



Commentary

Dietary intake of university students during COVID-19 social distancing in the Northeast of Brazil and associated factors

Jerusa da Mota Santana^{a,*}, Maria Patricia Milagres^b, Caroline Silva dos Santos^b,
Jamille Marinho Brazil^c, Evely Rocha Lima^b, Marcos Pereira^d

^a Health Sciences Center, Federal University of Recôncavo da Bahia, Avenida Carlos Amaral, R. do Cajueiro, 1015, Santo Antônio de Jesus - BA, 44574-490, Brazil

^b Postgraduate Program in Nursing and Health, State University of Southwest Bahia, Av. José Moreira Sobrinho, S/n°, Jequié, BA, CEP: 45.208-409, Brazil

^c Multidisciplinary Health Institute, Federal University of Bahia, Campus Anísio Teixeira, Rua Hormindo Barros, 58, Quadra 17, Lote 58, Vitória da Conquista, BA, CEP: 45.029-094, Brazil

^d Institute of Collective Health (ISC), Federal University of Bahia, Rua Basílio da Gama, S/n°, Campus Universitário Canela, Salvador, BA, Brazil



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ABSTRACT

This study aimed to analyze the influence of COVID-19 social distancing on the dietary pattern of university students in the Northeast of Brazil and associated factors. This is a cross-sectional study of 955 students from four universities carried out via a web survey containing social, economic, demographic, and health information. A food frequency questionnaire was used to evaluate diet. Weight and dietary alterations were reported. Exploratory factor analysis and multivariate logistic regression were used as statistical analyses. The mean age was 26 and 53.7% of the students observed an increase in their weight. Four dietary patterns were identified: (1) a predominantly *in natura* pattern, (2) a pattern of processed and ultra-processed foods, (3) a protein-based pattern, and (4) an infusion-based pattern. It was observed that students having a darker skin colour (OR 1.8; CI 95% 1.3–2.6) and 19–29 years old and not being a health course student (OR 1.5; CI 95% 1.1–2.1) were associated with greater adherence to the *in natura* pattern. Not engaging in physical activity was statistically associated with not adhering (OR 0.5; CI 95% 0.4–0.7) to that pattern. The university students who saw an alteration in their weight during the social distancing period studied presented a greater probability of consuming the processed and ultra-processed foods pattern (OR 1.8; CI 95% 1.2–2.6), while the men (OR 0.7; CI 95% 0.4–0.9) and those not engaging in physical activity (OR 0.7; CI 95% 0.5–0.9) presented less adherence to that pattern. These findings indicate that social isolation affected the dietary intake of university students, with adherence to mixed dietary patterns in terms of health. The adherence to the pattern of processed and ultra-processed foods identified may affect the students' health, especially the occurrence of excess weight and obesity.

1. Introduction

The COVID-19 pandemic is considered a serious problem for public health throughout the world (World Health Organization, 2020). The virus was identified in December of 2019, in Wuhan, in China, and has gained worldwide visibility, due to its high transmissibility and clinical complications. It can result in acute respiratory syndrome, the most common being pneumonia, and its evolution can lead to death (Lu et al., 2020).

In Brazil, in February of 2021, 9,765,455 confirmed cases and

237,489 deaths were recorded, with a lethality rate of 2,4% (Brasil, 2021). Brazil has one of the highest rates of social inequality in the world, and showing profound regional inequalities (Magno et al., 2020). The COVID-19 pandemic has deepened these inequalities, not only producing a greater impact on the number of cases and deaths in the poorest regions, such as the North and Northeast (Kerr et al., 2020). In Bahia, the numbers have already exceeded 623,678 cases (Brasil, 2021). Brazil is thus one of the main COVID-19 epicenters.

Social distancing is the main prevention and control measure for COVID-19 (West et al., 2020), but it has several implications, such as job

* Corresponding author. Health Sciences Center, Federal University of Recôncavo da Bahia, Avenida Carlos Amaral, R. do Cajueiro, 1015, Santo Antônio de Jesus - BA, 44574-490, Brazil.

E-mail addresses: jerusanutri@ufrb.edu.br (J.M. Santana), mpmilagres@yahoo.com.br (M.P. Milagres), nutricaroline@hotmail.com (C. Silva dos Santos), jamille.marinho@hotmail.com (J.M. Brazil), evely.rl@gmail.com (E.R. Lima), pereira.santasm@yahoo.com (M. Pereira).

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losses and reduced income, reduced engagement in physical activity, mental disorders and weight gain. The impacts on mental health in the context of a pandemic are generated by fear of being infected with the virus, worrying about relatives, anxiety about being at home and having one's daily routine altered, stress, frustration, inadequate supplies, inadequate information, financial loss, and stigma (Brooks et al., 2020). All these factors contribute negatively to maintaining healthy dietary habits, directly affecting the health-disease process, which can result in a higher occurrence of obesity (Mantau, Hattula, & Bornemann, 2018).

Within this context, university students warrant mentioning, as their routine has been altered, with the suspension of activities, delays in graduating, and, in some cases, distance activities carried out remotely. Added to this is the phenomenon of the pandemic, which can lead to an increase in anxiety, stress, and frustration among this population. One study conducted using university students in Portugal revealed that faced with the pandemic the students presented higher levels of depression, anxiety, and stress (Maia & Dias, 2020). But the evidence on the repercussions of the pandemic on the diet of university students remains limited (Gallo, Gallo, Young, Moritz, & Akison, 2020) and weight gain.

University students should also be seen as an important population for studying food insecurity, as studies show that households with university students have higher rates of food insecurity than those that do not have university students (Hagedorn & Olfert, 2018; Owens et al., 2020). This situation tends to worsen with the implications of the COVID-19 pandemic, as reported in the study by Owens et al. (2020), which classified 34.5% of the university students interviewed as being affected by food insecurity.

The evidence on the effects of the pandemic on the health of university students is still limited. It is thus important to study this topic, as diet is essential for promoting health and preventing illness. On the other hand, the COVID-19 pandemic may have implications in daily life that are reflected in access to an adequate and healthy diet. Therefore, this study aims to evaluate the influence of COVID-19 social distancing on the dietary intake and anthropometric alterations of university students in the Northeast of Brazil.

2. Methods

2.1. Design and study population

This cross-sectional study was conducted in four universities in the state of Bahia, Northeast region of Brazil, from April to May 2020. Participants from two public and two private universities ($N = 955$) completed a web-based survey between April and May 2020 about COVID-19-related nutrition and behavior change. This web-based survey was anonymous, and completely voluntary.

The study included students from the State University of the Southeast of Bahia (Jequié, Vitória da Conquista, and Itapetinga campuses), the Federal University of Bahia (Salvador and Vitória da Conquista campuses), the Faculty of Technology and Sciences (Jequié campus), and the Independent Faculty of the Northeast (Vitória da Conquista campus).

Students aged 18 years or older who were enrolled in higher education courses at the universities chosen for the research were considered eligible. The researchers' access to the academic community of the universities was adopted as a selection criterion. Repeated records were excluded from the study, in order to avoid duplicate data.

2.2. Data collection

The web survey was conducted via the Google Docs online platform using a closed questionnaire (link: <https://forms.gle/S2Z5Gr69rcRZJN837>). This instrument was sent to the collegiate boards of the courses of the chosen universities and these sent it on to the students enrolled, as well as being divulged via social media (Facebook and

Instagram).

The survey contained socioeconomic, demographic, and lifestyle information, height and weight data, information about changes in eating habits during social isolation, medication and supplement use, as well as an investigation of dietary intake in the last 60 days before to study response data.

2.2.1. Anthropometric assessment

The anthropometric assessment was carried out using the height and weight self-reported by the university students, from which their body mass index (BMI) was calculated, using the equation: weight (kg)/height (m)². After this calculation, the results were classified according to the values established for adults (WHO Consultation on Obesity (1999: Geneva & Organization, 2000)).

In order to evaluate the anthropometric changes of the population under study during the social isolation period, the students were asked to give their height and weight two months before and during social distancing. It was thus possible to establish their BMI at both points in time.

2.2.2. Dietary intake assessment

To evaluate the students' dietary intake in the social distancing period, Willett's (1998) Qualitative Food Frequency Questionnaire was employed, adapted for university students of nutrition in Recôncavo in Bahia (Pereira-Santos, da MotaSantana, Neves de Carvalho, & Freitas, 2016).

This qualitative instrument was composed of 70 dietary items distributed among seven food consumption frequency categories: daily (once a day, two or more times a day), weekly (once a week, two to four times a week), monthly (less than once a month, one to three times a month), and never or almost never. Alterations in the volume, preparation, and fractioning of food during social distancing were also evaluated.

2.3. Data analysis

Descriptive analyses were conducted, using proportions for the qualitative variables and mean and standard deviation for the quantitative variables.

For the Food Frequency Questionnaire analysis, the consumption frequency of each food was initially converted into daily consumption frequency. For this, the value 1 (one) was attributed to the food when it was consumed once a day. If the food had been consumed more than once a day, the value 1 was multiplied by the interval of the daily frequency reported by the student. For the options with weekly and monthly time intervals, the mean of the interval of frequencies was employed, divided by the period, whether weekly (7) or monthly (30) (Coelhode et al., 2015).

To identify the dietary intake pattern of the university students, exploratory factor analysis (EFA) was adopted. Before proceeding with this analysis, the Kaiser-Meyer-Olkin (KMO) statistical test and the Bartlett sphericity test were employed to verify the fit of the factor analysis to the data collected. During the interpretation of the EFA, minimum commonalities of 0.30 were accepted to keep the food items in the analysis. The principal components analysis (PCA) technique was employed to extract the factors (dietary patterns) and varimax rotation was used to better interpret the factors extracted.

The number of factors to be extracted was outlined based on the Cattell graph or screenplot test. Subsequently, the factor loading of each food item was evaluated and a factor loading of ≥ 0.4 was adopted to keep the food item in each factor (pattern).

Finally, the patterns were labeled based on the nutritional characteristics of the foods that compose them and the internal consistency of each factor was evaluated using Cronbach's alpha test. Student's t-test was employed for independent samples to verify differences in the dietary intake pattern during the social distancing period according to sex

and Pearson's chi-square test ($p \leq 0.05$) was adopted to assess the changes in dietary behavior, body weight, and engagement in physical activity according to sex.

The response variables of this study are the four dietary intake patterns. The factorial scores of each pattern were categorized into lower than 75% and equal to or greater than 75%. As they are considered healthier dietary patterns, patterns 1 and 3 were dichotomized as (0) factorial score equal to or greater than 75% and (1) intake lower than 75%. As they are considered less healthy, dietary patterns 2 and 4 were categorized as (0) intake lower than 75% and (1) factorial score equal to or greater than 75%.

The covariables of interest are: sex [(0) female or (1) male]; marital status [(0) married or living together or (1) single or widow (er)]; race [(0) white or (1) having a darker skin colour]; income [(0) greater than or equal to one minimum wage or (1) lower than one minimum wage]; university type [(0) private or (1) public]; age [(0) 30 or more or (1) 19 to 29]; courses [(0) health and (1) other courses]; BMI during the pandemic [(0) eutrophic or (1) overweight or obese]; perception of weight [(0) there was no change in weight or (1) there was an increase in weight]; physical activity [(0) engages in physical activity or (1) does not engage in physical activity].

Descriptive analyses were carried out, using means and standard deviations for the quantitative variables and proportions for the categorical variables. To evaluate the factors associated with the dietary intake patterns multivariate logistic regression was used, including the variables with a p value greater than or equal to 0.20 in the bivariate analysis and adopting in the final model variables that presented a value of $p \leq 0.05$. Subsequently, the odds ratio estimates, and their respective confidence intervals were obtained. For the statistical analyses of the data, the Statistical Package for Social Sciences (SPSS) software, version 21, was used.

2.4. Ethical criteria

This research followed the ethical principles of the Helsinki Declaration and those described in Resolution n. 466/12 of the Brazilian National Health Council (Opinion n. 4,074,053). The data collection only began after authorization by the Ethics Committee of the State University of the Southeast of Bahia. The research participants took part voluntarily, after signing an informed consent form online.

3. Results

3.1. Description of the population

955 university students from the public (88.6%) and private (11.4%) sector took part, with a mean age of 26 (SD: 8.07) and more than half being from courses in the area of health (52.6%). The socioeconomic, demographic, and lifestyle characterization of the study population is described in Table 1. There is an observed predominance of students of the female sex (77%), singles (81.7%), having a darker skin colour (71.8%), and a family income of between two and four minimum wages (47.2%).

With relation to income during the social isolation period, 42.6% of the students revealed a reduction in income, which had an impact on food acquisition (15.7%) (Table 1).

3.2. Anthropometric and dietary changes during a social isolation period

It was observed that during the social isolation period 67.3% of the university students perceived a change in their body weight. Of these, 53.7% observed an increase in weight. Regarding physical activity, 66.8% of the students engaged in physical activity before the pandemic, which decreased to 37.9% during the social distancing period (data not presented in a table).

The prevalence of being overweight and obese two weeks before

Table 1

Socioeconomic and demographic characterization of university students during COVID-19 social distancing, Bahia, Brazil, 2020.

VARIABLES	n	%
Sex		
Male	220	23.0
Female	735	77.0
Marital status		
Married/stable union	151	15.8
Single	780	81.7
Others	24	2.5
Race/color		
White	259	27.1
Brown	477	49.9
Black	209	21.9
Indigenous/yellow	10	1
Family income		
1 minimum wage or less	162	17.0
2 to 4 minimum wages	451	47.2
>5 minimum wages	209	21.9
Did not want to say	133	13.9
Alteration of income during social isolation		
Reduction in income	407	42.6
Increase in income	54	5.7
No alteration of income	494	51.7
Alteration of income and acquisition of food		
It slightly hindered the acquisition of food	150	15.7
It did not hinder the acquisition of food	640	67.0
Does not apply	165	17.3
Consumption of alcoholic drinks		
Increase in consumption	139	14.6
No alteration in consumption	283	29.6
Reduction/does not consume	533	55.8
Work during social distancing		
Presidential	131	13.7
At home	172	18.0
Does not work/other	652	68.3
University		
Public	846	88.6
Private	109	11.4
Courses		
Health	502	52.6
Others	453	47.4

social isolation was 23.2% and 8.7%, respectively, increasing to 28.2% and 10.7%, respectively, during social isolation. It was observed that 30.5% of the participants reported eating more processed and ultra-processed foods as they felt anxiety and anguish because of the pandemic (data not presented in a table).

Table 2 presents the main changes in dietary behavior, body weight, and physical activity during COVID-19 social distancing, according to sex. It was observed that during the social isolation period an increase in the fractioning and volume of meals was recorded among both sexes; however, the women presented an increase of around 6.8% more in volume ($p = 0.003$) and 12.4% in fractioning ($p = 0.009$) compared to the men (Table 2).

Regarding engagement in physical activity, 66.8% of the students (31.3% female and 35.3% male) revealed that they engaged in physical activity before social isolation, but after the pandemic there was a reduction in this practice, with no differences between sexes (Table 2).

Regarding the students' perception with relation to their weight, both sexes stated that they perceived an increase in body weight, with the women highlighting this increase more (54.0%); however, this was not statistically significant (Table 2).

The prevalence of excess weight (overweight/obese) before and during social isolation was higher in the group of men, at 45.2% and 53.9% ($p = 0.004$), respectively (Table 2).

The results of the KMO (0.77) and Bartlett's sphericity statistical tests ($p < 0.001$) indicated adequacy of the data to carry out the factor analysis (data not shown in a table). Thus, four dietary patterns were identified that explained 61.44% of the total variability in the dietary

Table 2
Changes in dietary behavior, body weight, and physical activity during COVID-19 social distancing, Bahia, Brazil, 2020.

SEX	VARIABLES				P value
	Female		Male		
	n	%	n	%	
Volume of meals					
Increase	356	48.4	92	41.8	0.009
Reduction	141	19.2	40	18.2	
No alteration	735	32.4	88	40	
Fractioning of meals					
Increase	345	46.9	76	34.5	0.003
Reduction	150	20.4	49	22.3	
No alteration	240	32.7	95	43.2	
Physical activity					
Didn't practice and started practicing	116	15.8	24	10.9	0.799
Didn't practice and continued not practicing	201	27.3	51	23.2	
Practiced and continued	161	21.9	61	27.7	
Practiced and didn't continue	230	31.3	78	35.5	
None of the options	27	3.7	6	2.7	
Body weight					
No alteration in weight	168	22.9	61	27.7	0.101
Loss of weight	158	21.5	55	25.0	
Gain in weight	397	54.0	99	45.0	
None of the options	12	1.6	5	2.3	
BMI before social distancing					
Low weight	65	11.1	14	7.8	0.000
Eutrophia	358	61	84	46.9	
Overweight	118	20.1	60	33.5	
Obesity	46	7.8	21	11.7	
BMI during social distancing					
Low weight	34	10.1	5	4.9	0.004
Eutrophia	187	55.5	42	41.2	
Overweight	83	24.6	41	40.2	
Obesity	33	9.8	14	13.7	

intake of the university students in this study (Table 3).

The food groups chosen to compose each factor were those that presented a factor loading higher than 0.4, considering the highest saturation. From this perspective, dietary pattern 1 (predominantly *in*

Table 3
Distribution of the factor loadings for the four dietary patterns identified in the diet of university students in the COVID-19 social distancing period, Bahia, Brazil, 2020.

Foods/Food groups	Dietary intake patterns			
	Healthy pattern	Processed and ultra-processed pattern	Traditional Brazilian pattern	Anxiety pattern
Roots and tubers	0.723	–	–	–
Fruits	0.714	–	–	–
Greens	0.747	–	–	–
Olive oil	0.684	–	–	–
Sugar and sweets	–	0.489	–	–
Ready industrialized	–	0.749	–	–
Fats	–	0.733	–	–
Bread and cereals	–	0.565	–	–
Dairy products	–	0.592	–	–
Legumes	–	–	0.814	–
Meat and eggs	–	–	0.564	–
Coffee and tea	–	–	–	0.888
Eigenvalues	3.09	2.09	1.16	1.02
% explanation of the variance	25.78%	17.43%	9.72%	8.51%
% cumulative variance	25.78%	43.20%	52.93%	61.44%
Cronbach's alpha	0.60	0.66	0.51	0.30

natura pattern), composed of roots and tubers, fruits, greens, and olive oil, explained 25.78% of the variability in dietary intake. Dietary pattern 2 (pattern of processed and ultra-processed foods), characterized by sugar and sweets, industrialized products ready for consumption, fats, bread and refined cereals, and dairy products, explained 17.43% of the dietary intake. Dietary pattern 3 (protein-based pattern), composed of legumes, meat, and eggs, accounted for 9.72% of the students' intake, and dietary pattern 4 (infusion-based pattern), composed of coffee and tea, explained 8.51% of this intake (Table 3).

The highest factor score was for the coffee and tea group (0.888) and the lowest score was recorded in the sugar and sweets group. It was recorded that 35.5% of the explanation of the dietary intake of the sample studied is represented by dietary consumption patterns considered to be healthy (predominantly *in natura* pattern and protein-based pattern). Regarding the consistency of the dietary patterns extracted, homogeneity of the dietary patterns was observed (Cronbach's $\alpha > 0.5$), except for the infusion-based dietary pattern (0.3) (Table 3).

By comparing the means of the factor scores of the dietary patterns according to the sex variable, it was observed that the men had less adherence to patterns 1 and 2 and more adherence to pattern 3 compared to the group of women (Table 3).

Table 4 presents the gross odds ratios between dietary intake patterns and socioeconomic, demographic, educational, and nutritional variables of the university students during COVID-19 social distancing. It can be observed that the variables that present a positive and significant association with the predominantly *in natura* dietary pattern were marital status (OR 1.7; CI 95% 1.1–2.4), income (OR 2.8; CI 95% 1.7–4.7), age (OR 2.4; CI 95% 1.4–4.2, students not from the area of health (OR 1.8; CI 95% 1.3–2.4), and a negative association with engagement in physical activity (OR 0.5; CI 95% 0.3–0.6). The processed and ultra-processed dietary pattern was negatively associated with engagement in physical activity (OR 0.6; CI 95% 0.4–0.9) and sex (OR 0.7; CI 95% 0.4–0.9) and positively associated with a perceived change in weight (OR 1.8; CI 95% 1.2–2.6). Marital status (OR 0.5; CI 95% 0.3–0.8), income (OR 0.5; CI 95% 0.3–0.7) and engagement in physical activity (OR 0.7; CI 95% 0.5–0.9) were negatively associated with the protein-based dietary pattern. Regarding the infusion-based pattern it was identified that the type of course (OR 0.7; CI 95% 0.5–0.9) and university (OR 0.4; CI 95% 0.2–0.7) were negatively associated with this pattern.

The results of the multivariate analysis of the association between dietary intake patterns and associated factors are presented via the odds ratios and respective IC 95% (Table 5). It was observed that students having a darker skin colour (OR 1.8; CI 95% 1.3–2.6), 19–29 years old (OR 2.6; CI 95% 1.4–4.5), and not being students of health area courses (OR 1.5; CI 95% 1.1–2.1) were associated with less adherence to the predominantly *in natura* dietary pattern. Not engaging in physical activity was statistically associated with not adhering (OR 0.5; CI 95% 0.4–0.7) to that pattern (Table 5).

The university students who saw a change their weight in the social distancing period studied presented greater adherence to the processed and ultra-processed dietary pattern (OR 1.8; CI 95% 1.2–2.6), while the men (OR 0.7; CI 95% 0.4–0.9) and those that did not engage in physical activity (OR 0.7; CI 95% 0.5–0.9) presented less adherence to that pattern (Table 5).

Associated with less adherence to the protein-based dietary pattern were single individuals (OR 0.6; CI 95% 0.3–0.9) and those who did not engage in physical activity (OR 0.7; CI 95% 0.5–0.9). Regarding the infusion-based dietary pattern, it was observed that public university students presented less adherence to this pattern (OR 0.5; CI 95% 0.2–0.8).

4. Discussion

This study enabled heterogeneity to be identified in the dietary

Table 03

Gross odds ratio and respective IC 95% between dietary intake patterns in the COVID-19 social isolation period according to socioeconomic, demographic, educational, and nutritional variables of university students, Bahia, Brazil, 2020. (n = 955).

Variables	Descriptive n (%)	Predominantly <i>in natura</i> pattern OR (IC95%)	Processed and ultra-processed pattern OR (IC95%)	Protein-based pattern OR (IC95%)	Infusion-based pattern OR (IC95%)
Sex					
Male	220 (23.0)	1.4 (0.9–1.9)	0.7 (0.4–0.9)*	0.7 (0.5–1.0)	1.13 (0.8–1.6)**
Female	735 (77.0)	1	1	1	1
Marital status					
Single	804 (84.2)	1.7 (1.1–2.4)*	1.5 (0.9–2.3)	0.5 (0.3–0.8)*	0.9 (0.6–1.4)**
Married/stable union	151 (15.8)	1	1	1	1
Race					
Black and brown	686 (72.9)	1.8 (1.3–2.4)*	0.9 (0.6–1.2)	1.0 (0.8–1.5)**	0.7 (0.5–1.0)
White	269 (27.1)	1	1	1	1
Income					
<1 minimum wage	162 (17.0)	2.8 (1.7–4.7)*	0.9 (0.6–1.4)**	0.5 (0.3–0.7)*	0.7 (0.5–1.1)**
≥1 minimum wage	793 (83.0)	1	1	1	1
Age					
19–29 years old	831 (87.0)	2.4 (1.4–4.2)*	1.1 (0.7–1.7)**	1.0 (0.6–1.6)	0.9 (0.6–1.5)**
30 or more	124 (13.0)	1	1	1	1
University type					
Public	846 (88.6)	1.2 (0.8–2.0)	1.2 (0.7–1.9)	1.1 (0.7–1.8)**	0.4 (0.2–0.7)*
Private	109 (11.4)	1	1	1	1
Course					
Other courses	453 (47.4)	1.8 (1.3–2.4)*	1.0 (0.7–1.4)**	0.8 (0.6–1.0)	0.7 (0.5–0.9)*
Health	502 (52.6)	1	1	1	1
BMI during social isolation					
Overweight/obese	210 (47.8)	1.2 (0.8–1.8)**	1.0 (0.6–1.5)**	1.1 (0.7–1.7)**	1.3 (0.8–2.0)**
Eutrophic	229 (52.2)	1	1	1	1
Perception of weight					
Weight increased	709 (74.2)	1.0 (0.7–1.3)**	1.8 (1.2–2.6)*	1 (0.7–1.4)**	0.8 (0.6–1.2)**
No change/decrease	246 (25.8)	1	1	1	1
Physical activity					
Does not engage in it	362 (37.9)	0.5 (0.3–0.6)*	0.6 (0.4–0.9)*	0.7 (0.5–0.9)*	0.8 (0.6–1.1)
Engages in it	593 (62.1)	1	1	1	1

choices of university students during the first two months of COVID-19 social distancing, with four types of dietary intake patterns being identified: predominantly *in natura*, processed and ultra-processed, protein-based, and infusion-based. These patterns explained more than half of the variation in dietary intake, with the predominantly *in natura* dietary pattern, followed by the processed and ultra-processed dietary pattern, being the two most predominant ones in the sample. Variables such as sex, marital status, race/color, course, university type, physical activity, and weight were associated with different dietary behavior patterns. Highlighting the two main patterns, it was observed that the university students adhering most to the processed and ultra-processed pattern were those that presented the greatest weight gain and did not engage in physical activity when compared to those adhering to the predominantly *in natura* pattern, in which most of them were having a darker skin colour students and aged between 19 and 29. The predominantly *in natura* dietary pattern is considered healthy as it is composed of root vegetables and tubers, fruit, vegetables, and olive oil. This dietary pattern has nutritional characteristics of a Mediterranean dietary pattern (B. S. Maia, Melo, & Miranda, 2017), which involves nutrients such as important vitamins, minerals, and fibers in the metabolic process and contributes to enhancing human health (Martínez-González et al., 2015) and for that reason is recommended by the Dietary Guide for the Brazilian Population (Brasil. Ministério da Saúde., 2014; Monteiro et al., 2018). These benefits, combined with the guidelines from the WHO and nutritional experts to increase during quarantine the consumption of healthy foods that protect the immune system, for example fruit and vegetables (World Health Organization, 2020), may explain the adoption of a healthier dietary pattern in the current pandemic context.

It should be noted that the COVID-19 pandemic is an emerging event underway and so there is a lack of studies gauging the impact of the phenomenon on diet, it warrants noting that the results of the scientific literature on the group studied are still underdeveloped. A cross-sectional study using adults living in China identified higher consumption of foods that make up the healthy dietary pattern, composed of

vegetables, fruits, and cereals, while high-protein foods, such as fish and legumes, had intermediate consumption on the day before the research (Zhao et al., 2020). This was similar to in this study, which revealed greater adherence by the university students to the dietary pattern predominantly composed of *in natura* foods (pattern 1; variance 25.78%) and intermediate adherence to the protein-based dietary pattern (pattern 3, variance 9.72%). It also revealed generally inadequate dietary diversity among the Chinese residents studied during the COVID-19 pandemic.

However, when comparing these data with another cross-sectional study developed using university students from the same state in Brazil prior to the current pandemic context, it was also possible to observe greater evidence of the healthy dietary pattern among the university students (Pereira-Santos et al., 2016). Therefore, this finding may not be a specific characteristic of the course of the pandemic, but rather a peculiarity of the group studied. It is possible that in the social isolation period evaluated the students that already had a healthy dietary pattern maintained it.

These results are similar to the one identified in this study of adult university students, in which the most evident dietary pattern during social distancing was the healthy pattern composed of fruits, vegetables, legumes, roots, tubers, and olive oil, which are nutritional characteristics of a standard Mediterranean diet (B. S. Maia et al., 2017), involving important nutrients (vitamins, minerals, and fibers) in the metabolic process and contributing to enhanced human health (Martínez-González et al., 2015). These elements may be associated with the pandemic currently underway.

As this is a serious pandemic without precedents in the history of society and health, with uncertainties about the medicinal treatments to control the disease, diet has been gaining visibility and importance as it is an element that contributes to protecting human health (World Health Organization, 2020) and this may be one of the reasons that have induced university students to adhere to a predominantly healthy dietary pattern.

Table 4
Adjusted OR with respective IC95% between dietary intake patterns of university students in the social isolation period and associated factors, Bahia, Brazil, 2020. (n = 955).

Variables	Predominantly in natura pattern	Processed and ultra-processed pattern	Protein-based pattern	Infusion-based pattern
	Adjusted OR (IC 95%)	Adjusted OR (IC 95%)	Adjusted OR (IC 95%)	Adjusted OR (IC 95%)
Sex				
Male	1.4 (0.9–2.0)	0.7 (0.4–0.9) ^a	0.8 (0.5–1.0)	^b
Female	1	1	1	
Marital status				
Single	1.5 (0.9–2.1)	1.6 (1.0–2.5)	0.6 (0.3–0.9) ^a	^b
Married/civil union	1	1	1	
Race				
Black and brown	1.8 (1.3–2.6) ^a	0.9 (0.6–1.2)	^b	0.8 (0.6–1.0)
White	1	1		1
Age				
19–29 years old	2.6 (1.4–4.5) ^a	^b	1.2 (0.7–1.8)	^b
30 or more	1		1	
University type				
Public	1.0 (0.6–1.7)	1.3 (0.8–2.1)	^b	0.5 (0.2–0.8) ^a
Private	1	1		1
Course				
Other courses	1.5 (1.1–2.1) ^a	^b	0.9 (0.6–1.2)	0.8 (0.6–1.0)
Health	1		1	1
Perception of weight				
Increased/decreased	^b	1.8 (1.2–2.6) ^a	^b	^b
No alteration				
Physical activity				
Does not engage in it	0.5 (0.4–0.7) ^a	0.7 (0.5–0.9) ^a	0.7 (0.5–0.9) ^a	0.8 (0.6–1.1)
Engages in it	1	1	1	1

^a Statistically significant.

^b Variables not included in the adjustment of each model as they did not have a p value in the gross analysis ≤0.2.

In parallel to the healthy dietary intake, adherence to a non-healthy dietary pattern was also observed in this population, characterized by processed and ultra-processed foods, which are sources of fat, salt, simple carbohydrates, dyes, and acidulants (Monteiro et al., 2018). The adherence to this pattern may be related to various factors, including the effects of the phenomenon of the nutritional transition of the Brazilian population, with repercussions in the dietary habits of university students (M. Santana, Alves de Oliveira Queiroz, Monteiro Brito, Barbosa Dos Santos, & Marluccia Oliveira Assis, 2015), before the pandemic, as well as elements of the pandemic currently underway.

Studies developed before the pandemic using university students from other countries reveal the presence of dietary patterns composed of processed and ultra-processed foods that are unhealthy and seen as imprudent (Sprake et al., 2018; Tanton, Dodd, Woodfield, & Mabhalala, 2015). A universal dietary profile is recorded in this group studied.

In this study, the dietary pattern also differed by sex, with the processed and ultra-processed dietary pattern being more evident among women. In the social isolation period, a previous observational study carried out using Australian university students recorded that this group presented modifications in its dietary intake pattern, with a greater

increase in total energy intake and in the frequency and density of snacks consumed, which led to an increase of around 20% in the quantity of energy consumed in relation to pre-pandemic periods (Gallo et al., 2020). These results corroborate the findings of this research.

It was also identified in this study that the students whose weight increased in this period presented greater adherence to the processed and ultra-processed pattern. As it contains foods with a greater calorie density and lower level of nutrients, this pattern is related with weight gain. Data from a study conducted using university students in the United Kingdom show a positive correlation between this dietary pattern and energy intake, contributing to a positive increase in energy balance and consequent weight gain (Sprake et al., 2018), besides being a risk to the health of the population due to its low-quality nutritional content (Vale et al., 2019).

In a perspective paper on the closure of classes due to COVID-19 and impacts on diet, Rundle, Park, Herbstman, Kinsey, & Wang (2020) highlight the concern about weight gain and mention as an explanation the increase in purchases of ultra-processed comfort foods with a high calorie content due to stress and boredom (Rundle et al., 2020). Research by Nielsen (2020) presents current food purchasing trends that indicate that families are stocking up on long-lasting ultra-processed comfort foods with a high energy density, such as chips, popcorn, chocolate, ice-cream, and alcohol. The results of this research corroborate with the trends and perspectives presented by the authors + with data on greater consumption of processed and ultra-processed foods explained by people's anxiety and anguish about the pandemic context evaluated (30.5%).

In fact, weight gain was an outcome of the pandemic reported by other authors in various parts of the world and in various populations (Bhutani & Cooper, 2020; Pellegrini et al., 2020; Rundle et al., 2020).

In this context, attention should be paid to the risk of small changes in body weight in relatively short periods becoming permanent and contributing to substantial weight gain in the long term (Schoeller, 2014). Thus, it is important for research to evaluate weight gain among populations in the period of changes in routines caused by COVID-19, identifying and discussing factors that may have contributed to this increased weight gain among the population, especially because excess weight is a risk factor for COVID-19 and is associated with greater severity and negative outcomes (Wu & McGoogan, 2020). And it was observed in this research that in two months of social distancing the prevalence of being overweight and obese among university students increased by 5% and 3%, respectively.

In a retrospective cohort study during the current pandemic, there was a high observed prevalence of obesity (47.5%) in patients hospitalized for COVID-19. Moreover, it was noted that obesity was associated with the admission of those patients into intensive care units (ICUs) and a greater need for invasive mechanical ventilation in this group (Kalligeros et al., 2020).

In Italy, a study conducted using patients in a critical state due to infection by COVID-19 revealed that 88% of them were overweight or obese (Piva et al., 2020). This again confirms being overweight or obese as a risk factor for deterioration due to infection by this new virus.

Being overweight or obese are outcomes that were present in the global population prior to current pandemic. According to the World Health Organization, in 2016 around 39% of adults in the whole world were overweight and 13% were obese. The main influencers for this scenario are an unbalanced diet and inactivity (World Health Organization, 2020). It is noted that in this study, in the social isolation period an unbalanced diet and inactivity were present in the daily lives of the students.

The unbalanced diet in this social isolation period may be associated with access to food. From this perspective, Zhao et al. (2020) observed less dietary diversity among people who live in areas with a high number of confirmed cases of COVID-19 in China, demonstrating some effect of the quarantine regimes. They also identified a mixed diet among their population, ranging from the consumption of healthy foods such as

fruits, vegetables, and legumes to high consumption of snacks and non-healthy foods such as refined cereals and sweets. The high consumption of these latter food groups is worrying, as it is associated with the occurrence of higher body weight during the quarantine period (Zhao et al., 2020), which may affect health in subsequent life cycles.

The protein-based dietary pattern composed of foods that are sources of vegetable and animal proteins (legumes, meats, and eggs) revealed in this study was associated with the university students who did not engage in physical activity during the social distancing period. This piece of data may be associated with the pandemic context underway, as studies from before the pandemic reveal that individuals who engage in physical activity adhere more to a more protein-based dietary pattern associated with muscle hypertrophy, which is very common among those who engage in physical activity (Tinline-Goodfellow, West, Malowany, Gillen, & Moore, 2020). The reason for this finding is that the engagement in physical activity variable investigated in this study is only related to the pandemic period. Thus, the individuals who engaged in physical activity before the pandemic and are not doing so at the moment may be maintaining the habit of consuming more protein-based foods. When evaluating the diet of the group studied in this pandemic period in general, a mixed diet composed of healthy and unhealthy foods is observed with some modifications in dietary pattern. Results of epidemiological studies with participations from Spain, Italy, Brazil, Colombia, Chile, and East Asia have revealed dietary modifications during COVID-19 confinement (Husain & Ashkanani, 2020; Ruiz-Roso et al., 2020). In particular, there was a recorded increase in the consumption of fried foods, sweets, fruits, and vegetables (Zhao et al., 2020) and greater adherence to the Mediterranean diet (Ruiz-Roso et al., 2020), similar to the dietary pattern highlighted in this study. The greater availability of time during the pandemic for the subjects to prepare food at home, reviving a culture of culinary practices (Di Renzo et al., 2020), associated with the guidance of the WHO and of nutrition professionals to consume more healthy foods that protect the immune system, for example fruits and vegetables (World Health Organization, 2020), may explain the adoption of a healthier dietary pattern.

Our results confirm previous studies by identifying that the students increased their fractioning and volume of meals. This is because quarantine can lead to a higher frequency of irregular meals and snacks due to boredom and stress (Ruiz-Roso et al., 2020; Wang et al., 2020). Within this context, the preference for fried foods and sweets increases considerably (Ruiz-Roso et al., 2020; Zhao et al., 2020). The increase in BMI has also been associated with lower consumption of vegetables, fruits, and legumes and greater adherence to meat, dairy, and fast food (Sidor & Rzymiski, 2020). As a result, there is an increase in calorie intake, associated with physical inactivity and, consequently, weight gain, as reported by the university students in this research and in other studies (Ruiz-Roso et al., 2020; Zhao et al., 2020).

With regards to the students' dietary pattern according to sex, the women presented greater adherence to dietary patterns 1 (healthy) and 2 (processed and ultra-processed), which are characteristics of a mixed dietary routine. The greater adherence to the healthy dietary pattern may be associated with the women's greater concern about taking care of their health compared to the men. Women show greater interest in attitudes related to promoting health and preventing diseases, seeking information that helps in choosing better foods (Irl, Evert, Fleming, Gaudiani, & GuggenmosKaufert, Martinez, 2019), as well as presenting healthier culinary practices (Milte, Ball, Crawford, & McNaughton, 2019).

In parallel to this discussion, it is noted that social isolation may also be a factor that contributes to an increase in the multi-tasking that women usually carry out in the family, social, and professional environment. From this perspective, the increase in demands, especially domestic ones, in some cases added to remote studying and the known implications of confinement, such as boredom, social isolation, stress, and lost sleep, as well as the emotional consequences such as anxiety, post-traumatic stress disorder, and depression (Mengin et al., 2020),

appear to be potential triggers for an emotional diet (Kontinen, van-Strien, Männistö, Jousilahti, & Haukkala, 2019). This is a condition in which foods with a high sensorial appeal seem to be most attractive, and these characterize the second dietary pattern very well, consisting of processed and ultra-processed foods, which also had greater adherence on the part of the women.

A study conducted during the peak of social isolation in Italy revealed that women were more anxious and likely to seek comfort in food than men (Di Renzo et al., 2020). This study reveals the tendency women present to use food to cope with their emotions.

The men in this study, in turn, presented greater adherence to pattern 3 (traditional Brazilian), characterized by a group of protein-rich foods of vegetable and animal origin. The greater adherence of the male students to this pattern may be related with their higher protein intake and muscle hypertrophy, which are very common among those who engage in physical activity (Tinline-Goodfellow et al., 2020).

In this research, the results record that, proportionally, the male sex maintained greater interest in engaging in physical activity even during the social isolation period, which seems to positively influence their greater interest in protein-rich foods.

From this perspective, this study reveals that the university students in social isolation react in two ways with regards to diet in the face of the uncertain phenomenon of the pandemic currently underway in Brazil and around the world. The first involves greater adherence to healthy dietary practices and nutritional quality, which are considered protective for the health of this population when faced with COVID-19. The other dietary scenario identified is the adoption of dietary patterns composed of processed and ultra-processed foods with a high calorie content, low nutritional level, and increased food volume and frequency, which are considered risk factors that immediately affect the student's health or may have a negative effect in subsequent life cycles.

4.1. Study limitations

This study presents some limitations. The first relates to the web survey methodology, used due to its convenience and health safety during the pandemic. There is no pre-test of self-reporting efficiency of the instrument used online. However, most of the research participants were young and highly educated. On the other hand, the instrument used was self-applied in person among nutrition students in 2015 (Pereira-Santos et al., 2016), which may minimize the presence of bias in our results. Weight and height were self-reported, but this procedure is already validated for the Brazilian population (Moreira et al., 2018). It is also recognized that due to the study design it was not possible to obtain dietary intake measures from before and during the pandemic, observing the effect of quarantine on the modification of the dietary patterns. However, this is the first study to evaluate the dietary pattern of adults during the COVID-19 pandemic in Brazil and it is important for supporting nutritional interventions and guidance for the public in question.

Finally, during social isolation four dietary intake patterns were observed, with the two most prevalent containing healthy and unhealthy foods. Adherence to this pattern was different depending on the demographic, social, and lifestyle characteristics of the university students. The processed and ultra-processed dietary pattern identified was revealed to be associated with excess weight in the university students in this period and for that reason it stands out as a risk factor, as being overweight or obese are risk factors for more severe complications from COVID-19 and for non-transmittable chronic illnesses in previous life cycles. Thus, actions to promote a healthy diet and physical activity should be considered with the aim of contributing to the health of university students.

Author contributions

Santana JMS and Santos C contributed to the conception of the

project, analysis and interpretation of the data, and elaboration and critical review of the article. Brazil JM and Pereira-Santos M participated in the analysis, interpretation of the data, and elaboration and critical review of the article. Lima ER and Milagres MP contributed to the conception of the project and critical review of the article.

Declaration of competing interests

The authors declare no conflicts of interest.

Ethical criteria

This research followed the ethical principles of the Helsinki Declaration and those described in Resolution n. 466/12 of the Brazilian National Health Council (Opinion n. 4,074,053). The data collection only began after authorization by the Ethics Committee of the State University of the Southeast of Bahia. The research participants took part voluntarily, after signing an informed consent form.

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Ethical statement

Approved by the Research Ethics Committee of the State University of Southwest Bahia (Case Number: 4.074.053).

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References

- Bhutani, S., & Cooper, J. A. (2020). COVID-19 related home confinement in adults: Weight gain risks and opportunities. *Obesity*, 28(9), 1576–1577. <https://doi.org/10.1002/oby.22904>
- Brasil. Ministério da Saúde. (2021). *Painel de casos de doença pelo coronavírus 2019 (COVID-19) no Brasil [Internet]*. Brazil. Coronavírus Brasil. Brasília: Ministério da Saúde. <https://covid.saude.gov.br/>.
- Brooks, S. K., Webster, R. K., Smith, L. E., Woodland, L., Wessely, S., Greenberg, N., et al. (2020). The psychological impact of quarantine and how to reduce it: Rapid review of the evidence. *Lancet (London, England)*, 395(10227), 912–920. [https://doi.org/10.1016/S0140-6736\(20\)30460-8](https://doi.org/10.1016/S0140-6736(20)30460-8)
- Coelho, N., de, L. P., Cunha, D. B., Esteves, A. P. P., Lacerda, E. M., de, A., et al. (2015). Dietary patterns in pregnancy and birth weight. *Revista de Saúde Pública*, 49(62), 1–10. <https://doi.org/10.1590/S0034-8910.2015049005403>
- Di Renzo, L., Gualtieri, P., Cinelli, G., Bigioni, G., Soldati, L., Attina, A., et al. (2020). Psychological aspects and eating habits during COVID-19 home confinement: Results of EHLCOVID-19 Italian online survey. *Nutrients*, 12(7). <https://doi.org/10.3390/nu12072152>
- Gallo, L. A., Gallo, T. F., Young, S. L., Moritz, K. M., & Akison, L. K. (2020). The impact of isolation measures due to COVID-19 on energy intake and physical activity levels in Australian university students. *Nutrients*, 12(6). <https://doi.org/10.3390/nu12061865>
- Hagedorn, R. L., & Olfert, M. D. (2018). Food insecurity and behavioral characteristics for academic success in young adults attending an Appalachian university. *Nutrients*, 10(3). <https://doi.org/10.3390/nu10030361>
- Husain, W., & Ashkanani, F. (2020). Does COVID-19 change dietary habits and lifestyle behaviours in Kuwait?. <https://doi.org/10.20944/PREPRINTS202006.0154.V1>
- Irl, B. H., Evert, A., Fleming, A., Gaudiani, L., Guggenmos, M., et al. (2019). Culinary medicine: Advancing a framework for healthier eating to improve chronic disease management and prevention. *Clinical Therapeutics*, 41(10), 2184–2198. <https://doi.org/10.1016/j.clinthera.2019.08.009>
- Kalligeros, M., Shehadeh, F., Mylona, E. K., Benitez, G., Beckwith, C. G., Chan, P. A., et al. (2020). Association of obesity with disease severity among patients with coronavirus disease 2019. *Obesity*, 28(7), 1200–1204. <https://doi.org/10.1002/oby.22859>
- Kerr, L., Kendall, C., da Silva, A. A. M., Aquino, E. M. L., Pescarini, J. M., de Almeida, R. L. F., et al. (2020). COVID-19 in northeast Brazil: Achievements and limitations in the responses of the state governments. *Ciência & Saúde Coletiva*, 25, 4099–4120. <https://doi.org/10.1590/1413-812320202510.2.28642020>
- Konttinen, H., van Strien, T., Männistö, S., Jousilahti, P., & Haukka, A. (2019). Depression, emotional eating and long-term weight changes: A population-based prospective study. *International Journal of Behavioral Nutrition and Physical Activity*, 16(1), 28. <https://doi.org/10.1186/s12966-019-0791-8>
- Lu, R., Zhao, X., Li, J., Niu, P., Yang, B., Wu, H., et al. (2020). Genomic characterisation and epidemiology of 2019 novel coronavirus: Implications for virus origins and receptor binding. *Lancet (London, England)*, 395(10224), 565–574. [https://doi.org/10.1016/S0140-6736\(20\)30251-8](https://doi.org/10.1016/S0140-6736(20)30251-8)
- Magno, L., Rossi, T. A., de Mendonça-Lima, F. W., dos Santos, C. C., Campos, G. B., Marques, L. M., et al. (2020). Challenges and proposals for scaling up COVID-19 testing and diagnosis in Brazil. *Ciência & Saúde Coletiva*, 25, 3355–3364. <https://doi.org/10.1590/1413-81232020259.17812020>
- Maia, B. R., & Dias, P. C. (2020). Anxiety, depression and stress in university students: The impact of COVID-19. *Estudos de Psicologia (Campinas)*, 37. Retrieved from http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0103-166X2020000100504&nrm=iso.
- Maia, B. S., Melo, F. R. de, & Miranda, P. (2017). The mediterranean diet: Is it worth it? *Revista Portuguesa de Medicina Geral e Familiar*, 33, 76–78. Retrieved from http://www.scielo.mec.pt/scielo.php?script=sci_arttext&pid=S2182-51732017000100011&nrm=iso.
- Mantau, A., Hattula, S., & Bornemann, T. (2018). Individual determinants of emotional eating: A simultaneous investigation. *Appetite*, 130, 93–103. <https://doi.org/10.1016/j.appet.2018.07.015>
- Martínez-González, M. A., Salas-Salvadó, J., Estruch, R., Corella, D., Fitó, M., & Ros, E. (2015). Benefits of the mediterranean diet: Insights from the PREDIMED study. *Progress in Cardiovascular Diseases*, 58(1), 50–60. <https://doi.org/10.1016/j.pcad.2015.04.003>
- Mengin, A., Allé, M. C., Rolling, J., Ligier, F., Schroder, C., Lalanne, L., et al. (2020). Conséquences psychopathologiques du confinement. *L'Encéphale*, 46(3), S43–S52. <https://doi.org/10.1016/j.j.encep.2020.04.007>
- Milte, C. M., Ball, K., Crawford, D., & McNaughton, S. A. (2019). Diet quality and cognitive function in mid-aged and older men and women. *BMC Geriatrics*, 19(1), 361. <https://doi.org/10.1186/s12877-019-1326-5>
- Ministério da Saúde, B. (2014). Guia Alimentar para a População Brasileira Guia Alimentar para a População Brasileira. *Ministério da Saúde*, (2 ed), 156p. <https://doi.org/10.1038/srep21871>
- Monteiro, C. A., Cannon, G., Moubarac, J.-C., Levy, R. B., Louzada, M. L. C., & Jaime, P. C. (2018). The UN Decade of Nutrition, the NOVA food classification and the trouble with ultra-processing. *Public Health Nutrition*, 21(1), 5–17. <https://doi.org/10.1017/S13688980017000234>
- Moreira, N. F., Luz, V. G., Moreira, C. C., Pereira, R. A., Sichieri, R., Ferreira, M. G., et al. (2018). Self-reported weight and height are valid measures to determine weight status: Results from the Brazilian National Health Survey (PNS 2013). *Cadernos de Saúde Pública*, 34, Article e00063917. <https://doi.org/10.1590/0102-311x00063917>
- Owens, M. R., Brito-Silva, F., Kirkland, T., Moore, C. E., Davis, K. E., Patterson, M. A., et al. (2020). Prevalence and social determinants of food insecurity among college students during the COVID-19 pandemic. *Nutrients*, 12(9). <https://doi.org/10.3390/nu12092515>
- Pellegrini, M., Ponzio, V., Rosato, R., Scumaci, E., Goitre, I., Benso, A., et al. (2020). Changes in weight and nutritional habits in adults with obesity during the “lockdown” period caused by the COVID-19 virus emergency. *Nutrients*, 12(7). <https://doi.org/10.3390/nu12072016>
- Pereira-Santos, M., da Mota Santana, J., Neves de Carvalho, A. C., & Freitas, F. (2016). Dietary patterns among nutrition students at a public university in Brazil. *Revista Chilena de Nutrición*, 43(1). <https://doi.org/10.4067/S0717-75182016000100006>
- Piva, S., Filippini, M., Turla, F., Cattaneo, S., Margola, A., De Fulvisi, S., et al. (2020). Clinical presentation and initial management critically ill patients with severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection in Brescia, Italy. *Journal of Critical Care*, 58, 29–33. <https://doi.org/10.1016/j.jcrc.2020.04.004>
- Ruiz-Roso, M. B., de Carvalho Padilha, P., Mantilla-Escalante, D. C., Ulloa, N., Brun, P., Acevedo-Correa, D., et al. (2020). Covid-19 confinement and changes of adolescent's dietary trends in Italy, Spain, Chile, Colombia and Brazil. *Nutrients*, 12(6). <https://doi.org/10.3390/nu12061807>
- Rundle, A. G., Park, Y., Herbstman, J. B., Kinsey, E. W., & Wang, Y. C. (2020). COVID-19-Related school closings and risk of weight gain among children. *Obesity*, 28(6), 1008–1009. <https://doi.org/10.1002/oby.22813>
- Santana, M. J., Alves de Oliveira Queiroz, V., Monteiro Brito, S., Barbosa Dos Santos, D., & Marluca Oliveira Assis, A. (2015). Food consumption patterns during pregnancy: A longitudinal study in a region of the North East of Brazil. *Nutricion Hospitalaria*, 32 (n01), 130–138. <https://doi.org/10.3305/nh.2015.32.1.8970>
- Schoeller, D. A. (2014). The effect of holiday weight gain on body weight. *Physiology & Behavior*, 134, 66–69. <https://doi.org/10.1016/j.physbeh.2014.03.018>
- Sidor, A., & Rzymiski, P. (2020). Dietary choices and habits during COVID-19 lockdown: Experience from Poland. *Nutrients*, 12(6). <https://doi.org/10.3390/nu12061657>
- Sprake, E. F., Russell, J. M., Cecil, J. E., Cooper, R. J., Grabowski, P., Pourshahidi, L. K., et al. (2018). Dietary patterns of university students in the UK: A cross-sectional study. *Nutrition Journal*, 17(1), 90. <https://doi.org/10.1186/s12937-018-0398-y>
- Tanton, J., Dodd, L. J., Woodfield, L., & Mahbala, M. (2015). Eating behaviours of British university students: A cluster analysis on a neglected issue. *Advances in Preventive Medicine*, 2015, 639239. <https://doi.org/10.1155/2015/639239>
- Tinlin-Goodfellow, C. T., West, D. W. D., Malowany, J. M., Gillen, J. B., & Moore, D. R. (2020). An acute reduction in habitual protein intake attenuates post exercise anabolism and may bias oxidation-derived protein requirements in resistance trained men. *Frontiers in Nutrition*, 7(55). <https://doi.org/10.3389/fnut.2020.00055>
- Vale, D., Morais, C. M. M., de Pedrosa, L., de, F. C., Ferreira, M. A. F., Oliveira, A. G. R., et al. (2019). Spatial correlation between excess weight, purchase of ultra-processed

- foods, and human development in Brazil. *Ciência & Saúde Coletiva*, 24(3), 983–996. <https://doi.org/10.1590/1413-81232018243.35182016>
- Wang, C., Pan, R., Wan, X., Tan, Y., Xu, L., Ho, C. S., et al. (2020). Immediate psychological responses and associated factors during the initial stage of the 2019 coronavirus disease (COVID-19) epidemic among the general population in China. *International Journal of Environmental Research and Public Health*, 17(5). <https://doi.org/10.3390/ijerph17051729>
- WHO. (2000). Consultation on obesity (1999): Geneva S., & organization W. H. In *Obesity :: Preventing and managing the global epidemic : Report of a WHO consultation TT - Obésité : prévention et prise en charge de l' épidémie mondiale : Rapport d' une consultation de l' OMS*. W.H.O. tech. rep. ser. <https://apps.who.int/iris/handle/10665/42330>.
- World Health Organization. (2020). Food and nutrition tips during self-quarantine. August 4, from <https://www.euro.who.int/en/health-topics/health-emergencies/coronavirus-covid-19/technical-guidance/food-and-nutrition-tips-during-self-quarantine>.
- World Health Organization. (March 2020). (n.d.). WHO Director-General's opening remarks at the media briefing on COVID-19-11. <https://www.who.int/dg/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19-11-march-2020>. (Accessed 4 August 2020).
- Wu, Z., & McGoogan, J. M. (2020). Characteristics of and important lessons from the coronavirus disease 2019 (COVID-19) outbreak in China: Summary of a report of 72 314 cases from the Chinese center for disease control and prevention. *Journal of the American Medical Association*, 323(13), 1239–1242. <https://doi.org/10.1001/jama.2020.2648>
- Zhao, A., Li, Z., Ke, Y., Huo, S., Ma, Y., Zhang, Y., et al. (2020). Dietary diversity among Chinese residents during the COVID-19 outbreak and its associated factors. *Nutrients*, 12(6), 1699. <https://doi.org/10.3390/nu12061699>