of space at home, and loss of family income. Moreover, the absence of face-to-face contact with colleagues and teachers[18] could also impact eating and behavioral habits, promoting this body dissatisfaction.

Due to the social distancing promoted by the COVID-19 pandemic, this study presented as a limitation a smaller number of evaluated students. Data collection started after 3 months of social isolation in the city of Canaã, MG, which may have been influenced by students' memory lapse regarding their behavior before the pandemic. It also did not assess the level of physical activity in relation to the consumption of beverages and foods during the pandemic nor did it establish the type of energy balance and whether this could interfere with the satisfaction of the students' body image. On the other hand, this study identified a percentage of 51.6% of students from the rural area, which is representative for the city of Canãa, MG, in which 59.8% of the population lives in the rural areas[25]; therefore, it is possible to infer conclusions for both students from urban and rural areas, which is unprecedented information for most scientific publications of this region.

CONCLUSION

From the results of this study, it can be concluded that natural juice and regular soda were the most consumed beverages before and during the pandemic; however, there was a change in the consumption of the type of beverage, frequency, and volume during the COVID-19 pandemic. Although most students are eutrophic, before the pandemic there was a high rate of dissatisfaction due to thinness, triggering an underestimation of body image, however, this reduced during the pandemic. The reason for body dissatisfaction was related to health and aesthetics, with girls exhibiting greater changes in body dissatisfaction between the period before and during the pandemic. Anthropometric parameters confirmed the high rate of body dissatisfaction among students, when compared to their classification according to nutritional status.

Preventive measures, such as educational health programs and nutritional and psychological guidance, should be implemented by the Health Department of Canaã, MG to prevent further behavioral and eating disorders among these adolescents. Students with underestimation and overestimation of body image suffer from the effects of stressful factors caused by the COVID-19 pandemic, and deserve special attention, as the pandemic may promote significant changes to the physical and mental health of these adolescents.

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