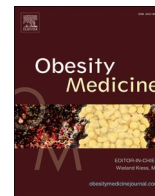ELSEVIER

Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Food consumption changes among teachers during the COVID-19 pandemic

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ABSTRACT

The present study aimed to analyze changes in food consumption among teachers of state schools in Minas Gerais in the context of the pandemic of coronavirus disease 2019 (COVID-19). This is a cross-sectional study of teachers at elementary, middle, and high schools in Minas Gerais. An online questionnaire was made available to all participants through the Google Forms platform. For the analysis, sociodemographic, economic, occupational profile, health conditions, and behavioral/habitual variables were used. Food consumption was assessed through the weekly frequency of eating foods considered healthy and unhealthy before and during the pandemic. The changes observed in the frequency were classified as: decreased intake, no change in intake, and increased intake during the pandemic. Statistical analysis was performed using bivariate and multiple analysis using the Multinomial Logistics Regression model. The data were tabulated with the aid of the Statistical Package for Social Sciences (SPSS), version 18.0. A total of 15,641 teachers participated in this study, with an average age of 42.96 (±9.27) years, and most of them were female (81.9%). During the pandemic, approximately 40% reported altered sleep quality and alcohol consumption, and lack of physical activity with 60.4% of the professionals categorized as overweight. During this period, there was an increase in the consumption of sweets (19.5%), soft drinks (13.3%), sausages (12.0%), frozen foods (8.9%), salty foods (6.3%), vegetables (13.1%), fruits (12.6%), and wholegrain products (8.3%). In the regression analysis, several factors were found to be associated with changes in teachers' food consumption in a bidirectional way when associated with variables related to sociodemographic characteristics, occupational profile, general health, and lifestyle.

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1. Introduction

The coronavirus disease 2019 (COVID-19) is a highly infectious disease caused by SARS-CoV-2 (severe acute respiratory syndrome coronavirus 2), and its first occurrence was reported in China in December 2019 (Ye et al., 2020). Due to its worldwide spread, the World Health Organization (WHO) declared COVID-19 as a global pandemic (WHO, 2020). In January 2021, Brazil ranked third in the number of cases observed worldwide and second with respect to number of deaths (Hallal, 2021). For stemming the spread of the infection, interventions have been imposed by governments. These include restrictive measures of circulation and social agglomeration with the closing of schools, universities, events, and any service considered non-essential (Garcia and Duarte, 2020; Martinez-Ferran et al., 2020).

Prevention measures with social restrictions were essential to minimize infection rates, but they can also effect changes in the population's lifestyle (Ammar et al., 2020). Among the behavioral changes, there were changes in eating habits (Di Renzo et al., 2020; Malta et al., 2020; Fiocruz, 2020; Kriaucioniene et al., 2020; Sánchez-Sánchez et al., 2020; Błaszczyk-Bębenek et al., 2020; Sidor and Rzymski, 2020; Steele et al., 2020; Scarmozzino and Visioli, 2020). The published studies, so far, have evidenced the impact of the pandemic on eating behaviors, manifested by the increase in the consumption of "unhealthy" foods such as alcoholic beverages, snacks, and sweets and the reduction in the practice of physical activity (Sánchez-Sánchez et al., 2020). However, other studies have identified an increase in the consumption of healthy foods, especially vegetables, fruits, legumes, fish, and eggs (Steele et al., 2020; Pérez-Rodrigo et al., 2020).

The increase in the frequency of risky eating behaviors is worrying and can result in damage to health, such as an increase in the occurrence of chronic non-communicable diseases (Steele et al., 2020). In Brazil, chronic non-communicable diseases are among the leading causes of hospital admissions generating increasing impacts on the direct costs for the Health System (BRASIL, 2011). It is also necessary to consider that most comorbidities were associated with the worsening of the clinical condition and an increased risk of mortality of COVID-19 patients (Williamson et al., 2020; Emami et al., 2021; Naeini et al., 2021).

In addition to this context, one of the most significant challenges ever faced by education systems was observed, where many governments enforced the interruption of face-to-face teaching in favor of the implementation of virtual education (Daniel, 2020). The need for prompt support and professional development for teachers globally required a critical skill set to realign from face-to-face to emergency remote teaching. The teachers, already shaken by the pandemic, included in their teaching practice the ability to teach outside the physical classrooms (Abaci et al., 2020).

Teaching is a profession with different levels of work-related stress (Agai-Demjaha et al., 2015) and may have consequences on occupational health and quality of life, among other aspects, due to negative behaviors in the diet and practice of insufficient physical activity (Sanchez et al., 2019). There is limited evidence to assess the effect of the blocks and restrictions linked to the COVID-19 pandemic on changes in dietary behaviors among teachers. Therefore, the present study aimed to analyze changes in food consumption among teachers from state schools in Minas Gerais in the context of the COVID-19 pandemic.

2. Methods

This study is part of the Projeto ProfSMoc – Etapa Minas Covid "Health and work conditions among teachers in the state education system in the state of Minas Gerais in the COVID-19 pandemic." This is an epidemiological, cross-sectional, and analytical study of teachers at elementary schools, middle schools, and high schools from state public schools of Minas Gerais, Brazil. Minas Gerais comprises approximately 90,000 teachers who work at schools that provide services from the elementary to high school levels (data provided by the Minas Gerais

State Department of Education - SEE-MG), working in 3441 state public schools.

For sample calculation, a reasoned formula was used for an infinite population, considering a prevalence of 50% and the tolerable error of 3%. Additionally, the sample was doubled (Deff = 2) because it came from conglomerates. Further, a 20% increase was made in the sample size to compensate for possible losses (non-response rate) that could compromise the study's validity. Thus, it was estimated that there was a need to collect data from 2564 teachers from the state schools in Minas Gerais to ensure inclusive representation.

Access to the list of state schools and teachers present in the state was made available by the Minas Gerais State Department of Education. This made it possible to identify the total number of teachers and their distribution according to the Regional Teaching Superintendence (SRE) to which the teachers were affiliated. Thus, the minimum numbers necessary to ensure representativeness in each of the 45 Regional Teaching Superintendence have been achieved.

The study included teachers in the exercise of the teaching function in 2020, those working in early childhood education, elementary education, and/or high school (linked to some state public schools in Minas Gerais) and those who agreed to participate in the study. Teachers who were not currently practicing their profession, retirees, and those who answered "no" when asked if they agreed to participate in the study were not included.

2.1. Ethical aspects of research

In all stages of this study, the ethical precepts determined by Resolution No. 466 were followed in accordance with the approval of the Research Ethics Committee Involving Human Beings at the State University of Montes Claros - UNIMONTES, upon substantiated opinion no. 4,200,389/2020 and conducted with authorization from the State Education Secretariat of Minas Gerais.

2.2. Data collection

For data collection, a partnership was initially made with the Minas Gerais State Department of Education, where authorizations were obtained to carry out the study. A standardized online questionnaire was used, made available to all participants through the Google Forms platform. This consisted of questions about the sociodemographic and economic profiles, occupational profile, health conditions during the pandemic, and behaviors/habits during the pandemic.

For this study, the variables evaluated were: 1) *Sociodemographic and economic profile*, which was evaluated considering the following variables: age (in years: ≤40; > 40), sex (female; male), skin color (white; non-white), living with a partner (yes; no) and family income (considering the current minimum wage of R $ 1045.00 at the time of data collection: 1 to 2 minimum wage; 3 to 5 minimum wage; >6 minimum wage). 2) *Occupational profile*, evaluated by teaching hours per week (2–10; 11 to 39; 40 or more). 3) *Health conditions during the pandemic*, which were assessed according to the presence of diseases such as hypertension, diabetes, heart disease, and respiratory diseases (yes; no), adhered to social isolation (yes; no), and whether the pandemic affected the quality of life, including sleep (no; yes). 4) *Behaviors/Habits during the pandemic*, which were assessed according to: alcohol consumption during the pandemic (no; yes); if the participant currently smoked (no; yes); if the participant was doing physical activity during the pandemic (yes; no), overweight (no; yes) and food consumption (days a week).

Food consumption was assessed using groups of foods considered healthy (raw or cooked vegetables/fruits, beans, and whole foods) and unhealthy (sausage, frozen foods, "packaged" snacks, sweets, soft drinks, and/or artificial juice). This instrument aims to identify the weekly frequency of consumption of some foods and/or drinks that are related to both a healthy and an unhealthy diet, in the seven days before the interview, with the answer options: never/almost never, 1/2 times a

week, 3/4 times a week, and 5/6 times a week or every day of the week.

The percentage of change in food group consumption was estimated based on answers to the questions. These included: "BEFORE the pandemic; how many days of the week did you use to eat [the particular food group]?" "DURING the pandemic, how many days of the week do you usually eat [the particular food group]?" The changes observed in the frequency were used to determinate three consumption patterns:

(-1) decreased intake during the pandemic;
(0) never consumed before and during the pandemic; no changes in intake;
(1) increased intake during the pandemic.

From the self-reported data of weight and height, the Body Mass Index (BMI) was calculated, obtained through the calculation: current weight in kilograms divided by the height in centimeters squared [PA/(A^2)] and classified by the parameters made available by the WHO: <18.5 (low weight), 18.5 to 24.9 (normal weight), ≥25 overweight (WHO, 2000). Overweight and obese participants were included in the "overweight" variable.

The link to this survey was released by the Minas Gerais State Department of Education on its social networks and sent to all Regional Teaching Superintendencies (SRE). At the beginning of the digital form, participants were presented with the Free and Informed Consent Form and a question on the consent to participate in the research. The automatic filling was avoided through the reCAPTCHA system.

2.3. Statistical analysis

A descriptive analysis of the investigated variables was carried out through their frequency distributions and expressed in percentage (%) and absolute (n). Then, bivariate analyses were performed between the outcome variables and each independent variable. The gross Odds Ratio (OR) was estimated, with their respective 95% confidence intervals. The variables that presented a descriptive level (p-value) below 0.20 were selected for multiple analysis, in which the Multinomial Logistics Regression model was adopted. A theoretical model was used for the multiple models, as shown in Fig. 1. In the analysis of the fit quality of the multiple models, the Deviance test was used. The data were tabulated and analyzed using the Statistical Package for Social Sciences (SPSS), version 18.0.

3. Results

A total of 15,641 teachers participated in this study, with an average age of 42.96 (±9.27) years, working in 795 different municipalities in Minas Gerais. Most participants were female (81.9%), non-white race/skin color (51.2%), monthly income being categorized as 3–5 on the
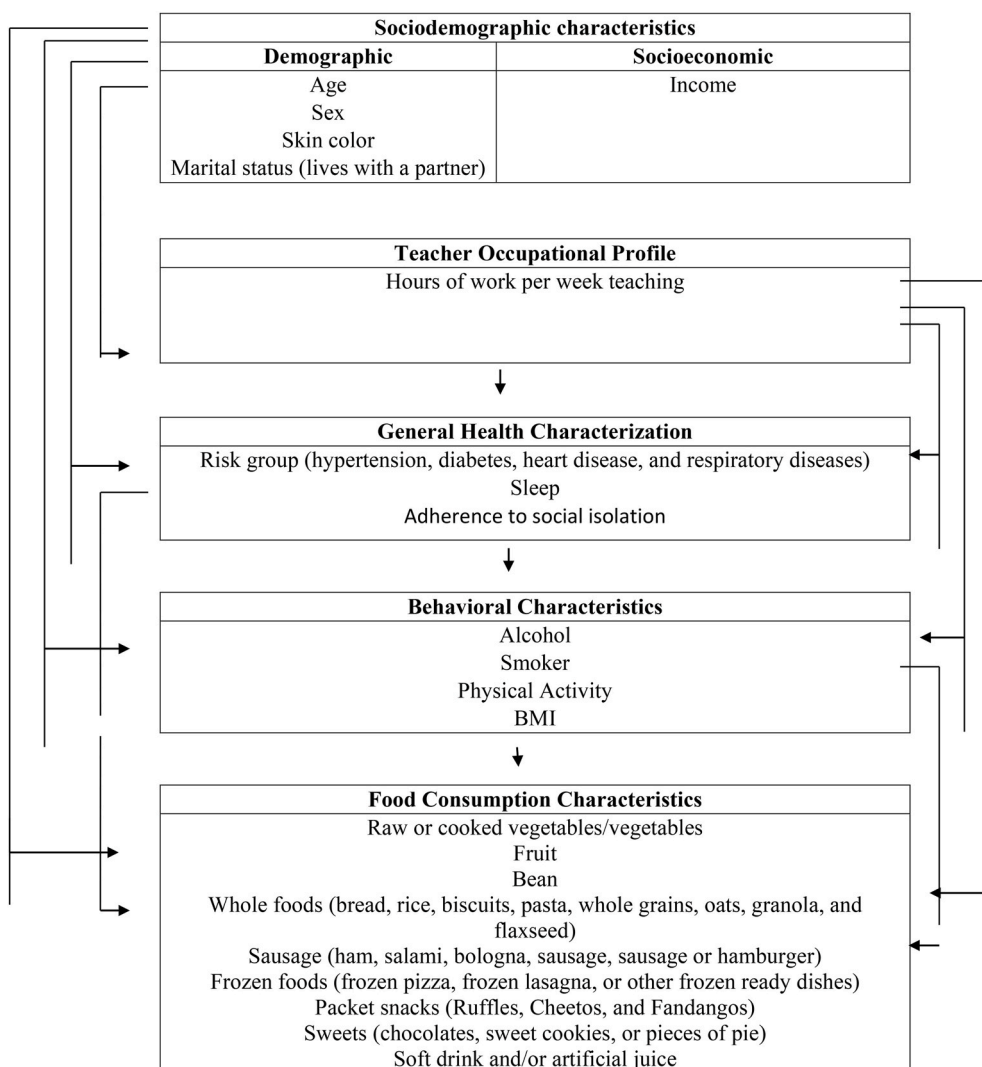

Fig. 1. Theoretical research model for the association of independent variables with teachers' food consumption before and during the COVID-19 pandemic.

minimum wage range used in this study (59.5%), and lived with a partner (66.8%). During the pandemic, 75.6% worked from 11 to 39 h/week in teaching and 79.8% adhered to social isolation. Approximately 40% reported altered sleep quality, as well as alcohol consumption and lack of physical activity. Finally, 60.4% of the professionals were observed to be overweight (Table 1).

Table 2 shows the characterization of teachers' food consumption during the COVID-19 pandemic. During this period, there was an increase in the consumption of unhealthy foods, such as sweets (19.5%), soft drinks (13.3%), sausage (12.0%), frozen foods (8.9%), and salty foods (6, 3%). Among healthy foods, there was an increase in the consumption of vegetables (13.1%), fruits (12.6%), and whole products (8.3%), and a 6.4% decrease in the consumption of beans among

Table 1
Sociodemographic, work, health, and behavioral characteristics of teachers during the pandemic. ProfSMoc Project - Minas Covid Stage, 2020 (n = 15641).

Variables	n	%
Sociodemographic characteristics		
Sex		
Female	12817	81.9
Male	2824	18.1
Age (years)		
21 a 40	6447	41.2
>41	9194	58.8
Income (minimum wages) [a]		
1 a 2	3969	25.4
3 a 5	9301	59.5
≥6	2371	15.2
Lives with a partner		
Yes	10453	66.8
No	5188	33.2
Skin color		
White	7642	48.9
Non-white	7999	51.2
Work characteristics		
Hours of work/week		
2 to 10	1351	8.6
11 to 39	11816	75.6
≥40	2472	15.8
Health characteristics		
Hypertension		
No	12981	83.0
Yes	2660	17.0
Diabetes		
No	14990	95.8
Yes	651	4.2
Heart diseases		
No	15361	98.2
Yes	280	1.8
Respiratory diseases		
No	14159	90.5
Yes	1482	9.5
Behavioral Characteristics		
Adhered to social isolation		
Yes	12486	79.8
No	3155	20.2
Altered sleep quality		
No	8648	55.3
Yes	6993	44.7
Alcohol consumption		
No	9290	59.4
Yes	6351	40.6
Currently smokes		
No	14788	94.5
Yes	853	5.5
Practice of physical activities		
Yes	8798	56.2
No	6843	43.8
Overweight		
No	5846	37.4
Yes	9452	60.4

[a] Minimum wage: R$1045, 00.

Table 2
Frequency of consumption of teachers' food groups before and during the COVID-19 pandemic. ProfSMoc Project - Minas Covid Stage, 2020 (n = 15641).

	Decreased		No changes		Increased	
	N	%	n	%	n	%
Vegetables	1442	9.2	12144	77.6	2055	13.1
Fruits	1519	9.7	12151	77.7	1971	12.6
Beans	1005	6.4	13836	88.5	800	5.1
Whole foods	1004	6.4	13337	85.3	1300	8.3
Sausage	1055	6.7	12710	81.3	1876	12.0
Frozen Foods	826	5.3	13427	85.8	1388	8.9
Savory	530	3.4	14126	90.3	985	6.3
Sweets	903	5.8	11689	74.7	3049	19.5
Soft drinks and/or artificial juice	970	6.2	12588	80.5	2083	13.3

teachers.

Tables 3–6 show the multiple multinomial regression analysis results for healthy and unhealthy foods with independent variables, respectively. Variables related to sociodemographic characteristics, occupational profile, general health, and lifestyle were associated with changes in the increase and/or decrease in food consumption of teachers during the COVID-19 pandemic in the adjusted analysis.

For the sex variable, it was found that men had the slightest chance of changing (increasing/decreasing) the consumption of food in the fruit groups (15.4%/20.6%), whole foods (29.9%/36.7%), and sweets (38.8%/19.2%). This group of teachers still had a lower chance of increasing the consumption of vegetables (25.8%), beans (38.1%), and soft drinks and/or artificial juice (17.1%).

Regarding age, a lesser chance of changing (increasing/decreasing) the consumption of all food groups was observed in individuals over 41 years old. For healthy foods, the reduction varied between 16.3% and 28.6% and for unhealthy foods from 16.3% to 49.4%.

Income greater than or equal to six minimum wages was associated with higher chances of altering the consumption of fruit groups (22.9%/30.5%) and soft drinks and/or artificial juice (50.8%/34.9%). Teachers with the highest income also had a 41.1% higher chance of increasing consuming frozen foods and 64.7% of sweets. Income of 3–5 minimum wages was associated with greater chances of increasing consumption of fruits (28.3%), sweets (27.8%), and soft drinks and/or artificial juice (25.6%).

Regarding food consumption and the variable "living with a partner", teachers who did not live with their partners or spouse had an increased chance of altering (increasing/decreasing) bean consumption (24.5%/43.3%), savory food (17.2%/21.7%), sweets (11.8%/20.2%) and soft drinks and/or artificial juice (20.0%/20.3%). Teachers with this characteristic also had a greater chance of decreasing the consumption of groups of vegetables (15.6%), fruits (19.1%), whole foods (18.7%), and sausages 17.6%), and increasing the consumption of frozen food group (21.8%).

The variable non-white skin color was associated only with increased chances of consumption of sausages by 12.5%. The higher workload per week of teachers led to greater chances of increasing the consumption of groups of vegetables (39.2%), beans (35.5%–63.4%), frozen foods (29.9%–42.7%), savory food (52.9%), sweets (39.1%), and soft drinks and/or artificial juice (39.5%–56.9%). Moreover, these teachers can be seen to have greater chances of decreasing the consumption of the bean group (47.7%) and lesser chances of reducing the consumption of the frozen (37.7) and savory food (28.9%) groups.

For associations of food consumption and health conditions, hypertensive teachers, when compared to those without hypertension, were more likely to increase the consumption of vegetables (15.1%) and fruits (18.8%) and fewer chances of increasing the consumption of sweets (13.6%) during the pandemic. The diagnosis of diabetes represents a 38.2% chance of decreasing the consumption of sweets and 26.5% chance of increasing the consumption of soft drinks and/or artificial

Table 3

Multiple multinominal regression analysis for the consumption of vegetables and fruits for the association between sociodemographic characteristics, teacher occupational profile, health characterization, behavioral characteristics.

Variables	Vegetables						Fruits					
	Increased consumption			Decreased consumption			Increased consumption			Decreased consumption		
	OR	IC95%	P value	OR	IC95%	P value	OR	IC95%	P value	OR	IC95%	P value
Sociodemographic characteristics												
Age (years)												
From 21 to 40	1.00			1.00			1.00			1.00		
41 or more	0.76	0.69–0.85	0.000	0.73	0.66–0.83	0.000	0.75	0.68–0.83	0.000	0.73	0.65–0.82	0.000
Sex												
Female	1.00			1.00			1.00			1.00		
Male	0.75	0.66–0.86	0.000	1.00	0.87–1.16	0.971	0.85	0.75–0.98	0.020	0.80	0.69–0.94	0.005
Income (minimum wages)												
1 to 2	-	-	-	-	-	-	1.00			1.00		
3 to 5	-	-	-	-	-	-	1.28	1.14–1.45	0.000	1.04	0.92–1.20	0.495
Higher than 6	-	-	-	-	-	-	1.22	1.04–1.45	0.014	1.30	1.09–1.56	0.003
Lives with spouse												
Yes	1.00			1.00			1.00			1.00		
No	0.94	0.85–1.05	0.265	1.15	1.03–1.30	0.015	1.02	0.93–1.14	0.595	1.19	1.06–1.34	0.003
Work characteristic												
Hours of work per week teaching												
2 to 10	1.00			1.00			-	-	-	-	-	-
11 to 39	1.19	0.99–1.44	0.058	0.98	0.81–1.21	0.908	-	-	-	-	-	-
40 or more	1.39	1.13–1.72	0.002	1.03	0.82–1.31	0.771	-	-	-	-	-	-
Health characteristics												
Hypertension												
No	1.00			1.00			1.00			1.00		
Yes	1.15	1.01–1.31	0.034	0.97	0.83–1.14	0.738	1.18	1.04–1.35	0.010	0.88	0.76–1.04	0.143
Respiratory diseases												
No	1.00			1.00			1.00			1.00		
Yes	1.25	1.07–1.46	0.004	1.39	1.18–1.65	0.000	1.27	1.09–1.49	0.002	1.16	0.98–1.39	0.083
Behavioral characteristics												
Adhered to social isolation												
Yes	1.00			1.00			1.00			1.00		
No	0.82	0.73–0.94	0.003	0.99	0.87–1.15	0.993	0.84	0.75–0.96	0.010	0.90	0.78–1.04	0.169
The pandemic affected sleep quality												
No	1.00			1.00			1.00			1.00		
Yes	1.21	1.11–1.34	0.000	2.00	1.79–2.25	0.000	1.32	1.20–1.46	0.000	2.12	1.90–2.38	0.000
During the pandemic is doing physical activity												
Yes	1.00			1.00			1.00			1.00		
No	0.73	0.67–0.82	0.000	1.57	1.41–1.76	0.000	0.65	0.60–0.73	0.000	1.39	1.25–1.56	0.000
Overweight												
No	1.00			1.00			1.00			1.00		
Yes	1.17	1.06–1.30	0.002	1.17	1.05–1.33	0.007	1.18	1.06–1.31	0.002	1.15	1.03–1.30	0.016

Variables with - did not remain in the final model of the regression analysis.
[1]OR – odds ratio; [2] IC – confidence interval of 95%.

juice. Heart disease was associated with reduced chances of increased consumption of frozen foods (46.2%) and soft drinks and/or artificial juice (35%).

Respiratory diseases increased the chance of alteration (increase/decrease) in the consumption of vegetables (25.2%/39.1%) and whole foods (48.8%/31.1%). There was an even greater chance of increasing fruit consumption (27.5%) and reducing bean consumption (38.8%). There was an association of respiratory diseases with the change (increase/decrease) in the consumption of all unhealthy foods, except savory foods, with a higher prevalence for the chance of decreasing these (40%–50%).

Concerning behavioral characteristics, among teachers who did not adhere to social isolation, there was less chance of increased consumption of groups of vegetables (18.3%), fruits (16.4%), whole foods (20.9%), and sweets (13.1%). As for the association of food consumption and alcohol intake during the pandemic, there was a greater chance of increasing the consumption of sausages (48%), frozen foods (36.3%), savory (46.5%), sweets (42.9%), and soft drinks and/or artificial juice (42.3%), and to reduce the consumption of beans (42.6%). Teachers who drank alcohol were also associated with lower chances of decreasing the consumption of snacks (18.3%), sweets (19.2%), and soft

drinks and/or artificial juice (16.9%).

Among the teachers who smoked, there was an increase in the chances of consuming sausages (50.1%), frozen foods (58.1%), salty foods (34.2%), and soft drinks and/or artificial juice (32, 3%). There were also greater chances of reducing the consumption of snacks (69.2%) and beans (38%).

Regarding the practice of physical activity during a pandemic, the results showed that sedentary teachers are less likely to increase the consumption of food from groups of vegetables (27.2%), fruits (35.1%), and whole foods (45.4%) and lower chances of reducing consumption of sausage (24.7%), salty (29.7%), sweets (26.5%), soft drinks and/or artificial juice (24.5%). On the other hand, these teachers had an even greater chance of decreasing the consumption of the groups of vegetables (57.5%), fruits (39.9%), and beans (16.4%) and of increasing the consumption of sausages (32%), frozen foods (43.8%), salty foods (50.8%), sweets (30.2%), and soft drinks and/or artificial juice (57.2%).

The variable sleep quality altered due to the pandemic. Being overweight was associated with greater chances of changes (increase/decrease) in the consumption of all food groups, except for whole foods. It also increased the chances of changes in the consumption of unhealthy foods (25.2%–72.8%).

Table 4

Multiple multinominal regression analysis for the consumption of beans and whole foods for the association between sociodemographic characteristics, teacher occupational profile, health characterization, behavioral characteristics.

Variables	Beans						Whole foods					
	Increased consumption			Decreased consumption			Increased consumption			Decreased consumption		
	OR	IC95%	P value	OR	IC95%	P value	OR	IC95%	P value	OR	IC95%	P value
Sociodemographic characteristics												
Age (years)												
From 21 to 40	1.00			1.00			1.00			1.00		
41 or higher	0.78	0.68–0.91	0.001	0.74	0.65–0.85	0.000	0.84	0.75–0.95	0.006	0.72	0.63–0.83	0.000
Sex												
Female	1.00			1.00			1.00			1.00		
Male	0.62	0.51–0.78	0.000	1.05	0.89–1.24	0.565	0.71	0.60–0.84	0.000	0.64	0.53–0.78	0.000
Lives with spouse												
Yes	1.00			1.00			1.00			1.00		
No	1.24	1.07–1.45	0.005	1.43	1.25–1.64	0.000	1.04	0.93–1.18	0.465	1.18	1.04–1.36	0.014
Work characteristics												
Hours of work per week teaching												
2 to 10	1.00			1.00			-	-	-	-	-	-
11 to 39	1.35	1.01–1.82	0.044	1.18	0.92–1.53	0.185	-	-	-	-	-	-
40 or more	1.63	1.17–2.28	0.004	1.47	1.11–1.96	0.007	-	-	-	-	-	-
Health characteristics												
Respiratory diseases												
No	1.00			1.00			1.00			1.00		
Yes	1.12	0.89–1.42	0.338	1.38	1.15–1.68	0.001	1.48	1.25–1.77	0.000	1.31	1.07–1.60	0.008
Behavioral characteristics												
Adhered to social isolation												
Yes	-	-	-	-	-	-	1.00			1.00		
No	-	-	-	-	-	-	0.80	0.69–0.94	0.005	0.94	0.80–1.12	0.535
The pandemic affected sleep quality												
No	1.00			1.00			1.00			1.00		
Yes	1.44	1.25–1.68	0.000	2.02	1.77–2.32	0.000	1.29	1.15–1.46	0.000	1.78	1.56–2.04	0.000
Alcohol consumption during the pandemic												
No	1.00			1.00			-	-	-	-	-	-
Yes	1.10	0.95–1.28	0.193	1.42	1.25–1.63	0.000	-	-	-	-	-	-
Currently smokes												
No	1.00			1.00			-	-	-	-	-	-
Yes	1.16	0.85–1.59	0.342	1.38	1.08–1.76	0.010	-	-	-	-	-	-
During the pandemic is doing physical activity												
Yes	1.00			1.00			1.00			1.00		
No	0.94	0.82–1.10	0.470	1.16	1.02–1.33	0.024	0.55	0.49–0.63	0.000	1.09	0.96–1.25	0.190
Overweight												
No	1.00			1.00			1.00			1.00		
Yes	1.19	1.02–1.39	0.023	1.17	1.02–1.35	0.024	1.19	1.06–1.35	0.005	1.13	0.99–1.30	0.071

[1]OR – odds ratio; [2] IC – confidence interval of 95%.

Variables with - did not remain in the final model of the regression analysis.

4. Discussion

The findings of this study show a higher proportion of increased consumption of different food groups, whether healthy or not, due to the social isolation caused by the pandemic of COVID-19. Only the bean group was associated with decreased consumption during this period. Similar results have recently been found in other populations that have demonstrated that the current home confinement can effect changes in the population's eating behaviors (Ammar et al., 2020; Malta et al., 2020; Rehm et al., 2020). However, this study first analyzed changes in food consumption among teachers in the state network of Minas Gerais before and during the COVID-19 pandemic considering the frequency of consumption and exploring the associated factors. Although it is understandable, the specific approach for a given group of foods considered healthy or unhealthy does not allow a bidirectional and more realistic assessment of the complexity and dynamics of food consumption during a pandemic.

It is widely agreed that anxiety, fear, uncertainty, lack of information, and frustrations caused by social isolation are considered risk factors for consuming more food. This includes the consumption of lower quality food, as recorded by an international online survey on mental health and behaviors—multidimensional lifestyles during home confinement (Ammar et al., 2020). Therefore, at the beginning of the pandemic, the WHO published a guide on eating healthy during the self-quarantine of COVID-19. This guide contains valuable nutrition information to strengthen the immune system. It guides control in the intake of salt, sugar, fat, and alcohol; and encourages increased fiber and water consumption (WHO, 2020).

In the present study, it was found that people over the age of 41 were less likely to change their eating habits. A cross-sectional study was conducted in Brazil with data from the virtual health survey "ConVid, Behavioral Research." It showed that during the pandemic, there was an increase in the prevalence of consumption of unhealthy foods (i.e., of frozen and salty foods) for two or more days per week in both sexes. Simultaneously, consumption of chocolates/cookies, sweets/pieces of pie was higher among women. Among young adults (18–29 years old), the frequency of consumption of all unhealthy foods increased by a more significant proportion, with a highlight on chocolates/sweet, cookies/ pieces of pie for two or more days of the week, from 54.2% before the pandemic to 63.0% during the pandemic (Malta et al., 2020).

The variables of income and living without a partner were associated with a greater chance of changing eating habits among teachers. A

Table 5
Multiple multinominal regression analysis for the consumption of sausages and frozen foods for the association between sociodemographic characteristics, teacher occupational profile, health characterization, behavioral characteristics.

Variable	Sausages						Frozen foods					
	Increased consumption			Decreased consumption			Increased consumption			Decreased consumption		
	OR	IC95%	P value	OR	IC95%	P value	OR	IC95%	P value	OR	IC95%	P value
Sociodemographic characteristics												
Age (years)												
From 21 to 40	1.00			1.00			1.00			1.00		
41 or higher	0.59	0.54–0.66	0.000	0.71	0.63–0.81	0.000	0.69	0.62–0.78	0.000	0.84	0.73–0.98	0.025
Skin color												
White	1.00			1.00			-	-	-	-	-	-
Non-white	1.12	1.02–1.24	0.021	0.97	0.86–1.11	0.716	-	-	-	-	-	-
Income (minimum wages)												
1 to 2	-	-	-	-	-	-	1.00			1.00		
3 to 5	-	-	-	-	-	-	1.03	0.90–1.19	0.660	1.08	0.91–1.30	0.344
Higher than 6	-	-	-	-	-	-	1.41	1.17–1.70	0.000	0.96	0.75–1.24	0.761
Lives with spouse												
Yes	1.00			1.00			1.00			1.00		
No	1.09	0.98–1.21	0.107	1.17	1.03–1.34	0.017	1.21	1.08–1.37	0.001	1.14	0.98–1.33	0.080
Work characteristics												
Hours of work per week teaching												
2 to 10	-	-	-	-	-	-	1.00			1.00		
11 to 39	-	-	-	-	-	-	1.29	1.03–1.64	0.030	0.63	0.51–0.79	0.000
40 or more	-	-	-	-	-	-	1.42	1.09–1.86	0.009	0.79	0.60–1.05	0.103
Health characteristics												
Heart diseases												
No	-	-	-	-	-	-	1.00			1.00		
Yes	-	-	-	-	-	-	0.54	0.33–0.92	0.022	0.80	0.46–1.41	0.446
Respiratory diseases												
No	1.00			1.00			1.00			1.00		
Yes	1.37	1.18–1.60	0.000	1.49	1.23–1.81	0.000	1.21	1.02–1.44	0.032	1.39	1.12–1.73	0.003
Behavioral characteristics												
The pandemic affected sleep quality												
No	1.00			1.00			1.00			1.00		
Yes	2.18	1.97–2.42	0.000	1.48	1.30–1.68	0.000	2.24	2.00–2.53	0.000	1.26	1.09–1.45	0.002
Alcohol consumption during the pandemic												
No	1.00			1.00			1.00			1.00		
Yes	1.48	1.34–1.64	0.000	0.92	0.81–1.05	0.216	1.36	1.21–1.53	0.000	0.90	0.78–1.05	0.168
Currently smokes												
No	1.00			1.00			1.00			1.00		
Yes	1.50	1.24–1.82	0.000	1.18	0.89–1.56	0.246	1.58	1.28–1.95	0.000	1.25	0.93–1.70	0.142
During the pandemic is doing physical activity												
Yes	1.00			1.00			1.00			1.00		
No	1.32	1.19–1.46	0.000	0.76	0.67–0.87	0.000	1.43	1.28–1.61	0.000	0.87	0.76–1.02	0.083
Overweight												
No	1.00			1.00			1.00			1.00		
Yes	1.25	1.13–1.392	0.000	1.35	1.18–1.55	0.000	1.33	1.18–1.51	0.000	1.37	1.18–1.60	0.000

[1] OR – odds ratio; [2] IC – confidence interval of 95%.
Variables with - did not remain in the final model of the regression analysis.

similar result was presented in a study carried out in the Chilean territory. In the study, both income and medium to high socioeconomic status were associated with increased consumption of unhealthy foods; consequently, increased body weight (Reyes-Olavarría et al., 2020). Such changes can be justified by factors such as increasing the amount of food consumed, and diversity, preference, and food knowledge (Ren et al., 2019). The study carried out by Górnicka et al. (2020) with Polish adults found that adherence to the consumption of unhealthy foods was 1.8 times higher in the interviewees who lived with a partner and/or children than in those who lived alone. The increase in the frequency of evening meals and snacks can increase calorie intake (Lee et al., 2020).

The workload was also associated with greater chances of changes in eating habits. The previous investigation with adults evidenced that the adherence to the consumption of unhealthy foods was 1.5 times higher in the interviewees who did not work or had a considerable level of reduction in working time than in those whose workload remained the same as before (Górnicka et al., 2020).

There was a variation in the increase and decrease in the

consumption of healthy and unhealthy foods in teachers with hypertension, diabetes, and respiratory diseases. In a study by Destri et al. (2017), when analyzing the frequency of consumption of the participants, it was observed that the recommended weekly frequency for fried foods and snacks was higher among individuals with hypertension and diabetes. The daily consumption of raw salad/fruits and the frequency of consumption of soft drinks up to once a week were higher among those who had only diabetes (Destri et al., 2017). Considering that healthy eating habits can be a protective factor for health, heart disease has been shown to be associated with less consumption of frozen foods and soft drinks, and/or artificial juice. A healthy diet can reduce the levels of inflammatory markers, contributing to the prevention/control of metabolic conditions related to the manifestation of chronic non-communicable diseases (Geraldo and Alfenas, 2008). In this sense, it is of utmost importance to maintain healthy eating habits through a balanced and varied diet since this can help strengthen the immune system, acting as a protection against COVID-19 (WHO, 2020; Reyes-Olavarría et al., 2020). Such an explanation for greater consumption of

Table 6

Multiple multinominal regression analysis for the consumption of snacks, sweets, and soft drinks and/or artificial juice for the association between sociodemographic characteristics, teacher occupational profile, health characterization, behavioral characteristics.

Variables	Savory						Sweets						Soft drink and/or artificial juice					
	Increased consumption			Decreased consumption			Increased consumption			Decreased consumption			Increased consumption			Decreased consumption		
	OR	IC95%	P value	OR	IC95%	P value	OR	IC95%	P value	OR	IC95%	P value	OR	IC95%	P value	OR	IC95%	P value
Sociodemographic characteristics																		
Age (years)																		
From 21 to 40	1.00			1.00			1.00			1.00			1.00			1.00		
41 or higher	0.51	0.45–0.59	0.000	0.56	0.47–0.67	0.000	0.58	0.54–0.64	0.000	0.64	0.56–0.74	0.000	0.58	0.54–0.64	0.000	0.61	0.54–0.71	0.000
Sex																		
Female	-	-	-	-	-	-	1.00			1.00			1.00			1.00		
Male	-	-	-	-	-	-	0.62	0.55–0.70	0.000	0.81	0.67–0.98	0.030	0.83	0.74–0.96	0.009	1.06	0.90–1.26	0.484
Income (minimum wages)																		
1 to 2	-	-	-	-	-	-	1.00			1.00			1.00			1.00		
3 to 5							1.27	1.15–1.42	0.000	1.17	1.00–1.40	0.057	1.25	1.11–1.42	0.000	1.12	0.95–1.33	0.170
Higher than 6	-			-			1.64	1.43–1.89	0.000	1.22	0.97–1.56	0.094	1.50	1.28–1.78	0.000	1.34	1.08–1.69	0.009
Lives with spouse																		
Yes	1.00			1.00			1.00			1.00			1.00			1.00		
No	1.17	1.02–1.35	0.024	1.21	1.01–1.46	0.035	1.11	1.02–1.22	0.015	1.20	1.04–1.39	0.014	1.20	1.08–1.33	0.001	1.20	1.04–1.39	0.011
Work characteristics																		
Hours of work per week teaching																		
2 to 10	1.00			1.00			1.00			1.00			1.00			1.00		
11 to 39	1.14	0.88–1.48	0.308	0.72	0.55–0.95	0.022	1.09	0.93–1.28	0.301	0.90	0.71–1.15	0.423	1.39	1.14–1.71	0.001	0.94	0.74–1.20	0.627
40 or more	1.52	1.15–2.04	0.004	0.95	0.68–1.33	0.768	1.39	1.15–1.68	0.001	0.94	0.71–1.27	0.707	1.56	1.25–1.97	0.000	1.16	0.88–1.53	0.297
Health characteristics																		
Hypertension																		
No	-	-	-	-	-	-	1.00			1.00			-	-	-	-	-	-
Yes	-	-	-	-	-	-	0.87	0.77–0.99	0.029	1.02	0.84–1.24	0.819	-	-	-	-	-	-
Diabetes																		
No	-	-	-	-	-	-	1.00			1.00			1.00			1.00		
Yes	-	-	-	-	-	-	0.82	0.66–1.04	0.096	0.62	0.42–0.95	0.026	0.74	0.57–0.97	0.029	0.90	0.64–1.27	0.545
Heart diseases																		
No	-	-	-	-	-	-	-	-	-	-	-	-	1.00			1.00		
Yes	-	-	-	-	-	-	-	-	-	-	-	-	0.66	0.44–0.99	0.047	0.82	0.48–1.40	0.476
Respiratory diseases																		
No	1.00			1.00			1.00			1.00			1.00			1.00		
Yes	1.31	1.08–1.60	0.006	1.14	0.86–1.53	0.341	1.30	1.14–1.49	0.000	1.49	1.21–1.84	0.000	1.23	1.06–1.44	0.006	1.40	1.14–1.72	0.001
Behavioral characteristics																		
Adhered to social isolation																		
Yes	-	-	-	-	-	-	1.00			1.00			-	-	-	-	-	-
No	-	-	-	-	-	-	0.87	0.79–0.98	0.021	0.93	0.78–1.12	0.452	-	-	-	-	-	-
The pandemic affected sleep quality																		
No	1.00			1.00			1.00			1.00			1.00			1.00		
Yes	2.41	2.10–2.78	0.000	1.20	1.01–1.44	0.040	2.13	1.96–2.32	0.000	1.35	1.18–1.56	0.000	2.24	2.04–2.48	0.000	1.36	1.19–1.56	0.000
Alcohol consumption during the pandemic																		
No	1.00			1.00			1.00			1.00			1.00			1.00		
Yes	1.46	1.28–1.68	0.000	0.82	0.69–1.00	0.044	1.42	1.31–1.56	0.000	0.81	0.71–0.95	0.007	1.42	1.29–1.57	0.000	0.84	0.73–0.97	0.016
Currently smokes																		
No	1.00			1.00			-	-	-	-	-	-	1.00			1.00		
Yes	1.34	1.04–1.73	0.023	1.69	1.21–2.38	0.002	-	-	-	-	-	-	1.32	1.09–1.60	0.004	1.21	0.91–1.63	0.189
During the pandemic is doing physical activity																		
Yes	1.00			1.00			1.00			1.00			1.00			1.00		
No	1.50	1.32–1.72	0.000	0.71	0.59–0.86	0.000	1.30	1.20–1.42	0.000	0.74	0.65–0.86	0.000	1.57	1.43–1.73	0.000	0.76	0.67–0.88	0.000
Overweight																		
No	1.00			1.00			1.00			1.00			1.00			1.00		
Yes	1.32	1.15–1.53	0.000	1.45	1.20–1.76	0.000	1.25	1.15–1.37	0.000	1.52	1.31–1.77	0.000	1.39	1.26–1.55	0.000	1.72	1.49–2.00	0.000

[1]OR – odds ratio; [2] IC – confidence interval of 95%.

Variables with - did not remain in the final model of the regression analysis.

unhealthy foods during the pandemic may be found in their high energy density and the addition of ingredients to increase the durability and palatability of the products (BRASIL, 2014).

This study observed that both alcohol intake and cigarette use favored an increase in the consumption of unhealthy foods. It is worth mentioning that other studies sought to describe changes in the population's lifestyle based on the effects of home confinement during the pandemic (Malta et al., 2020; WHO, 2020; Reyes-Olavarría et al., 2020; Górnicka et al., 2020; Rodríguez-Muñoz et al., 2020). However, this study was the first to assess the association of alcohol and tobacco consumption with changes in food consumption among teachers. In a different scenario from the one presented in our study, Rodríguez-Muñoz et al. (2020) established an association between consumption of psychoactive substances and nutrition. The authors pointed out that alcohol, for example, inhibits food intake while tobacco stimulates it. Given the pandemic scenario caused by COVID-19 and the importance of keeping the immune system strengthened, it is significant that any changes in alcohol and tobacco consumption related to eating habits are monitored. There is a scarcity of studies on the consumption of these substances and eating habits among teachers. Thus, there is a need for more research to analyze and understand this correlation to promote teachers' health.

Concerning sedentary teachers, they were less likely to increase the consumption of whole foods, groups of vegetables, fruits, and even greater chances of increasing the consumption of sausage, frozen, savory, and sweet and soft drinks, and/or artificial juice. Another study carried out in Brazil with about 45,000 participants found a significant association between reduced physical activity and increased sedentary behavior and consumption of unhealthy foods, such as ultra-processed foods, during the pandemic (Werneck et al., 2021). In the study, Werneck et al. point out that sedentary behavior caused by social restriction measures is associated with increased energy intake. This can occur through different mechanisms such as increased consumption of ultra-processed foods, mainly when watching TV and using cell phones. That is, for example, due to greater exposure to commercials about these types of foods leading to the desire to consume them. In the literature, there is clear evidence that a sedentary lifestyle associated with inadequate food consumption negatively impacts the population's health. The practice of physical activity contributes to their physical and mental health, helping prevent COVID-19 and its consequences (SBMEE, 2020; SBC, 2020).

Given the current situation, sleep quality is an essential condition associated with health that must be evaluated to avoid both physical and mental illness of the population. In this study, sleep quality was associated with greater chances of changes in eating habits. Recent studies have stated that sleep disorders aggravate the picture related to quarantine (Barros et al., 2020; Zupo et al., 2020), further aggravating stress and increasing food intake, generating a dangerous vicious cycle for health (Zupo et al., 2020). Some factors contributing to the change in the population's sleep pattern are changes in routine, less exposure to sunlight, and the stress caused by the current state (Barros et al., 2020).

The presence of excess weight was another determining factor for the increase in the consumption of unhealthy foods in this research. A cross-sectional online study was carried out with 1097 adults on nutritional and consumption habits in Poland. It recorded that about 30% of these individuals who were already overweight experienced weight gain. Additionally, the increase in BMI was associated with less frequent consumption of vegetables, fruits, and vegetables during quarantine and greater adherence to meat, dairy, and fast food (Błaszczyk-Bębenek et al., 2020). Another international study carried out with 312 adults during the lockdown found that the body weight of 46.8% of the interviewees increased significantly, with bad eating habits as an influencing factor. Overweight individuals are at increased risk of developing chronic or acute diseases, including infection and complications by COVID-19 (Sidor and Rzymski, 2020; Chowdhury et al., 2021).

The increase in the frequency of consumption of unhealthy foods, observed in this research, calls attention to possible damage to health, such as changes in body weight and an increase in the occurrence of chronic non-communicable diseases. Suppose there was an increase in consumption when one explores the different food groups. In that case, it is possible to observe that the phenomenon of change in food habits at the same time that favors the consumption of some unhealthy foods such as industrialized ones also allowed them to increase the consumption of fruits and vegetables, reflecting the likely need for the act of cooking. According to a survey carried out by Pérez-Rodrigo et al. (2020), 62.5% of the participants declared that they cook at home regularly and 14.1% more said that they cook regularly during this pandemic period. Such changes at home may suggest a more significant concern regarding food consumption.

The ambiguity of the results of this study was reported in another Brazilian study where the implications of the pandemic are linked to sudden changes in lifestyle and which can directly reflect on diet and changing habits, which can be either positive or negative (Durães et al., 2020). The number of teachers' absences due to health problems in recent years has increased significantly (Antunes, 2014). Negative behaviors in eating and low physical activity practice have also been found more frequently in this population and different regions of the country (Rocha et al., 2015), demonstrating the relevance and the need for further studies on public school teachers.

This study has a limitation as it utilized a self-reported questionnaire to assess lifestyle changes, with the possibility of selection and memory biases, transversality, and assessment of food consumption by healthy and unhealthy food groups. However, the study's strengths stand out, such as the robust sample population, well distributed in the different regions of the state and essential support from SEE-MG, the analysis method through the regression of multinomial logistics, score, and bidirectional evaluation.

It is hoped that the results presented in this study can be used in future research to contribute to the development of strategies that assist in promoting teachers' health, especially after this period of the COVID-19 pandemic.

5. Conclusion

The COVID-19 pandemic and variables related to sociodemographic characteristics, occupational profile, general health, and lifestyle were bi-directionally associated with changes in teachers' food consumption. The findings of this study showed an increase in the consumption of all food groups, except for beans. Harmful and beneficial effects of social isolation were observed, requiring further studies aimed at the health and nutrition of teachers in this particular period.

CRediT authorship contribution statement

Sabrina Alves Durães: Investigation, Formal analysis, Data curation, Writing – original draft. **Geórgia das Graças Pena:** Writing – original draft. **Luciana Neri Nobre:** Writing – original draft. **Audrey Handyara Bicalho:** Writing – original draft. **Rosângela Ramos Veloso Silva:** Supervision, Project administration, Investigation. **Desirée Sant'Ana Haikal:** Supervision, Project administration, Investigation. **Carolina Amaral Oliveira Rodrigues:** Writing – original draft. **Marise Fagundes Silveira:** Writing – review & editing. **Maria Fernanda Santos Figueiredo Brito:** Writing – review & editing. **Vítor Fonseca Bastos:** Writing – original draft. **Lucineia de Pinho:** Supervision, Project administration, Investigation, Formal analysis, Data curation, Writing – original draft, Writing – review & editing, All authors read and approved the final manuscript.

Declaration of competing interest

None to declare.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.obmed.2021.100366.

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