



Association of Ultra-Processed Foods Consumption with Health Outcomes in Nutrition Students: A Post-COVID-19 Analysis

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Authors' contributions

This work was carried out in collaboration among all authors. Author KAS completed this research as part of a nutrition sciences dissertation and was the primary author of this article. Authors MTOF, MLRS, MAA and RESP contributed to data acquisition, formal analysis, drafts and revisions of this article. Authors CSS and EAE supervised the research and contributed to drafts and revisions of this article. All authors agree with the manuscript's content, which has not been published elsewhere. All authors read and approved the final manuscript.

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ABSTRACT

The consumption of ultra-processed foods (UPF) has been associated with increased disease risk. The COVID-19 pandemic affected eating practices, favoring university students' consumption of these foods. Nutrition students could have been less influenced. Therefore, we evaluated associations between the consumption of UPF items and markers of health status in nutrition students one year after the beginning of the COVID-19 pandemic. It was a cross-sectional study with nutrition students from a public university. Sociodemographic, anthropometric, physical activity, sleep quality, eating practices, and body image data were collected through a self-answered questionnaire using an online platform. Food items consumed on the previous day were obtained through individual interviews on two days of the same week. They were classified according to the NOVA classification. Almost 50% of the foods reported were in-natura/minimally processed (37 items out of 80); 40% of the participants consumed less than half of these food items. Almost 15% of all food items were UPF, and the number of food items in more than 85% was up to 4.5. The consumption was higher in students with poor eating practices and overweighted males, younger and under the first half of the major. The greater UPF items consumption, the greater the prevalence ratios of overweight ($\geq 1=35\%$; $\geq 2=44\%$; $\geq 3=66\%$) or inadequate eating practices ($\geq 1=32\%$; $\geq 2=40\%$; $\geq 3=52\%$). The participation of one UPF item in the diet was associated with the prevalence of overweight or poor eating practices; the higher the UPF item participation, the higher the prevalence.

Keywords: Ultra-processed foods; students; nutrition; overweight; eating practices; COVID-19.

1. INTRODUCTION

Human diets progressively incorporate higher quantities of highly processed foods. These foods have been associated with poor health outcomes in children, adolescents, adults and older people. These associations contributed to developing food classification systems according to food processing (Poti et al., 2015). Currently, NOVA is, by far, the best-known food classification system worldwide. NOVA classifies foods according to their extent and purposes of industrial processes as in natura or minimally processed (IN/MP); processed culinary ingredients (PCI); processed (P); and ultra-processed foods (UPF). UPF are industrial formulations made entirely or partially from ingredients pulled from foods (such as oils, fats and sugar), derived from food constituents (such as hydrogenated fats and modified starch), or artificially synthesized from food substrates or organic sources (flavor enhancers, colors and several food additives) (Monteiro, et al., 2016). Furthermore, UPF have an unbalanced nutritional composition and are deficient in micronutrients compared to IN/MP, which should be the basis for a healthy diet (Fondevila-Gascón et al., 2022). UPF are also associated with poor diet quality and poor health outcomes (Pagliari et al., 2021).

Recent research has demonstrated that ultra-processed foods (UPF) constitute at least half of the total dietary energy intake in certain high-income nations, including the United States, Canada, United Kingdom, Australia and between one-fifth and one-third in middle-income countries. In Brazil, a change in the dietary pattern has been recently observed, including replacing IN/MP foods and culinary preparations with UPF. Household food acquisition surveys indicate that the proportion of total energy intake derived from ultra-processed foods (UPF) increased from 14.3% in 2002/2003 to 19.4% in 2017/2018 (IBGE, 2020). In addition, different countries have shown the association of increased consumption of UPF with a higher risk of type 2 diabetes, obesity, coronary artery disease, overweight, metabolic syndrome, depression, inflammatory bowel diseases, frailty and all-cause mortality (Elizabeth et al., 2020). It has also been shown that the consumption of UPF is increasing among adolescents, adults, and older people of both sexes, and it is more expressive among adolescents and adults compared to older people (Ministério da Saúde, 2014).

In studies evaluating the quality of diets and their impact on health employing NOVA classification,

the most frequently metric used is the dietary share, in calories or grams, of UPF. (Elizabeth et al., 2020; Rodriguez-Besteiro et al., 2022). It has been shown that the energy density of UPF ranges from 2.5 (bread) to 5.0 (packed snacks) Kcal/gram, which is from 2 to 5 times higher than a rice and bean mixture (2:1). Conversely, the Dietary Guide for the Brazilian Population (DGBP) does not emphasize food nutrients or calories in its recommendations, but food quality based on the extent and purposes of industrial processes (Ministério da Saúde, 2014).

The DGBP is the first dietary guideline to emphasize qualitative recommendations, expressed through terms like "prefer," "avoid," and "limit." Its core principle is to prioritize natural or minimally processed foods over ultra-processed foods (UPF) (Ministério da Saúde 2014). However, studies evaluating whether markers of health status are associated with the simple presence of one, two, three, or more UPF items in the diet need to be included in the literature.

In this context, university students face new demands in their adult lives, endure long physical and mental hours of effort, and often eat incomplete meals with poor nutritional value (Rodriguez-Besteiro et al., 2022). In addition, from 2020 through 2022, the COVID-19 pandemic forced homeschooling, introducing additional challenges and requiring students to adapt their study habits quickly (von Keyserlingket al., 2022). This new reality also has increased anxiety and depressive symptoms in these students (Riboldiet al., 2022). Communication technology and social media contributed to sedentary behavior and to spreading pseudo-science regarding eating habits. Therefore, this scenario also favored poor eating practices, contributing to restrictive and unbalanced diets, (Barbosa et al., 2020) increasing UPF consumption (Rodriguez-Besteiro et al., 2022), and the risk of developing obesity, type 2 diabetes, cardiovascular diseases, and eating behavior disorders, among others (Andrade et al., 2023).

Among university students, a group of interest in the context of dietary patterns, but still poorly explored, is the human nutrition students. In Brazil, the major in nutrition trains professionals to act in all fields in which food and nutrition are fundamental for promoting, maintaining, and recovering health and preventing diseases in individuals or population groups Ministério da

Educação. (2001). These students learn about food and healthy dietary patterns throughout their training. However, to our knowledge, we did not find investigations of eating practices or food consumption according to NOVA classification in this group, especially during the COVID-19 pandemic.

Therefore, this study aimed to evaluate associations between the qualitative contribution of UPF items in the diet (number of items) and health outcomes of nutrition students from a public university in Brazil one year after the beginning of the COVID-19 pandemic. As a secondary aim, we described the participation of food items in the diet of these students, classified according to NOVA.

2. METHODOLOGY

This study was conducted in March 2021, one year after social distancing and quarantine measures began. The lockdown measures were suspending nonessential activities (closing restaurants, bars, shopping malls, and gyms), closing schools and universities, and implementing remote education. Therefore, all data collection was completed in a virtual format.

A cross-sectional study, designed and implemented following the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines, was conducted using probabilistic sampling von (Elm et al., 2008). We recruited participants from a public university's nutrition major. All participants agreed to participate via virtual informed consent through the Google form platform. The university's Ethics Committee Board approved the protocol.

To determine the appropriate sample size, OpenEpi software, version 3.01, was employed. A proportional stratified probability sample was chosen. It was considered for the calculation: (a) population size: 198 Nutrition students regularly enrolled in March 2021; (b) frequency of primary outcome: 80% for the consumption of at least one UPF item in the previous day; (Steele et al., 2020) (c) confidence limit: 5%; (d) design effect for random samples: 1; (e) the number of strata: 9 (semesters of the major); and (f) the number of students enrolled in each semester (elements/stratum). Therefore, the sample size was 110 students with a 95% confidence interval. After an adjustment of 10% for losses, the total was 121. After selecting the participants, an

electronic correspondence was sent with a link to the consent form. The study was carried out in two phases.

The phase one, which involved sociodemographic and health information, was acquired through self-answered questionnaires using the Google Forms platform. The economic class was evaluated using the Economic Classification Criteria 2020 (CCEB). Individuals were categorized in classes A, B1, B2, C1, C2, D and E. Associação Brasileira de Empresas de Pesquisa. (2019) Anthropometric measurements (body mass and height) were self-reported. Body Mass Index (BMI = weight (kg) height squared (m²)), was categorized as follows: underweight (<18), healthy weight (18-25.9), and overweight (≥25) according to WHO guidelines. To quantify physical activity levels, participants completed the International Physical Activity Questionnaire (IPAQ), short version, and all participants were categorized as sedentary, active, or very active (Guedes et al., 2005). Sleep quality was evaluated as "good," "bad," or "sleep disorder" by using the Pittsburgh Sleep Quality Index – PSQI (Bertolazi et al., 2011). Body image (dis)satisfaction and perception were investigated through a body silhouette scale (Kakeshita et al., 2009). In the analysis, a "zero" difference between perceived silhouette (perceived BMI) and desired silhouette (desired BMI) implied satisfaction with the body image. When this difference was higher or lower than zero, it implied dissatisfaction due to being overweight or thin, respectively. When the difference between perceived silhouette (perceived BMI) and actual silhouette (actual BMI) was equal to zero, there was no body image distortion. When this difference was higher or lower than zero, they underestimated or overestimated their body weight respectively.

Also, in phase one, eating practices were evaluated through a self-administered scale validated for individuals aged between 18 and 60 years, with 24 four-point Likert-type items ("strongly agree," "agree," "disagree," and "strongly disagree"). The scale comprises the four dimensions of adequate and healthy eating practices addressed in the DGBP: food choice, modes of eating, planning, and household organization. The sum of the individual scores attributed to the answers of each sentence resulted in a score classified as "inadequate" when the sum of the points was less than 31, "risk" when it was between 31 and 41 points, and

"adequate" when it exceeded 41 points. (Barbosa et al., 2020, Gabe and Jaime 2019).

In phase two, a qualitative description of all food items consumed by each participant on the previous day was accessed. The consumed foods were obtained from two days of the same week (one typical and one atypical day) (Cruzet al., 2021). The interviews were scheduled and conducted by trained interviewers using the multiple-pass method and by video calls through the Google Meet platform. Basic information on all food items and drinks consumed was asked for over 24 hours before each interview. In addition, participants were also asked about food preparation (fried, cooked, roasted, for example), food brands, and the presence or absence of ingredients (salt, sugar, olive oil, for example) in the culinary preparations and meal settings (time and place). All culinary preparations reported were dismembered, and each food or one culinary ingredient corresponded to one food item. At last, all reported food items were classified according to the NOVA into: (1) in natura/minimally processed IN/MP, (2) processed culinary ingredients - PCI, (3) processed – P, and (4) ultra-processed foods - UPF. The food items' organization, evaluation, and classification followed the best practices for applying the NOVA food classification (Martinez-Steele et al., 2023).

All statistical analyses were carried out with the SPSS® v.26 (IBM Corporation 2019) software. A descriptive analysis was performed using frequencies, tertiles, minimum and maximum. The Mann-Whitney or Kruskal-Wallis test was used in the association analysis for an asymmetrical numeric outcome. To summarize the data, variables were presented as medians with interquartile ranges (IQR). The Poisson regression with robust variance was used to construct an adjusted model. For that, the exposition variables were BMI ≥25 kg/m² (overweight) and eating practice scores ≤ 41 (bad/at risk), and the outcome was the consumption of UPF items. In this model, a forward adjustment was performed for possible confounding variables, and those that, in association with exposure and outcome, presented a p-value in the Wald test ≤ 0.25 were included. In addition, variables with p-values <0.05 remained in the final model. Variables were described as prevalence ratios (PR) at a 95% confidence interval. The value of 5% (p < 0.05) was significant in all analyses.

3. RESULTS

This study included 111 students who were regularly enrolled in the Nutrition major program at a public university, one year after the beginning of the COVID-19 pandemic measurements of social distancing and quarantine. The general characteristics of these students are in Table 1. Most were female, aged between 19 and 24 years, categorized in the B economic class, and under remote teaching (Table 1). At most, they were sedentary, had poor sleep quality or a sleep disorder, were dissatisfied with their body image and had distorted body image perception. In contrast, most had healthy body weight and good eating practices (Table 1).

Table 2 describes the analysis of the participation in the diet of food items from each NOVA group consumed on the day before the interview (two interviews). Up to 80 food items

were reported, 46.9% of IN/MP, 32.5% of PCI, 5.6 of P, and 15% of UPF. Almost 40% of the participants ingested up to 12.5 IN/MP items. Less than 7% reported the highest consumption of those foods (26.00–37.50). The highest number of PCI was 26 but in the lowest tertile. P items were reported a few times. About 15% of the participants consumed 5 to 12 items for UPF, and the maximum consumption for almost 85% was 4.5 (Table 2). In the IN/MP group, the most reported food items were bananas, beans, carrots, coffee, eggs, meat, milk, onion, rice and tomato. The PCI items most reported were baking powder, butter, honey, lard, olive oil, salt, sour cream, sugar and vegetable oil. The most reported P foods were natural coloring, beer, corn, dried meat, French bread, granola, non-processed cheeses, olives, sweet bread and tomato extract. At last, UPF items most reported were chocolate, cocoa powder, cookies, ham, loaf bread, margarine, sausage, soft drinks, tomato sauce and yogurt.

Table 1. Distribution according to general characteristics of nutrition students at a public university (n=111)

Variables		n	%
Gender	Male	16	14.41
	Female	95	85.59
Age	19 – 24 years	77	69.37
	25 – 44 years	34	30.63
Semester	1 to 5	57	51.35
	6 to 9	54	48.65
Routine	Remote teaching and job out of home	25	22.52
	Just remote teaching	86	77.48
Socioeconomic class	B or higher	67	60.36
	C or lower	44	39.64
Physical activity	Sedentary	54	55.67
	Active	22	22.68
	Very active	21	21.65
Sleep Quality	Good	31	31.31
	Bad/sleep disturbance	68	68.69
Body image (dis)satisfaction	Dissatisfaction	90	81.08
	Satisfaction	21	18.92
Body image perception	Distorted perception	88	79.28
	Non-distorted perception	23	20.72
Body mass index	Underweight	9	8.33
	Healthy weight	69	63.89
	Overweight	30	27.78
Eating practices	Inadequate / at-risk	47	42.34
	Adequate	64	57.66

Table 2. Descriptive analysis of the participation in the diet of food items, according to NOVA classification, of nutrition students at a public university (n=111)

NOVA classification	Students % (n)	n° of food items* minimum – maximum
<i>In natura</i> and minimally processed	100 (111)	0.00 – 37.50
1 st tertile	40.54 (45)	0.00 – 12.50
2 nd tertile	52.25 (58)	12.60 – 25.00
3 rd tertile	7.21 (8)	26.00 – 37.50
Processed culinary ingredients	100 (111)	0.00 – 26.00
1 st tertile	25.22 (28)	0.00 – 8.50
2 nd tertile	59.45 (66)	9.00 – 17.50
3 rd tertile	15.31 (17)	18.00 – 26.00
Processed	100 (111)	0.00 – 4.50
1 st tertile	65.76 (73)	0.00 – 1.50
2 nd tertile	26.13 (29)	2.00 – 3.00
3 rd tertile	8.10 (9)	3.50 – 4.50
Ultra-processed	100 (111)	0.00 – 12.00
1 st tertile	85.58 (95)	0.00 – 4.50
2 nd tertile	12.61 (14)	5.00 – 8.00
3 rd tertile	1.80 (2)	9.50 – 12.00

*n° of food items according to NOVA classification was evaluated by two individual and qualitative interviews regarding the food items consumed on the previous day: one typical and another atypical

Table 3. Participation in the diet of UPF items, according to NOVA classification of nutrition students at a public university (n=111)

Variables	N	UPF items*	P-value
Gender^a			
Male	16	4.25 (2.37 – 6.00)	<0.001
Female	94	2.00 (1.00 – 3.00)	
Age^a			
19 – 24 years	77	2.50 (1.50 – 3.50)	0.03
25 – 44 years	32	2.00 (1.00 – 2.50)	
Semester^a			
1 to 5	52	3.00 (1.50 – 4.00)	<0.001
6 to 9	54	2.00 (1.00 – 3.00)	
Routine^a			
Remote teaching and job out of home	24	2.50 (1.50 – 3.50)	0.24
Just remote teaching	86	2.00 (1.00 – 3.50)	
Socioeconomic class^a			
B or higher	67	2.00 (1.00 – 3.50)	0.78
C or lower	44	2.25 (1.00 – 3.50)	
Physical activity^b			
Sedentary	53	2.00 (1.00 – 3.00)	0.28
Active	22	2.75 (1.50 – 3.75)	
Very active	21	2.50 (1.00 - 5.50)	
Sleep quality^a			
Good	30	2.50 (1.00 – 4.62)	0.59
Bad / disturbance	80	2.00 (1.12 – 3.50)	
Body image (dis)satisfaction^a			
Dissatisfaction	90	2.50 (1.00 – 3.50)	0.53
Satisfaction	21	2.00 (1.00 – 3.75)	
Body image perception^a			
Distorted perception	88	2.00 (1.12 – 3.50)	0.84
Non-distorted perception	23	2.50 (1.00 – 3.50)	
Eating practices^a			
Inadequate / at-risk	47	3.00 (1.50 – 3.50)	<0.001
Adequate	58	1.75 (1.00 – 2.50)	
Body mass index^b			
Underweight	9	2.00 (1.00 – 2.25)	<0.001
Healthy weight	65	2.00 (1.00 – 3.00)	
Overweight	30	3.25 (1.50 – 6.00)	

*Ultra-processed food items. Data were expressed as median and IQR of 25% - 75%. ^a Mann-Whitney test. ^bKruskal-Wallis test

Table 4. Association between body mass index (BMI), eating practices, and the number of UPF items in the diet of nutrition students at a public university (n=111)

			BMI ≥ 25 *
N° UPF items consumed	PR (95% CI)	P-value**	
≥ 1	1.34 (1.07 – 1.69)	0.01	
≥ 2	1.44 (1.09 – 1.88)	<0.001	
≥ 3	1.66 (1.26 – 2.17)	< 0.001	
			Eating practice scores < 41*
N° UPF items consumed	PR (95% CI)	P-value**	
≥ 1	1.32 (1.10 – 1.58)	0.003	
≥ 2	1.40 (1.13 – 1.73)	0.002	
≥ 3	1.52 (1.10 – 1.58)	0.003	

*Adjusted for the semester of the nutrition major. ** Wald test. BMI: Body Mass Index; PR: Prevalence Ratio; 95% CI: 95% Confidence Interval

The UPF items consumed were associated with gender, age, semester, eating practices, and BMI (Table 3). The consumption of the UPF item was higher for male students, younger students, and those from the first to fifth semesters. In addition, students with inadequate/at-risk eating practices and overweight reported more UPF items ($p < 0.05$, Table 3).

A Poisson model analysis (Table 4) was performed to estimate the PR for BMI ≥ 25 and inadequate/at-risk eating practices (scores < 41). We found a PR of 34% for being overweight (BMI ≥ 25) among participants consuming ≥ 1 UPF item compared to those consuming no UPF item. This prevalence increased by 44% among participants consuming ≥ 2 UPF items and 66% among those consuming ≥ 3 UPF items. In addition, there was a PR of 32% of inadequate/at-risk eating practices (scores < 41) among participants consuming ≥ 1 UPF item (PR 1.32; 95% CI 1.10 – 1.58) compared to participants consuming no UPF items. When the consumption of UPF items increased to ≥ 2 , the PR was 40%; when it was ≥ 3 , it was 52%. (Table 4).

4. DISCUSSION

Recent meta-analyses showed significant dose-response associations between the dietary share of UPF and increased risk of noncommunicable diseases (NCDs), such as obesity, cancer, cardiovascular diseases, diabetes, and all-cause mortality in several groups of individuals (Pagliai et al., 2021). In addition, most research worldwide has shown that the estimated energy intake from UPF consumption has consistently increased among adolescents and youths, accounting for a high proportion of the daily energy intake and contributing to poor health outcomes (Costa et al., 2021). In our study, we investigated possible relationships between UPF items consumption (number of items in the previous day) and health outcomes in nutrition students from a public university one year after the beginning of the social distancing measures due to the COVID-19 pandemic.

The pandemic has contributed to changes in people's lifestyles, changing food trends and habits. The stress of lockdowns, the uncertainty of the situation, and the shift to remote work have led many to adopt non healthy eating patterns (Rodriguez-Besteiro et al., 2022). Therefore, we first described the food items consumed by the participants, according to the NOVA

classification, on the previous day, in two days of the same week.

Overall, 15% of all food items reported were UPF. The number of UPF items eaten by more than 85% of the participants was up to 4.5. Also, the consumption of those items was higher for males, younger, enrolled from the first to fifth semesters of the major, with at-risk/inadequate eating practices, and overweighted. Conversely, although almost 50% of the food items reported were IN/MP, 40% of the participants consumed less than half of those food items (12.5 of all 37 food items). Similar data also showed the participation of UPF in the diet for young adults and males (Costa et al., 2021). Bonalume et al. (2020) showed that most university students (~90%, 66.2% from nutrition majors) did not consume UPF; they also were 18 to 51 years old and between their majors' sixth and eighth semesters. Costa et al. (2021) showed an eating frequency of 18.2% of UPF by youths from 27 capitals in Brazil. In agreement with our findings, it also was significantly lower in females, decreased linearly with age, and increased from the lower level to the intermediate level of education, corroborating our findings. Being in the first half of the nutrition course could have been a determinant because, during this time, biological and health sciences and social, human, and economic sciences were the focus of the human nutrition major (Ministério da Educação. (2001), Cicaroni Ottoni et al., 2022).

The ten most consumed food items from each NOVA group were also presented in our study. The most reported items in the UPF were margarine, loaf bread, and soft drinks. Costa et al. (2021) also found those items with the highest frequency of consumption on the previous day by adults from 27 Brazilian state capitals. In the IN/MP, beef, rice, beans, coffee, eggs, tomatoes, milk, onions, bananas, and carrots were the most cited. These findings partially agree with the last Brazilian Household Budget Survey carried out in 2017-2018, in which rice, beef, beans, and poultry were also the most cited IBGE. (2020).

The most relevant finding of our investigation was that the prevalence of overweight or poor eating practices was associated with only one UPF item in the diet. In addition, the prevalence of overweight or inadequate eating practices increased as the UPF items increased in the diet. Duran-Aguero et al. (2021) showed that Chinese university students consuming at least one serving of sugary drinks per day were associated

with higher odds of obesity. In our study, soft drinks were among the UPF items most cited. Recently, Fondevila-Gascón (2022) showed that university students with higher BMI had more unhealthy diets containing UP than those with lower BMI.

However, although the food items reported by the participants refer to just two days in the same week, food practices are long-term information that generally reflects food habits. To minimize that, we used a multidimensional scale that measures adherence to the four dimensions of adequate and healthy eating practices addressed in the DGBP Ministério da Saúde, Departamento de Atenção Básica. (2014): food choices, modes of eating, planning, and household organization. (Gabe and Jaime 2019). In the concurrent validation study of this scale, the score was positively associated with higher consumption of fresh and MP foods and inversely associated with UPF consumption. Therefore, our data align with its observed correlations: people with a higher degree of adherence to food guidelines consume more IN/MP and less UPF (Gabe and Jaime 2022). Therefore, we can speculate that UPF items in the participants' diets are a long-term practice, regardless of the number of items.

To the best of our knowledge, there is a gap in the literature demonstrating the "cause-effect" relationships between the consumption of UPF and adverse health effects. Nevertheless, some mechanisms have been postulated, such as poor nutritional profile and displacement of IN/MP foods in the diet, low satiety potential, high glycemic loads, reduced gut-brain satiety signaling, inflammatory responses linked to industrial food additives, gut microflora dysbiosis, and increased intestinal permeability (Poti et al., 2015) In addition, some properties of UPF may promote overconsumption, including their often-ubiquitous availability and convenience, palatability and quasi-addictiveness, and intensive marketing practices used to encourage purchasing and consumption, especially among children and adolescents IBGE. (2020).

Lastly, it is essential to point out that we did not find any association between the consumption of UPF items (or another NOVA group) and physical activity, sleep quality, or body image (dis)satisfaction and perception. Conversely, more than half of the participants reported being sedentary, having bad sleep quality or sleep disturbance, being dissatisfied, or having a distorted perception of their body image, which

are considered poor markers of health status, contributing to rising disease risks. In addition, although we did not investigate mental health, numerous studies have shown that the pandemic favored the increase of anxiety and depression in youth. They also show their strong influences on food habits, sleep quality, sedentary behavior, and body image, favoring adverse health outcomes (Alshammari et al., 2022).

Some potential limitations of this study deserve mention. We could not assess body composition; the BMI was the only nutritional indicator. BMI does not assess body fat; therefore, the overweight prevalence may be overestimated. Nevertheless, this finding may be attributed to the high prevalence of sedentary behavior among the participants, which is commonly associated with excess body fat. In addition, self-reported data may introduce recall bias, affecting the accuracy. However, the use of the multiple-pass method by trained interviewers aimed to minimize this bias. While these limitations must be acknowledged, this study provides valuable insights into the impact of ultra-processed food consumption on the health of young people.

The main strength of our study is that poor eating practices or being overweight are associated with consuming just one UPF food item. Although nutrition students supposedly know healthy food choices, there are UPF items in their diets. This finding reinforces the "gold rule" of the DGBP: make unprocessed/minimally processed foods the basis of the diet, reduce processed foods, and avoid UPF Monteiro et al., 2016, Ministério da Saúde, Departamento de Atenção Básica. (2014).

5. CONCLUSION

Nutrition students with poor eating practices and overweighted males, younger and in the first half of the major, consumed more UPF items in their diets. The prevalence of overweight or poor eating practices was associated with just one UPF item in their diets. The higher the prevalence, the higher the consumption of UPF items.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Authors hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

CONSENT

It is not applicable.

ETHICAL APPROVAL

All participants agreed to participate via virtual informed consent through the Google form platform. The Ethics Committee Board of the Universidade Federal dos Vales do Jequitinhonha e Mucuri approved the protocol (UFVJM, #4.529.090).

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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