Revista Contexto & Saúde
Editora Unijuí
Programa de Pós-Graduação em Atenção Integral à Saúde
ISSN 2176-7114 – v. 25, n. 50, 2025

http://dx.doi.org/10.21527/2176-7114.2025.50.15815

HOW TO CITE:
Dallanora S, de Macedo IC, Murari AL, Ruybal MCP dos S, da Silveira ID, Hagen MEK. Prevalence of addictive eating behavior among university student in social distancing due to Covid-19. Rev. Contexto & Saúde, 2025;25(50):e15815.

ORIGINAL ARTICLE

PREVALENCE OF ADDICTIVE EATING BEHAVIOR AMONG UNIVERSITY STUDENT IN SOCIAL DISTANCING DUE TO COVID-19

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Highlights:
(1) The prevalence of addictive eating behavior was 18%.
(2) The prevalence of addictive eating behavior was found to be high among female university students.
(3) The Covid-19 pandemic negatively impacted Brazilian academics.

ABSTRACT

This cross-sectional study determines the prevalence of addictive eating behavior among university students in the southern region of Brazil amid social distancing by the Covid-19 pandemic. Data were collected sociodemographic characteristics, anthropometric parameters, previous eating frequency and eating during social distancing, and duration of social distancing using an online self-report questionnaire. The modified *Yale Food Addiction Scale* 2.0 was also used. A total of 1525 students aged between 18 and 60 participated in the study, who were majority female, white, single, and from the state of Rio Grande do Sul. The prevalence of addictive eating behavior was 18%. Addictive eating behavior was found to be associated with being a female (PR=1.80; 95% CI 1.32-2.47), being between the ages of 18 and 33 (PR=5.12; 95% CI 1.44-18.3), being divorced (PR=2.46; 95% CI 1.41-4.27), an increased BMI 12 months after social distancing (PR=2.31; 95% CI 1.40-3.82); and decreased (PR=1.63; 95% CI 1.18-2.27) and increased (PR=2.18; 95% CI 1.31-2.79) number of meals per day. This study assessed the prevalence of addictive eating behaviors among university students in the southern region of Brazil during the Covid-19 pandemic, indicating that the pandemic negatively impacted Brazilian academics.

Keywords: feeding behavior; students; eating disorder; Covid-19.

PREVALÊNCIA DE COMPORTAMENTO ALIMENTAR ADITIVO ENTRE ESTUDANTES UNIVERSITÁRIOS EM DISTANCIAMENTO SOCIAL DEVIDO À COVID-19

RESUMO

Este estudo transversal determina a prevalência do comportamento alimentar aditivo entre estudantes universitários da Região Sul do Brasil em condições de distanciamento social devido à Covid-19. Foram coletados dados sobre características sociodemográficas, parâmetros antropométricos, frequência alimentar prévia, frequência alimentar durante o distanciamento social, tempo de distanciamento social utilizando um questionário ***on-line*** de autorrelato. Foi utilizada a *Yale Food Addiction Scale* 2.0 modificada. Participaram do estudo 1.525 estudantes com idade entre 18 e 60 anos, sendo a maioria do sexo feminino, brancos, solteiros e natural do Estado do Rio Grande do Sul. A prevalência do comportamento alimentar aditivo foi de 18%. O comportamento alimentar aditivo foi associado ao sexo feminino (RP=1,80; IC 95% 1,32-2,47), idade entre 18 e 33 anos (RP=5,12; IC 95% 1,44-18,3), divorciados (RP=2,46; IC 95% 1. 41-4,27), aumento do IMC 12 meses após o distanciamento social (RP=2,31; IC 95% 1,40-3,82); diminuição (RP=1,63; IC 95% 1,18-2,27) e aumento (RP=2,18; IC 95% 1,31-2,79) do número de refeições por dia. Este estudo avaliou a prevalência de comportamento alimentar aditivo entre estudantes universitários da Região Sul do Brasil durante a pandemia da Covid-19, indicando que a pandemia impactou negativamente os universitários brasileiros.

Palavras-chave: comportamento alimentar; estudantes; transtornos da alimentação; Covid-19

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INTRODUCTION

In December 2019, Sars-CoV-2, a novel coronavirus that caused the Covid-19 disease, was first identified as being transmitted by bats. However, studies have shown that transmission to humans could have occurred from other animals in Wuhan's (China) seafood market[1]. Consequently, Covid-19 spread rapidly worldwide and developed into a pandemic. Several countries implemented strict measures to curb its spread, forcing more than 4 billion people to practice social distancing and quarantining; consequently, remote work and study became the norm. The social distancing during quarantine increased psychological distress, irritability, exhaustion, insomnia, anxiety, fear, stress, and depression[2]. These stressful events can affect eating habits and increase the consumption of hyper-palatable foods, prompting individuals to cook more or purchase more ready-to-eat foods[3].

Sulejmani et al.[4] found that social distancing measures implemented to prevent the spread of Covid-19 contributed to decreased physical activity and increased food consumption in the initial stages of the pandemic. The consumption of hyper-palatable and high-calorie foods significantly contributes to the rising prevalence of obesity and being overweight[5]. These foods can be "addictive" for some individuals based on the overlapping brain circuits responsible for addictive behavior and the central pathways of food control[6].

Although the Covid-19 pandemic affected everyone, the changes it brought, such as the shift to online activities[7] and reduced socialization, may have increased the stress faced by undergraduate students[8]. The pandemic may have negatively impacted healthcare and increased the likelihood of changes in eating behavior for some individuals[9].

The evidence of addictive eating behavior has been growing, and it is characterized as dependence on hyper-palatable foods, similar to chemical dependency[10]. Based on this, Gerhard *et al.*[11] developed and validated the *Yale Food Addiction Scale Version 2.0 (YFAS 2.0)*. This scale is the first measure that specifically assesses the symptoms of food addiction and is based on the diagnostic criteria for substance dependence listed as Other Substance Use Disorder in the DSM-5[12]. When this scale was modified for better comprehension and practical use, the *modified Yale Food Addiction Scale Version 2.0 (mYFAS 2.0)* was created[13] and Nunes-Neto et al.[14] conducted a validation study in Brazil to evaluate its effectiveness.

Recently, Silva Júnior *et al.*[15] conducted a cross-sectional study covering all regions of Brazil to determine the prevalence of addictive eating behavior among university students using the *mYFAS 2.0*. They found that addictive eating behavior is associated with anxiety, depression, and adherence to social distancing during the Covid-19 pandemic.

Considering these findings, this study assess the prevalence of addictive eating behavior among students studying in southern Brazil who experienced social distancing owing to the Covid-19 pandemic.

MATERIALS AND METHODS

Design and population

This is a cross-sectional study that involves university students who are over the age of 18 and enrolled in higher education institutions in southern Brazil (Paraná, Santa Catarina, and Rio Grande do Sul).

Inclusion and exclusion criteria

The study included students aged 18 years and older who were enrolled in higher education institutions in the southern region of Brazil. Individuals with a known history of eating disorders, including bulimia nervosa, atypical bulimia nervosa, and anorexia nervosa, were excluded. A total of 44 students declined participation after reviewing the informed consent form (ICF). Additionally, respondents with a body mass index (BMI) below 14 or above 50 were excluded, as these extreme values might indicate undiagnosed eating disorders. Other exclusions were applied to duplicated questionnaires, pregnant participants, entries with missing weight or height data, university professors, and those with no response to the consumption of hyperpalatable foods. Participants were also excluded if they were professional graduates, students from another state, or failed to specify their university or course. Moreover, master's and doctoral students were not included. Figure 1 provides a flowchart detailing the selection process of participants.

Sample calculation

We determined the sample size based on the number of university students enrolled in higher education institutions in Brazil. There were a total of 8.680.354 such students, according to INEP's 2020 data[16]. Considering a 5% margin of error and a 95% confidence level, and an estimate for the prevalence of addictive eating behavior of 50%, chosen as a conservative value to maximize the sample size, the minimum sample size should be 385 participants based on the Qualtrics Sample Size Calculator.

Data collection

We searched for the contact information of coordinating professors or those overseeing the undergraduate courses from the websites of universities in Paraná, Santa Catarina, and Rio Grande do Sul. Subsequently, the research group underwent training and conducted a pilot study by administering a research questionnaire to the Federal University of Pampa and the Federal University of Santa Maria students who were part of the Center of Studies in Obesity and Eating Behavior. After identifying the flaws and challenges in conducting the pilot study, we adjusted the instrument. Between May 2021 and December 2021, we emailed the professors or program coordinators at public and private institutions in the southern region of Brazil. We requested that they distribute the questionnaire among their students. We sent three emails to each professor/coordinator at intervals of two months to remind them about the questionnaire in case they had not seen or answered it. The survey was also publicized on social network platforms, such as Facebook, Instagram, and WhatsApp, and shared with the contacts of the survey participants. After collecting data, we transferred it to a database where it was checked for inconsistencies, exclusions, and classifications.

Instruments for data collection

The researchers developed a structured questionnaire that collected data on sociodemographic characteristics, such as sex (female and male), ethnicity (white and non-white), age (18-33 years old, 34-49 years old and 50 years old or older), marital status (married or stable union, divorced or separated and single). Number of people living together (Living alone, 1-2 people, 3-4 people and more than 5 people), household income (Up to 1 minimum wage, 2-3 mw, 4-5 mw and more than 5), type of institution (public or private), State (RS, SC or PR), Study area according to CNPq (Agricultural Sciences, Biological Sciences, Health Sciences, Exact and Earth Sciences, Engineering, Human Sciences, Applied Social Sciences, Linguistics, Letters, and Arts, others). Anthropometric parameters, such as reported weight (kg) and height (cm), were included for calculating the BMI. The structured questionnaire also asked about previous eating frequency for day (1-2 meals per day, 2-3 meals, 3-4 meals, 4-5 meals, 5-6

meals, more than 6 meals), eating frequency during social distancing (1-2 meals per day, 2-3 meals, 3-4 meals, 4-5 meals, 5-6 meals, 6-mais de 6 meals), the frequency of consuming highly palatable foods (desserts, sweets, candies, cakes, soft drinks), and the duration of social distancing till the date of completing the questionnaire (Low: I leave the house when necessary and convenient, not caring much about safety. Medium: left home when necessary and/or felt safe. High: only leaves the house when strictly necessary).

Furthermore, the questionnaire comprised the *mYFAS 2.0* for assessing respondents' addictive eating behavior[13]. The *mYFAS 2.0* comprises 13 questions investigating eating behavior about consuming highly palatable foods within the last 12 months. Each question on the scale corresponds to the first 13 diagnostic criteria for substances of abuse in the Diagnostic and Statistical Manual of Mental Disorders (DSM-V)[12]. This scale has been widely used to assess food addiction[15,17-20]. Nunes-Neto *et al.*[14] conducted a validation study in Brazil to evaluate its effectiveness. The items in the *mYFAS 2.0* are rated between 1 and 7 in the following manner: never [0], less than once a month [1], once a month [2], 2-3 times a month [3], once a week [4], 2-3 times a week [5], 4-6 times a week [6], and every day [7]. A score of zero indicates that the threshold of clinical significance has not been reached, while a score greater than or equal to one indicates that the threshold has been reached. A symptom (related to a question) must reach the threshold to be counted in the final score. The final classification was set as one or no symptoms = no food addiction, two or three clinically significant symptoms = mild food addiction, four or five clinically significant symptoms = moderate food dependence, and six or more clinically significant symptoms = Severe food dependence[13]. The questionnaire was made available in digital format on the *Google Forms* platform.

Data organization and statistical analysis

After we collected data, we saved the *Google Forms* table as an Excel file to organize the database using variables. The sample was described using absolute and relative frequencies for each characteristic. The data were initially evaluated for normal distribution using the *Kolmogorov-Smirnov* test. The internal consistency of *mYFAS 2.0* was assessed using *Cronbach's alpha* coefficient with a 95% confidence interval (95% CI). For data analysis, the *Statistical Package for the Social Sciences* version 20 for Windows (SPSS, Inc., Chicago, IL, USA) was used[21].

Demographic and anthropometric data, eating frequency, and the duration of social distancing were analyzed in relation to *mYFAS 2.0* scores. To assess the association between the prevalence of addictive eating behavior and various sociodemographic and anthropometric factors, *Poisson* regression models with robust variance were applied, and prevalence ratios were estimated.

The outcome was dichotomized. It was divided into the presence or absence of addictive eating behavior. The levels of social distancing, "low, medium, and high," were grouped because most respondents had no addictive eating behavior, and the other levels of the ordinal scale had fewer observations. Another benefit is that it allows one to compare the prevalence of addictive behavior based on different variables. Some variables were grouped to reduce the number of categories, ensure a minimally sufficient number in each group, and obtain statistical power. The univariate models were adjusted for each explanatory factor separately concerning the outcome (additivity). The variables "BMI before the pandemic" and "BMI during the pandemic" were replaced with the calculated variable BMI_change, which has three categories (decreased, unchanged, and increased). This was done to incorporate the expected association between these factors. Similarly, the variables "number of meals before the pandemic (MBP)" and "number of meals 12 months after the start of the pandemic" were replaced with MBP_change. To adjust the multivariate model, we used the variables with $p<0.20$. Consequently, the following variables were selected: Sex, Age, Ethnicity, Marital Status, Degree Distance, BMI_change, and MBP_change. The significance level was set at $p < 0.05$ for all analyses.

Ethical aspects

The study design was approved by the Research Ethics Committee of the Federal University of Pampa with CAAE number 31678920.0.0000.5323. All participants were informed about the study and provided with clarification. They agreed to participate by clicking on the accept button in the Informed Consent Form (ICF). The ICF PDF file was attached to the questionnaire. It contained the researcher's telephone number and all information about the study in clear and easy-to-understand language. The anonymity and confidentiality of participants' data were guaranteed. According to the Guidelines and Norms for Research Involving Human Beings (Resolution 466/2012) of the National Health Council, all human studies carry some risks. However, this study carries minimal risk (CNS, 466/2012). The following text was written in the ICF: "Risks: The potential risks or discomforts associated with your participation in this study are related to the fact that we are asking you to critically evaluate your behaviors regarding the excessive consumption or lack thereof of certain types of food, which may cause embarrassment. In addition, filling out the form may cause fatigue or annoyance. Benefits: A potential benefit is identifying whether you risk developing eating behaviors that may lead to obesity or becoming overweight and appropriate measures to prevent it.

RESULTS

A total of 1,695 students completed the questionnaire. Notably, 44 students declined to participate in the study after reading the ICF. We requested that only individuals without a history of diagnosed eating disorders, such as bulimia nervosa and anorexia, continue to answer the questionnaire. Considering the exclusions, 1,525 university students were the final sample, as shown in Figure 1.

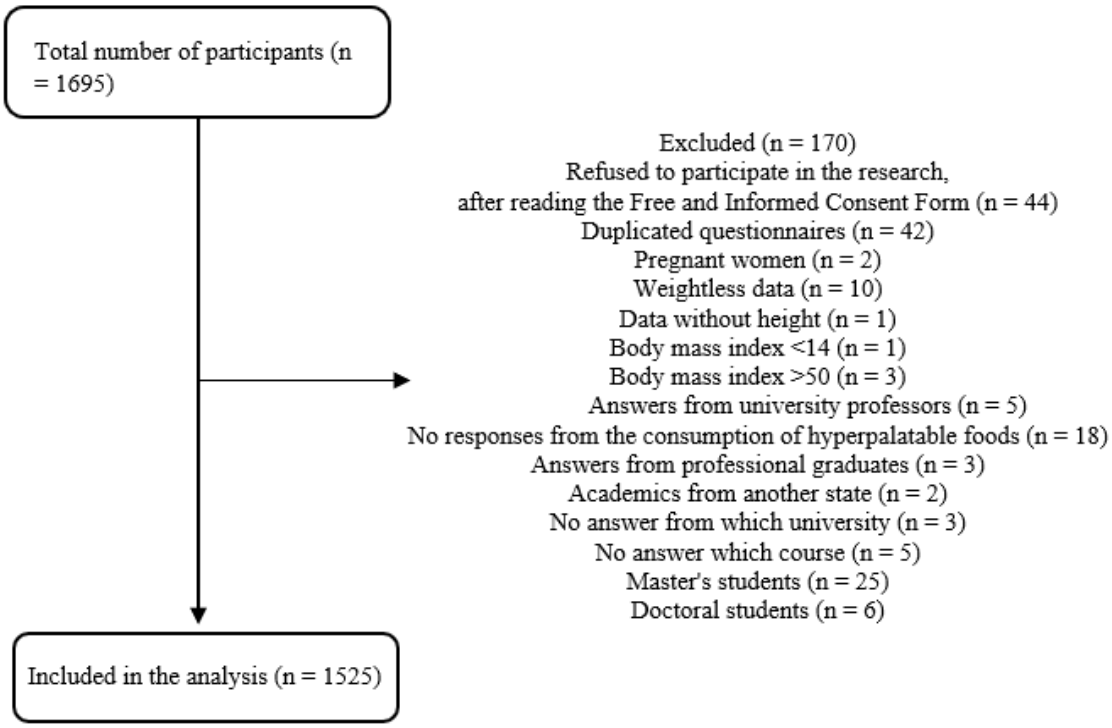

Figure 1 – Participant selection flowchart

Sample characteristics

Table 1 shows the demographic characteristics of our sample. Most respondents were female (75.5%), aged between 18 and 33 (87.3%), white (83.5%), single (79.3%), and from the state of Rio Grande do Sul (51.9%).

Table 1 – Demographic, social, and economic characteristics of the sample (n = 1525)

Variable	**n (%)**
Sex	
Female	1147 (75.5)
Male	373 (24.5)
Age	
18–33 years old	1332 (87.3)
34–49 years old	157 (10.3)
50 years old or older	36 (2.4)
Ethnicity	
White	1274 (83.5)
Non-white	251 (16.5)
Marital status	
Married or stable union	279 (18.3)
Divorced or separated	37 (2.4)
Single	1209 (79.3)
Number of people living together	
Living alone	153 (10.0)
1–2 people	601 (39.4)
3–4 people	677 (44.4)
More than 5 people	94 (6.2)
Household income	
Up to 1 minimum wage	155 (10.2)
2–3 mw	573 (37.6)
4–5 mw	363 (23.8)
more than 5	434 (28.5)
Type of institution	
Public	753 (49.4)
Private	772 (50.6)
State	
RS	792 (51.9)
SC	365 (23.9)
PR	368 (24.1)
Type of institution in each state	
Public - RS	490 (32.1)
Private - RS	302 (19.8)
Public - SC	93 (6.1)
Private - SC	272 (17.8)
Public - PR	170 (11.1)
Private – PR	198 (13.0)
Study area according to CNPq	
Agricultural Sciences	109 (7.2)
Biological Sciences	89 (5.8)
Health Sciences	524 (34.4)
Exact and Earth Sciences	172 (11.3)
Engineering	141 (9.3)
Human Sciences	191 (12.5)
Applied Social Sciences	241 (15.8)
Linguistics, Letters, and Arts	24 (1.6)
Others	32 (2.1)

RS: Rio Grande do Sul; SC: Santa Catarina; PR: Paraná. Mw: minimum wage

We found that the prevalence of addictive eating behavior was 18%. There were no significant differences in addictive eating behavior based on respondents' university, state, household income, remote learning, and degree of social distancing. In the multivariate model, the variables of sex, age, marital status, BMI 12 months after the start of the pandemic, and the number of meals after the pandemic showed a significant joint association with the prevalence of addictive eating behavior (Table 2).

The prevalence of addictive eating behavior was found to be higher among female students, irrespective of the other variables in the multivariate model (BMI, number of meals, marital status, and age). Therefore, it is inferred that the prevalence of addictive eating behavior is more significant among females than among males (PR = 1.80; 95% CI 1.32–2.47; p <0.001).

We created three age groups for data analysis: 18–33, 34–49, and 50 years old or older. There was a statistically significant difference between individuals aged 18–33 and those aged between 34 and 49 ($p < 0.05$). An important finding was that the prevalence of addictive eating behavior increased by 412% among students aged between 18 and 33 during the pandemic (PR = 5.12; 95% CI 1.44–18.3; p = 0.012). Another significant increase was observed compared to single students; the prevalence of addictive eating behavior was 146% higher among divorced students (PR = 2.46; 95% CI 1.41–4.27; p = 0.001).

The prevalence of addictive eating behavior was higher among the students who reduced the number of meals they had than those who did not change the number of meals (PR = 1.63; 95% CI 1.18–2.27; p = 0.003). However, students who significantly increased the number of meals also experienced a significant increase in their addictive eating behavior by 118% compared with those who maintained the same number of meals (PR = 2.18; 95% CI 1.61–2.79; $p < 0.001$). Students whose BMI increased 12 months after starting social distancing had a 131% higher prevalence of addictive eating behavior compared with those whose BMI decreased (PR = 2.31; 95% CI 1.40–3.82; p = 0.001).

Table 2 – Prevalence ratio of the univariate model and multivariate model for addictive behavior in Brazilian university students according to demographic, anthropometrics, social and economic variables

Variable	**Total**	**Addictive behavior**	**PR (95% CI)**	***p*-value**	**PR_a (95% CI)**	***p*-value**
	n (%)	n (%)				
	1.525 (100)	275 (18.0)				
Type of Institution						
Public	753 (49.4)	127 (16.9)	1			
Private	772 (50.6)	148 (19.2)	1.14 (0.92–1.41)	0.24		
Sex						
Male	373 (24.5)	38 (10.2)	1		1	
Female	1147 (75.5)	237 (20.7)	2.03 (1.47–2.80)	**<0.001**	1.80 (1.32–2.47)	**<0.001**
State						
RS	792 (51.9)	145 (18.3)	1.04 (0.80–1.36)	0.75		
SC	365 (23.9)	64 (17.5)	1			
PR	368 (24.1)	66 (17.9)	1.02 (0.75–1.40)	0.89		
Age						
18–33	1332 (87.3)	246 (18.5)	3.32 (0.86–12.8)	0.082	5.12 (1.44–18.3)	**0.012**
34–49	157 (10.3)	27 (17.2)	3.10 (0.77–12.4)	0.11	3.93 (1.09–14.2)	**0.036**
50+	36 (2.4)	2 (5.6)	1		1	

Ethnicity						
White	1274 (83.5)	239 (18.8)	1.31 (0.95–1.81)	0.1	1.22 (0.89–1.65)	0.21
Non-white	251 (16.5)	36 (14.3)	1		1	
Number of people living together						
Alone	153 (10)	32 (20.9)	1.27(0.89–1.81)	0.19	1.28 (0.84–1.95)	0.25
1 to 2	601 (39.4)	99 (16.5)	1		1	
3 to 4	677 (44.4)	124 (18.3)	1.11 (0.87–1.41)	0.39	1.19 (0.94–1.52)	0.15
more than 5	94 (6.16)	20 (21.3)	1.29 (0.84–1.98)	0.24	1.41 (0.99–2.01)	0.06
Household income						
up to 1 mw	155 (10.2)	26 (16.8)	1			
between 2 and 3	573 (37.6)	96 (16.8)	1.00 (0.67–1.48)	0.99		
Between 4 and 5	363 (23.8)	71 (19.6)	1.17 (0.78–1.75)	.46		
more than 5	434 (28.4)	82 (18.9)	1.13 (0.75–1.68)	0.56		
Marital status						
Married or Union	279 (18.3)	51 (18.3)	1.04 (0.79–1.37)	0.79	1.27 (0.96–1.68)	0.09
Divorced	37 (2.4)	11 (29.7)	1.69 (1.01–2.81)	0.044	2.46 (1.41–4.27)	**0.001**
Single	1209 (79.3)	213 (17.6)	1		1	
Remote Learning						
Had face-to-face classes	331 (21.7)	59 (17.8)	1			
No face-to-face classes	1194 (78.3)	216 (18.1)	1.02 (0.78–1.32)	0.91		
Distancing Degree						
High	354 (23.2)	68 (19.2)	2.31 (0.35–15.2)	0.39		
Medium	1062 (69.6)	182 (17.1)	2.06 (0.31–13.5)	0.45		
Low	97 (6.4)	24 (24.7)	2.97 (0.44–20.0)	0.26		
Null	12 (0.8)	1 (8.3)	1			
BMI After 12 months						
Decreased	121 (7.9)	15 (12.4)	1		1	
Equal	1116 (73.2)	158 (14.2)	1.14 (0.70–1.87)	0.6	1.08 (0.66–1.76)	0.77
Increased	287 (18.8)	101 (35.5)	2.84 (1.72–4.68)	**<0.001**	2.31 (1.40–3.82)	**0.001**
MBP After 12 months						
Decreased	310 (20.3)	57 (18.4)	1.83 (1.32–2.53)	**<0.001**	1.63 (1.18–2.27)	**0.003**
Equal	655 (43.0)	66 (10.1)	1		1	
Increased	560 (36.7)	152 (27.1)	2.69 (2.07–3.52)	**<0.001**	2.18 (1.61–2.79)	**<0.001**

Addictive behavior: Number of students with addictive eating behavior; PR: Prevalence ratio of the univariate model, along with its 95% confidence interval. PR: Prevalence ratio of the multivariate model, along with its respective 95% confidence interval.

RS: Rio Grande do Sul; SC: Santa Catarina; PR: Paraná; MW: Minimum wage; High distancing degree: Left home once a month and followed social distancing; Medium distancing degree: Left home once a week and followed social distancing; Low distancing degree: Left home once a day and followed social distancing; Null distancing degree: Did not follow social distancing; BMI (Body Mass Index)_ ***after 12 months***: After 12 months of social distancing, there was a significant change in BMI due to the changes in the meals throughout the day ($p < 0.05$). MBP (number of meals before the pandemic) After 12 months: meals during the day after 12 months of social distancing ($p < 0.05$).

DISCUSSION

This study aimed to assess the prevalence of addictive eating behaviors among academics in southern Brazil during the Covid-19 pandemic and the corresponding period of social distancing. The results indicated that 18% of the sample population exhibited symptoms consistent with addictive eating behaviors. Notably, a substantial increase of 412% was observed in the prevalence of these behaviors among young adults aged 18 to 33. Furthermore, significant increases in addictive eating behaviors were identified in divorced individuals (146%), participants who reported an increase in meal frequency (118%), and those whose body mass index (BMI) showed a rise 12 months after the onset of social distancing (131%).

The sample profile was predominantly female (75.5%), similar to recent studies that reported a higher proportion of female undergraduate students [15,22]. The prevalence of addictive eating behaviors among female students was 80% higher compared to their male counterparts, consistent with findings from other research on eating behaviors in healthy young women[15,23,24]. Studies indicate that, unlike men, women tend to prefer hyperpalatable foods more. This behavior is associated with mood swings related to hormonal changes in the menstrual cycle[25,26].

The variable University was not significantly associated with addictive eating behavior, household income, remote learning, and distancing degree. Furthermore, the prevalence of addictive eating behavior was not associated with ethnicity or the number of people living together, even after making adjustments in the multivariate analysis.

The prevalence of addictive eating behavior that this study found was higher than that found in other studies conducted in Brazil before the pandemic. Before the pandemic, Nunes-Neto et al.[19] conducted a survey with 7,639 individuals over the age of 18 (71.3% women) living all over Brazil. Using the *mYFAS 2.*0, they found that the prevalence of food dependence was 4.3%. A study administered the *mYFAS 2.0* on 150 medical students before the pandemic found an 8.6% prevalence of food addiction[27]. These values are much lower than the prevalence found in this study. Another study surveyed 5,368 university students (74.3% women) in Brazil during the pandemic and found a 19.1% prevalence of food addiction[14]. This prevalence was estimated using the *mYFAS 2.0*. However, we cannot assume a higher prevalence of addictive eating behavior because there are no pre-pandemic studies on this eating behavior with a sample similar to ours. Nonetheless, it is notable that, with only three regions of Brazil, we found a prevalence of addictive eating behavior that is similar to the prevalence Silva Júnior *et al.*[14] found throughout Brazil.

Addictive eating behavior was found to be significantly correlated with the age groups 18–33 years and 39–49 years. These results support the findings of Schulte and Gearhardt[28], who determined the prevalence of food addiction and its relationship with obesity and demographic factors in the United States. Food dependence was observed in 15% in individuals who were younger (<44 years), Hispanic and/or reported higher annual income[28]. A study on German individuals aged between 18 and 65 found that the prevalence of food addiction among participants aged between 18 and 29 was 13% based on the *YFAS 2.0*[29]. Food dependence estimated by the *mYFAS 2.0* was found to be associated with younger age during the Covid-19 pandemic (p=0.001). It was linked to higher consumption of hyper--palatable foods, and individuals reported more difficulty maintaining a healthy diet[30]. Furthermore, a Brazilian study found that stress was significantly associated with younger age during the Covid-19 pandemic[31]. Drastic changes that undergraduate students experienced, such as the format of online activities[7] and reduced socialization, may have increased their stress[8] and negatively impacted their health, which can increase the likelihood of developing addictive eating behaviors[9]. This may be attributed to emotional immaturity, as a recent study reported that the abrupt transition to remote learning during the pandemic led to substantial disruptions in educational processes, particularly

affecting younger students. These disruptions were exacerbated by reduced academic performance, increased levels of anxiety and stress, and difficulties adapting to digital learning platforms[22].

Contrary to our expectations, a high degree of social distancing was not found to be correlated with addictive eating behaviors. A systematic review and meta-analysis in total of 94 studies with 237,657 participants from 40 different countries (mean age 25.02 years; 57.41% females) reported that the prevalence of food addiction amid social distancing was 32%, and it was the only significant predictor of food addiction[32].

The findings of this study on addictive eating behavior and increased meal frequency during the pandemic are consistent with a previous study that examined eating behavior, stress, and associated factors among Brazilian adults during Covid-19. That study found an increase in the number of meals and overall food intake raised the likelihood of developing uncontrolled eating behaviors by 13.5% and 48.3%, respectively[31]. In another study, researchers evaluated how quarantining affects the diet, physical activity, and alcohol consumption of Lithuanians over the age of 18 and the association between these behaviors. Notably, 49% of the participants had begun eating more than usual, 45.1% increased their consumption of fast food, 20.6% increased their consumption of fried foods, and 37.7% increased their consumption of homemade sweets. The analysis revealed that individuals who increased their consumption of sweets, fast food, fried foods, or had higher overall food intake were more likely to experience weight gain. This relationship between weight gain and increased consumption of snacks, sweets, and fried foods remained statistically significant even in multivariate analyses[33].

Additional studies have shown that social distancing had a negative impact on eating habits[34,35], leading to an increase in meal frequency, snack consumption, and higher intake of sweets, fast food, and foods rich in saturated fats[31,36-38]. These behaviors were often accompanied by physical inactivity, insufficient sleep, inadequate fruit and vegetable consumption, excessive alcohol intake[39] and subsequent weight gain[40]. This evidence underscores the importance of closely monitoring dietary habits in the population, as these changes can have significant health implications.The association between addictive eating behavior and BMI 12 months after the start of the pandemic corroborates the results of a study cross-sectional that investigated whether food addiction is associated with weight change during the pandemic in adults (ages 18–78; M = 42.36, *SD* = 13.08) living in the United States[30]. This result suggests that one key factor contributing to addictive eating behavior is the anxiety triggered by social distancing during Covid-19. Changes in study routines, work, lifestyle, and reduced social interaction intensified anxiety and stress, both of which are known risk factors for developing food addiction, according to the systematic review and meta-analysis the support our finding, the majority of studies were carried out in adults (>18 years, 18.7–62.9 years) and ten studies were conducted in exclusively female population groups, with all other studies including both sexes, with an average of 74% females per study (range 55.1–93%)[41].

The pandemic has brought significant consequences for university students. They may consume hyper-palatable foods because of negative emotions, anxiety, and stress. Repeated consumption of such foods can promote food addiction, which neurobehavioral adaptations can explain[34]. These adaptations result from reducing the activities of the hypothalamic-pituitary-adrenal axis, which induces an increase in cortisol and inhibits dopamine release[3].

The strength of this study is that it conducted an online survey and thus reached a relatively large number of participants; this would have been impossible to achieve with face-to-face surveys amid social distancing. However, there are also some limitations. First, the results were based on students' recollections of their weight before the pandemic, which can lead to an underestimation. Moreover, the data may have been affected by biases and low reliability. Second, a majority of the sample were women, and we know that the highest prevalence of disordered eating behaviors

is among females[43]. Third, the invitation for the survey was sent via email and social networking platforms, which may have encouraged individuals who have a connection to the topic to respond to the questionnaire. Finally, we did not collect data from students who returned home during social distancing, as well as information on stress and anxiety, factors that can influence eating habits and contribute to the development of addictive eating behaviors. It is important to note that memory bias may have occurred, since the authors assessed food consumption prior to social distancing, which may have compromised the accuracy of the responses. In addition, the use of a convenience sample limits the generalizability of the data to the student population in Brazil, which represents another limitation of this study. Despite these limitations, this study may help healthcare professionals and researchers better understand addictive eating behavior during Covid-19 and aid in the treatment of patients with this behavior.

CONCLUSION

The prevalence of addictive eating behavior was found to be high among female university students and students aged between 18 and 33 in the southern region of Brazil, as estimated by the *mYFAS 2.0*. The prevalence was also high among divorced students, those who increased the number of meals they consumed daily, and those whose BMI increased after 12 months of social distancing. Considering that addictive eating behavior can cause various health problems and damage to society, healthcare professionals and government authorities must pay more attention to this behavior. They should seek more scientific evidence on diagnosing, preventing, and treating this behavior.

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Submitted: March 12, 2024
Accepted: December 11, 2024
Published: May 15, 2025

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All authors approved the final version of the text.	
Conflict of interest:	There is no conflict of interest
Funding:	This research received no external funding
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