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ORIGINAL ARTICLE

Effects of social distancing caused by the COVID-19 pandemic on physical activity level, sitting time, and binge eating: a comparison between overweight/obese and normal-weight adults

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Abstract

Purpose To compare changes in physical activity level (PAL), sitting time (ST), and binge eating disorder (BED) in overweight/obese adults vs. those normal weight during social distancing caused by the COVID-19 pandemic.

Methods A cross-sectional and retrospective study was carried out with adults of both sexes, aged 18–60 years, which assessed, through an online form, the PAL, ST, and BED pre (PSD) and during social distancing (DSD) caused by the COVID-19 pandemic. The PAL and ST were assessed by the short version of the International Physical Activity Questionnaire and the assessment of BED by the Binge Eating Scale.

Results 323 responses were included in the analysis (194 normal weight and 129 overweight/obese). There was a decrease in PAL and an increase in the prevalence of BED in both groups; nevertheless, the overweight/obese group had a 62% chance of presenting lower PALs than normal-weight individuals (OR = 1.62; 95% CI 1.03–2.55) and showed a lower total weekly physical activity time during the pandemic (adjusted p = 0.05). In addition, overweight individuals were more likely to binge eat before (OR = 4.21; 95% CI 2.10–8.45) and during the pandemic (OR = 4.24; 95% CI 2.54–7.06) and showed a higher prevalence during social distancing.

Conclusion The social distancing caused by the COVID-19 pandemic changed exercise behaviors and increased the prevalence of binge eating in the general population. However, overweight/obese participants engaged in less total weekly physical activity and showed a higher prevalence of binge eating before and during social distancing.

Level of evidence Level III; analytical observational cohort study.

Keywords Obesity · Eating disorders · Physical exercise · Sedentary behavior · COVID-19

Introduction

The pandemic caused by the novel coronavirus (COVID-19) was recognized by the World Health Organization (WHO) on March 11, 2020 [1]. Since then, in Brazil, preventive measures and restrictions were necessary, including social distancing and lockdown, to minimize and prevent the spread of the pathological agent. However, these measures are reflected in changes in the population's lifestyle, including limited physical activity, changes in work and study routines, and reduced socialization, which may negatively impact the physical and mental health of the population [2]. The reduced social behaviors associated with other pandemic measures can cause emotional and psychological changes, including increased feelings of loneliness, boredom, monotony, anxiety, anguish, stress, and depression [3–5]. These factors contribute to promoting disordered eating behaviors, thereby making individuals seek refuge in food, primarily unhealthy foods, such as ultra-processed foods, which have high amounts of sugar, fat, and sodium, in addition to low nutrient content, such as sugary drinks, stuffed cookies, snacks, ready-to-eat meals, and processed meats [6, 7]. Thus, emotional eating, especially binge eating disorder (BED), may occur in response to negative emotions experienced during the COVID-19 pandemic [8].

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Concomitantly, the closure of gyms, sports clubs, and restrictions on outdoor practices, combined with other social distancing measures, may lead to altered physical activity levels and sedentary behavior, which are related to the higher prevalence and worsening of diseases such as obesity, type 2 diabetes, and other chronic non-communicable diseases (NCDs) [9, 10]. Although the challenges imposed by the pandemic make it difficult to maintain a healthy and active lifestyle, physical activity and good nutritional status are known to play a key role in preventing NCDs and combating inflammation, including coronavirus-induced inflammation, by stimulating antioxidant and anti-inflammatory responses [11, 12]. In fact, previous studies have shown that good physical fitness is associated with healthy immune system function [11, 13].

Research conducted before the COVID-19 pandemic reported that overweight and obese adults are more physically inactive compared to normal-weight individuals [14, 15], presenting a series of barriers related to the practice of physical activity [16], in addition to a higher prevalence of binge eating and high levels of sedentary behavior [15, 17]. Therefore, it is believed that despite the restrictive measures imposed by the pandemic being transient, the changes caused by this new condition may hinder the lifestyle and health of individuals in the long term, disproportionately affecting overweight and obese individuals, who may present negative changes in behaviors related to body mass gain and more difficulty in maintaining a healthy lifestyle during this period. In addition, obese people are part of the risk groups and may present severe COVID-19 symptoms [18].

Given this scenario, it is crucial to evaluate the effects of the pandemic due to the lack of evidence concerning the effects of this period on the population's lifestyle. Therefore, this study aimed to compare changes in physical activity level, sitting time, and binge eating disorder in overweight/obese adults vs. those normal weight during social distancing caused by the COVID-19 pandemic.

Methodology

A cross-sectional and retrospective study was conducted from October 23 2020 to December 03 2020 with adults of both sexes and aged from 18 to 60 years using a survey covering physical activity levels, sitting time, and binge eating disorder during the social distancing of COVID-19. Data were collected anonymously using an online survey consisting of questions that assessed physical activity level, sitting time, and binge eating in the pre-pandemic period and during the social distancing imposed by COVID-19. The form was created on Google Forms® and disseminated through social media (WhatsApp®, Instagram®, and e-mail) and other media such as the radio and television programs. The inclusion criteria were: (1) adults (18–60 years), (2) both sexes, and (3) agreeing to the digital informed consent form (ICF). The exclusion criteria were: (1) refusal to agree to the ICF, (2) the completion of the questionnaire by children, adolescents, and the elderly, and (3) incomplete answers and/or non-completion of questionnaires. The participants agreed to the (ICF) before answering the survey. The sample calculation was performed from the prevalence estimation formula for a simple random sample, where $n = 323$. The protocol and ICF were approved by the Ethics Committee of the Federal University of Uberlândia (no. 38439920.9.0000.5152).

Questionnaire

Data were collected through an online questionnaire, and information such as gender, age, marital status, level of education, and body mass and height were obtained by self-reported measurements. The body mass index (BMI; kg/m^2) was calculated by measuring body mass and height, and the sample was classified as normal weight (18.5–24.9), overweight (25.0–29.9), and obese (≥ 30) [19].

The questions related to assessing physical activity levels, sitting time, and binge eating were presented differently. They required two answers, one referring to the period before the pandemic (retrospective information) and the other according to the conditions during social distancing (23 October 2020 until 03 December).

Physical activity level and sitting time

The physical activity level and sitting time were evaluated using the short version of the International Physical Activity Questionnaire (IPAQ). The questionnaire includes the time spent on moderate physical activity (PA), vigorous PA, and walking. It is possible to estimate the total time spent on weekly physical activity and estimated energy expenditure by multiplying the value of energy expenditure, in metabolic equivalents (METs), according to the activity performed (walking = 3.3 METs, moderate PA = 4.0 METs, and vigorous PA = 8.0 METs) by the weekly frequency and duration. The questionnaire also assesses daily sitting time [20].

Binge eating disorder

The Binge Eating Scale (BES) was used to analyze the presence of compulsive eating behavior. The BES is a 16-question self-administered and validated survey containing 62 statements, from which the one that best represents the individual's answer should be selected for each question. Each statement can be scored from 0 to 3, ranging from the absence (0) to the maximum severity (3) of BED. The final score is the result of the sum of the points for each question.

Individuals with scores below or equal to 17 are considered to have no compulsion, scores between 18 and 26 possess moderate compulsion, and scores equal to or above 27 have severe compulsion [21, 22].

Statistical analysis

Statistical analyses were performed using the SPSS software (version 23.0). The normality of the data distribution was verified by the Kolmogorov–Smirnov test, and values were calculated and reported as mean ± SD (standard deviation), frequency, and percentage. We calculated the delta and delta% change. The *Z* score was used to standardize data that did not follow the normality curve. The univariate general linear model was used to assess significant differences in sociodemographic variables and delta between groups. The effects of time and the interaction in responses before and during social distancing for continuous variables were evaluated by the general linear model for repeated measures. In addition, we used the adjusted p value by age and gender. The sphericity of the variables was corrected by Greenhouse–Geisser. The Pearson's or Kappa's Chi-square were used to assess differences in categorical data. The odds ratios (ORs) and 95% confidence intervals (CI) were used to assess the risk of physical inactivity and binge eating in overweight and obese adults before and during the COVID-19 pandemic. The effect size (eta squared) was used to evaluate the clinical effects of the variables related to physical activity levels (time sitting, walking, moderate and vigorous activity, and the total time of weekly physical activity) within the group and time analysis. Linear regression was used to identify the predictors of body mass gain during the COVID-19 pandemic, dummy variables were created for sex (female versus male), physical activity levels (inactive versus active), and binge eating (presence of compulsion versus no compulsion). A significance level of $p < 0.05$ was used for all analyses.

Results

A total of 323 individuals participated, with 194 (60.1%) being normal weight and 129 (39.9%) being overweight/obese. Statistically significant differences between the overweight/obese and normal-weight population in terms of age ($p \leq 0.001$), sex ($p = 0.005$), and level of education (incomplete high school, incomplete higher education, and complete higher education) ($p = 0.011$) were found. The general characteristics of the participants are listed in Table 1.

Participants with high BMI scores showed a higher body mass gain (prevalence and kilograms) during the pandemic compared to normal-weight adults (87.2 vs. 46.6% and 5.48 vs. 1.70 kg, respectively ($p \leq 0.001$) (Table 1). The predictors of the impact on body mass gain due to pandemic COVID-19 are described in Table 2. The analysis shows that factors such as older age ($p = 0.001$), male gender ($p \leq 0.001$), increased sitting time ($p = 0.006$), and increased binge eating

Table 1 General characteristics of normal-weight and overweight/obese individuals

Normal weight ($n = 194/60.1\%$)	Overweight/obese($n = 129/39.9\%$)
Mean ± SD	Mean ± SD
Age (years) 28.4 ± 10.1	33.0 ± 11.0†
Body mass (kg) 62.4 ± 8.9	83.7 ± 12.9†
Height (m) 1.68 ± 0.08	1.69 ± 0.09
BMI (kg/m^2) 21.90 ± 2.13	29.19 ± 3.53†
Body mass gain (kg) 1.70 ± 2.21	5.48 ± 3.38†
n (%)	*n* (%)
Prevalence of body mass gain during the pandemic 89 (46.6%)	109 (87.2%)†
Sex *n* (%)	*n* (%)
Female 142 (73.2%)*	76 (58.9%)*†
Male 52 (26.8%)	53 (41.1%)†
Marital status n (%)	*n* (%)
Single 135 (69.6%)	73 (56.6%)
Married 43 (22.2%)	43 (33.3%)
Divorced 3 (1.5%)	2 (1.6%)
Common-law marriage 13(6.7%)	11 (8.5%)
Level of education *n* (%)	*n* (%)
Non-formal education 1 (0.5%)	0 (0%)
Incomplete elementary school 1 (0.5%)	1 (0.8%)
Incomplete high school 0 (0%)	3 (2.3%)†
Complete high school 17 (8.8%)	6 (4.7%)
Incomplete higher education 86 (44.3%)	42 (32.6%)†
Complete higher education 89 (45.9%)	77 (59.7%)†

Values are expressed as mean ± SD (standard deviation) for continuous variables and as absolute number and percentage (*n* (%)) for categorical variables; univariate general linear model and Pearson's Chi-square,†$p < 0.05$ comparing normal-weight and overweight/obesity groups, *$p < 0.05$ for intragroup analysis. Body mass index (BMI)

Table 2 Linear regression model used to predict the variables that affected body mass gain during social distancing caused by the COVID-19 pandemic

	B	*p*	CI (95%)
Age (years)	0.054	0.001*	0.023 to 0.085
Gender (fem)	− 1.258	0.000*	− 1.957 to − 0.558
Sitting time (min/week)	0.000	0.006*	0.000 to 0.000
Physical activity levels	0.424	0.209	− 0.239 to 1.088
Binge eating	0.160	< 0.001*	0.128 to 0.193

B beta coefficient, *p* statistical significance, *CI (95%)* 95% confidence interval. Linear regression, *$p < 0.05$.

($p \leq 0.001$) had the most significant influence on body mass gain during social distancing.

As presented in Table 3, the prevalence of active individuals decreased in the normal-weight and overweight/obese groups between the pre-pandemic period and during social distancing. Nonetheless, overweight/obese adults showed a higher prevalence of physical inactivity during the pandemic ($p = 0.034$). When analyzing the risk of physical inactivity during the pandemic, the overweight/obese group had a 62% chance of presenting lower physical activity levels than normal-weight individuals (OR = 1.62; 95% CI 1.03–2.55). In addition, during the pandemic, there were decreased physical activity levels in all variables assessed: walking (effect size = 0.06), moderate PA (effect size = 0.34), vigorous PA (effect size = 0.10), and total weekly PA time (effect size = 0.10) and increased sitting time (effect size = 0.10). In the intergroup analysis, normal-weight participants showed higher sitting time before the pandemic, although no differences were found in this variable during the pandemic. Furthermore, lower levels of moderate, vigorous, and total PA were observed in the overweight/obese group during the pandemic. However, when the age and sex covariates were adjusted, only the total weekly PA time remained significant ($p = 0.054$) (Table 4).

There was higher binge eating in both groups ($p < 0.001$), in addition to an increased rate of severe binge eating during the pandemic. Nonetheless, a higher prevalence was found in the overweight/obese group before and during social distancing (Table 5). Overweight individuals were more likely to binge eat before (OR = 4.21; 95% CI 2.10–8.45) and during the pandemic (OR = 4.24; 95% CI 2.54–7.06).

Discussion

The results of this study indicate that the COVID-19 pandemic has negative effects on physical activity levels and binge eating in overweight/obese and normal-weight adults, disproportionately affecting overweight and obese individuals, who showed lower total weekly physical activity time, higher prevalence of binge eating, in addition to a higher prevalence of body mass gain.

Our data corroborate previous research that also reported body mass gain being associated with the BMI of the participants [23, 24]. In our study, 87.2% of overweight and obese individuals reported body mass gain compared to 46.6 of normal-weight participants; in another study, body mass gain was more prevalent in obese individuals (33.4%), although normal-weight participants reported greater body mass gain (24.7%) compared to overweight individuals (20.5%) [25]. The body mass gain reported by overweight and obese individuals in our study was 5.48 kg, which differs from a previous study conducted in the first month of the pandemic, in which obese individuals had a mean body mass gain of 1.51 kg [26], indicating that the time of social distancing increased the negative effects of this period. Our data were collected seven to ten months after the beginning of social distancing in Brazil, and since the pandemic of COVID-19 has yet to end, it is essential that further research be conducted since the increase in body mass may have a greater magnitude. This finding is important because it highlights the need to develop public policy strategies to assist these individuals in managing body mass and maintaining health, given that reducing the BMI of obese individuals goes hand in hand with significantly reducing the risk of several diseases [27].

Age, gender, sitting time, and binge eating had a more significant influence on body mass gain during social distancing of COVID-19, and similar findings have been reported elsewhere [24, 28]. Although no association was found between physical activity level and body mass gain during the pandemic in our study, similar research found divergent results [24, 26, 28]. In addition, it is known that physical activity is a protective factor against body mass gain [29]. In our sample, the male gender was associated with weight gain during the pandemic, and this result differs from studies carried out in which the female gender was associated with weight gain [24, 30, 31]. However, other studies have not found gender as a significant predictor of weight gain, indicating that it is not a consistent predictor [32–34].

Table 3 Prevalence of physical activity levels before and during the COVID-19 pandemic in the normal-weight and overweight/obese groups

	Normal weight ($n = 194/60.1\%$)			Overweight/obese ($n = 129/39.9\%$)		
	Before social distancing	During social distancing	Δ (Δ%)	Before social distancing	During social distancing	Δ (Δ%)
Inactive	47 (24.2%)	94* (48.5%)	47 (↑100%)	28 (21.7%)	78*† (60.5%)	50 (↑178.5%)
Active	147 (75.8%)	100* (51.5%)	−47 (↓ 31.9%)	101 (78.3%)	51*† (39.5%)	−50 (↓49.5%)

Values are expressed as number and percentage (n (%)).↑Percentage increase. ↓Percentage decrease. Kappa's Chi-square, *$p < 0.05$ in the intragroup difference between active and inactive;†$p < 0.05$ intergroup difference between active and inactive.

Table 4 Responses of the normal-weight and overweight/obese groups for the physical activity questionnaire before and during social distancing resulting from the COVID-19 pandemic

	Normal weight ($n = 194/60.1\%$)			Overweight/obese ($n = 129/39.9\%$)			
	Before social distancing	During social distancing	Δ (Δ%)	Before social distancing	During social distancing	Δ (Δ%)	p adjusted (interaction times vs. group)
Sitting time							
Min/week	2903.91 ± 1248.10	3892.35 ± 1733.04*	988.44(↑ 34.03%)	2619.36 ± 1390.83†	3813.17 ± 1751.20*	1193.81(↑ 45.57%)	0.06
Walking							
MET	702.83 ± 659.54	338.25 ± 466.52*	− 364.58(↓ 51.87%)	790.92 ± 837.97	332.23 ± 508.06*	− 458.69(↓ 57.99%)	0.07
Min/week	212.97 ± 199.86	102.50 ± 141.37*	− 110.47(↓ 51.87%)	239.67 ± 253.93	100.67 ± 153.95*	− 139(↓ 57.99%)	0.07
Moderate intensity							
MET	828.02 ± 731.14	618.13 ± 695.78*	− 209.89(↓ 25.34%)	738.35 ± 707.99	439.79 ± 559.01*†	− 298.56(↓ 40.43%)	0.33
Min/week	207 ± 182.78	154.53 ± 173.94*	− 52.47(25.34%)	184.58 ± 176.99	109.94 ± 139.75*†	− 74.64(↓ 40.43%)	0.33
Vigorous intensity							
MET	1134.09 ± 1491.30	795.51 ± 1190.24*	− 338.58(↓ 29.85%)	1119.10 ± 1349.37	497.47 ± 901.89*†	− 621.63(↓ 55.54%)	0.10
Min/week	141.76 ± 186.41	99.44 ± 148.78*	− 42.32(↓ 29.85%)	139.88 ± 168.67	62.18 ± 112.73*†	− 77.7(↓ 55.54%)	0.10
Total physical activity							
MET	2760.93 ± 2324.78	1835.02 ± 1864.67*	− 925.91(↓ 33.53%)	2830.44 ± 2384.78	1389.17 ± 1735.74*†	− 1441.27†(↓ 50.92%)	0.05†
Min/week	600.36 ± 490.75	398.92 ± 401.86*	− 201.44(↓ 33.55%)	566.78 ± 415.97	277.34 ± 306.29*†	− 289.44† (↓ 51.06%)	0.05†

Values are presented as mean ± SD (standard deviation); ↑percentage increase. ↓percentage decrease. Univariate general linear model and general linear model for repeated measures, adjusted by age and gender; *$p < 0.05$ for intragroup analysis;†$p < 0.05$ for intergroup analysis

Table 5 Prevalence of binge eating before and during social distancing among the normal-weight and overweight/obese groups

	Normal weight ($n = 194/60.1\%$)			Overweight/obese ($n = 129/39.9\%$)		
	Before social distancing	During social distancing	Δ (Δ%)	Before social distancing	During social distancing	Δ (Δ%)
No compulsion	181(93.3%)	161*(83%)	− 20(↓ 11%)	99†(76.7%)	69*†(53.5%)	− 30(↓ 30.3%)
Presence of BED	13(6.7%)	33*(17%)	20(↑ 153.8%)	30†(23.3%)	60*†(46.5%)	30(↑ 100%)
Moderate compulsion	10(5.2%)	20*(10.3%)	10(↑ 100%)	21†(16.3%)	29*†(22.5%)	8(↑ 38%)
Severe compulsion	3(1.5%)	13*(6.7%)	10(↑ 333.3%)	9†(7%)	31*†(24%)	22(↑ 244.4%)

Values are expressed as number (n) and percentage (%). Binge eating disorder (BED). ↑Percentage increase. ↓Percentage decrease. Kappa's Chi-square, *$p < 0.001$ in the intragroup analysis of pre-social distancing and during social distancing.†$p < 0.05$ in the intergroup analysis of pre-social distancing and during social distancing

This study found a decrease in the prevalence of active individuals and physical activity levels during the social distancing of the COVID-19 pandemic, and analogous findings have also been reported in other studies [26, 28, 36–39]. The overweight/obese group had a lower level of total weekly physical activity, corroborating another finding of our study

that showed that overweight and obese individuals were 62% more likely to have lower physical activity levels than normal-weight individuals during the pandemic. This is alarming given that physical activity is a protective factor for body mass gain and the worsening of COVID-19, and the obese population is one of the risk groups for this infectious disease [11–13, 18].

Another important discovery of our study was the increase in sitting time, and this was likely because people spent more time at home because of social distancing; nonetheless, sitting time was not significant when p was adjusted. The normal-weight group showed an increase of 34.03% in sitting time, while the overweight group showed an increase of 45.57% during the pandemic. These data corroborate another outcome of this study: the longer sitting time during the pandemic and recent studies that also demonstrated increased sedentary behavior during the period of social distancing [38, 39]. This is a worrisome fact since it is known that high sedentary behavior is directly related to an increased risk of becoming overweight and obese, regardless of physical activity [9], and with the incidence and mortality of diseases such as cancer, cardiovascular diseases, and type 2 diabetes [10].

Our findings revealed a high prevalence of binge eating in the overweight/obese group before and during social distancing and a high frequency of severe binge eating during the pandemic in both groups. The results corroborate previous studies that also found increased binge eating during the pandemic [40, 41]. Other studies have also shown altered eating behavior during social distancing, such as increased "eating in response to stress" and "eating when bored" [35, 36], and other research has reported higher levels of anxiety and depression in individuals with obesity during the pandemic [25, 36], which may be related to increased "emotional eating" being a trigger for binge eating. Additionally, it has been shown that during the pandemic, there was an increase in behaviors such as eating to escape worry or relieve stress, greater than normal feelings of fear, mood swings, negative thoughts, and discouragement and that there was a correlation between anxiety, higher stress levels, and inappropriate eating behaviors as a way to compensate for these changes caused by the quarantine [42]. Our findings reinforce that the changes caused by the COVID-19 pandemic likely reflect the development of eating disorders. Hence, it is essential that further research is conducted to monitor the population and that more support is provided to this population to minimize the development and/or worsening of eating disorders during this period.

This study showed that social distancing used to combat the COVID-19 pandemic may result in severe negative consequences on other health metrics, specifically by affecting mental and metabolic health through a combination of socioeconomic factors, psychological safety, and metabolic processes [43]. More longitudinal studies examining the maintenance and potential risk of these changes are needed, particularly in overweight individuals, as the pandemic continues. Thus, it is essential to consider strategies emphasizing the prevention and treatment of these diseases/disorders, and such research should guide governments and policymakers in implementing individual and/or social interventions to stem the worsening of obesity and its metabolic comorbidities.

Strengths and limits

Some limitations should be taken into consideration, such as the use of self-reported data, which may have been affected by bias and low reliability. In addition, the data were collected months after the pandemic started in Brazil, and the form included questions related to the period before the pandemic, so the data may contain biases. Furthermore, information related to the participants' work activity was not collected. Despite these limitations, to the best of our knowledge, this is the first study to compare the negative impact of social distancing caused by the COVID-19 pandemic on lifestyle and eating behavior between overweight/obese and normal-weight individuals. In addition, our findings show that the COVID-19 pandemic continues to affect the lifestyle and eating behavior of overweight individuals disproportionately. Such results may assist governments and policymakers in implementing individual and/or social interventions to curb the worsening of other diseases and metabolic disorders associated with COVID-19.

What is already known about this subject?

Previous studies have shown changes in eating habits, such as higher consumption of processed and hypercaloric foods and higher levels of anxiety, stress, and depression in overweight individuals during the pandemic, which instigated us to investigate whether these changes could be related to the development and worsening of binge eating. Additionally, studies have also shown that the first weeks of social distancing negatively affected the physical activity levels of overweight individuals and sedentary behavior of the general population; nonetheless, it is not known whether the effects of this period continued during social distancing.

What does this study add?

After 7–10 months of social distancing, the COVID-19 pandemic continues to result in severe negative consequences on other health metrics, particularly overweight individuals. The evidence presented herein showed increased binge eating, particularly the prevalence of severe binge eating, which may be related to dietary and psychological changes

reported in other studies, including increased consumption of unhealthy foods and food intake in response to higher levels of stress and anxiety. Additionally, there were decreased physical activity level and increased body mass gain, especially in the overweight population. Thus, the results of this study have highly relevant implications for interventions as the pandemic continues. Intervention efforts to decrease risks of eating disorders should focus on overweight individuals, and it is essential to encourage exercise and physical activity as a valuable non-pharmacological tool in addressing this pandemic.

Conclusion

The social distancing caused by the COVID-19 pandemic has negatively impacted the levels of physical activity and binge eating in overweight/obese and normal-weight individuals, disproportionately affecting overweight and obese individuals who had a lower level of physical activity and a higher prevalence of binge eating, in addition to presenting a higher prevalence of body mass gain. The findings have important implications for providing greater monitoring and support for the general population, especially overweight/obese individuals, who must be monitored and treated to decrease potential long-term consequences.

Author contributions All authors contributed to the study conception and design. The writing of the project, elaboration of the questionnaire, and data collection were performed by CPG, SMN, and NCC. Data analysis was performed by CPG, LOS, and NCC. CPG drafted the manuscript, and SMN, LOS, and NCC revised and corrected the manuscript. NCC carried out the supervision of the research. All authors read and approved the final manuscript.

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Availability of data and material Data are available upon request from the authors.

Declarations

Conflict of interest All authors certify that they have no affiliations with or involvement in any organization or entity with any financial interest or non-financial interest in the subject matter or materials discussed in this manuscript.

Ethics approval The protocol and ICF were approved by the Ethics Committee of the Federal University of Uberlândia (no. 38439920.9.0000.5152).

Consent to participate Informed consent was obtained from all individual participants included in the study.

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