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.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.

Nutrition, Metabolism & Cardiovascular Diseases (2022) **32**, 734–742

Available online at www.sciencedirect.com

Nutrition, Metabolism & Cardiovascular Diseases

journal homepage: www.elsevier.com/locate/nmcd

Association between lifestyle and emotional aspects of food consumption during the COVID-19 pandemic

Chayze de Souza Cunha [a], Desirée Sant'Ana Haikal [b], Rosângela Ramos Veloso Silva [b,e], Lucineia de Pinho [b,e], Geórgia das Graças Pena [c], Audrey Handyara Bicalho [d], Paulo de Souza Costa Sobrinho [a], Luciana Neri Nobre [a,*]

[a] Universidade Federal dos Vales do Jequitinhonha e Mucuri (UFVJM), Diamantina Postgraduate Program in Sciences of Nutrition, Minas Gerais, Brazil
[b] Postgraduate Program in Health Sciences, Universidade Estadual de Montes Claros (UNIMONTES), Montes Claros, Minas Gerais, Brazil
[c] Postgraduate Program in Health Sciences, Universidade Federal de Uberlândia (UFU), Uberlândia, Minas Gerais, Brazil
[d] Instituto Federal de Educação Ciência e Tecnologia do Norte de Minas Gerais, IFNMG Montes Claros, Minas Gerais, Brazil
[e] Postgraduate Program in Primary Health Care, Universidade Estadual de Montes Claros (UNIMONTES), Montes Claros, Minas Gerais, Brazil

Received 29 June 2021; received in revised form 23 November 2021; accepted 20 December 2021
Handling Editor: A. Siani
Available online 24 December 2021

KEYWORDS
COVID-19;
Food consumption;
School teachers

Abstract *Background and aims:* Adequate nutrition during infectious outbreaks require a personal management strategy, especially when there are emotional factors involved. To evaluate the association between lifestyle and emotional aspects of food consumption during the pandemic COVID-19.
Methods and results: Cross-sectional study using online self-applied questionnaire with 15,372 active schoolteachers who worked in primary education (kindergarten, elementary and high school) from Minas Gerais, Brazil. Poisson Regression model with robust variance was used to determine the association between lifestyle and emotional aspects and food consumption. Greater adherence to the healthy consumption profile showed a statistically significant association with decreased weight (PR = 1.58; p = 0.000), decreased physical activity (PR = 1.27; p = 0.000), reduced income, (PR = 1.26; p = 0.000), reduced alcohol consumption (PR = 1.22; p = 0.000), and changes in mental health (PR = 1.19; p = 0.000). Unhealthy consumption profile was significantly correlated with weight gain (PR = 1.54; p = 0.000), consuming more alcohol, or started drinking during the pandemic (PR = 1.44; p = 0.000), increased physical activity (PR = 1.43; p = 0.000); increased cigarette consumption (PR = 1.17; p = 0.000), and being a younger adult (PR = 1.17; p = 0.000).
Conclusions: The COVID-19 pandemic influenced the food profiles of basic education teachers in the Minas Gerais state education system in a bidirectional manner, favoring the practice of consuming healthy or unhealthy foods.
© 2022 The Italian Diabetes Society, the Italian Society for the Study of Atherosclerosis, the Italian Society of Human Nutrition and the Department of Clinical Medicine and Surgery, Federico II University. Published by Elsevier B.V. All rights reserved.

* Corresponding author. Department of Nutrition, Universidade Federal dos Vales do Jequitinhonha e Mucuri, Campus JK, Rodovia MGT 367 – Km 583, no 5000 – Alto da Jacuba, Diamantina 39100-000, Minas Gerais, Brazil.
E-mail addresses: chayzecunha@yahoo.com.br (C. de Souza Cunha), desireehaikal@gmail.com (D.S.A.Haikal), rosaveloso9@gmail.com (R.R.V. Silva), lucineiapinho@hotmail.com (L. de Pinho), georgia@ufu.br (G. das Graças Pena), handyara.bicalho@ifnmg.edu (A.H. Bicalho), psobrinho@ufvjm.edu.br (P. de Souza Costa Sobrinho), luciana.nobre@ufvjm.edu.br (L.N. Nobre).

https://doi.org/10.1016/j.numecd.2021.12.019
0939-4753/© 2022 The Italian Diabetes Society, the Italian Society for the Study of Atherosclerosis, the Italian Society of Human Nutrition and the Department of Clinical Medicine and Surgery, Federico II University. Published by Elsevier B.V. All rights reserved.

1. Introduction

The novel coronavirus, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is the etiologic agent of COVID-19 [1–3]. Its high pathogenicity has resulted in a pandemic [4,5], causing a state of emergency worldwide [6]. Due to a lack of definite treatment, non-pharmacological interventions such as isolation, quarantine, and social distancing have been recommended worldwide to reduce the spread of this disease [7].

Mandatory social distancing prevents and mitigates the spread of the virus [8,9]; however, it has been noted that it amplifies and worsens various stressors. The pandemic's influence [4,10] on population health caused a sudden involuntary change in behavior [3] due to these stressors being triggered.

The harmful consequences of non-pharmacological interventions [6] permeate the physical sphere and undermine people's mental well-being [11]. Moreover, the incidence of mental health disorders, such as depression and anxiety, has increased [12], manifesting symptoms such as boredom, stress, fear, panic [7,10], and mood changes [1]. These symptoms, in turn, influence lifestyle behaviors and food choices [6,13].

While some are unaffected by the pandemic and improve their lifestyle habits [3], others experience a significant personal burden [14]. Studies on the pandemic's consequences on lifestyle have shown an influence on socialization [3,14], increased screen time [4,6,9,15], physical inactivity [1,4,6,9,15,16], weight gain [1,3,8,15,17], increased consumption of alcoholic beverages [1,8,9,15,17], smoking [1,3,8,15], and dysfunctional eating habits, such as excessive eating and drinking [18], with a focus on foods that are sources of refined carbohydrates, high glycemic index and calorie density.

Adequate nutrition during infectious outbreaks requires a personal management strategy [19], especially when there are emotional factors involved. Natural and minimally processed foods have a positive impact on depression scores [11], examples of which include fruits, vegetables, and whole grains [20], which are rich in antioxidants, phenolic compounds, fiber, vitamins, minerals, and polyunsaturated fatty acids [4,13], accompanied by moderate intake of poultry, eggs, and dairy products, and occasionally red meat [21]. In contrast, a diet rich in simple sugars and saturated fat, and low in fiber has been associated with modulation of cytokine gene expression, which is correlated with inflammatory processes. These expressions are triggered by hormonal, neuronal, and inflammatory pathways that connect the immune system and the intestinal microbiome to brain functions, thereby influencing mood, depressive symptoms, and hunger [13].

Although several studies have reported the consequences of COVID-19 on lifestyle, its effect on teachers has not been thoroughly investigated. During the pandemic, teachers faced an overload of demands on a personal and professional level, and this may have compromised not only their performance at work and the students' learning, but also their lifestyle practices, such as food consumption.

Considering these aspects, this study aimed to identify the association between lifestyle and the emotional aspects of food consumption in the state network of teachers from Minas Gerais, Brazil, during the COVID-19 pandemic.

2. Methods

2.1. Study design and participants

In this cross-sectional epidemiological study, we evaluated the teachers who taught primary education (kindergarten, elementary and high school) at state schools in Minas Gerais, Brazil, from August to September 2020. During this period, Brazil and Minas Gerais were experiencing mandatory social distancing due to the COVID-19 pandemic. This study was part of the ProfSMoc Project entitled "Health and work conditions among teachers from the state education network of the state of Minas Gerais in the COVID-19 pandemic".

According to the Epidemiological Bulletin of the Minas Gerais State Health Department [22], from March to September 2020, 295,169 (1.4%) people in Minas Gerais tested positive for this disease, among which 7360 (0.034%) died. More than 70% of those who died were aged >60 years and suffered from chronic comorbid diseases. The case fatality rate was 2.5%.

A formula based on the prevalence of disease or event, equal to 50%, was used as a sample calculation, with an infinite and duplicated population (Deff = 2) because the sample comprised of clusters and an increase of 20% in the sample size to compensate for possible losses. Data from at least 2564 subjects was estimated to ensure the proportionality of teachers in the state of Minas Gerais.

Participants independently completed an anonymous online questionnaire and explicitly agreed to participate in the survey. Anonymity was guaranteed by the platform, with no way to link participants' email addresses to their responses. To avoid automatic filling of the survey form, a reCAPTCHA was used which prevented a form from being answered by a robot.

The inclusion criteria were teachers who worked in a teaching role in primary education in 2020 within the state school system in Minas Gerais, Brazil, of both sexes, who had internet access and signed the written consent form to participate in the research. The exclusion criteria were teachers currently not practicing their profession including retirees, and those with incomplete questionnaires. The study protocol was approved by the Human Research Ethics Committee of the State University of Montes Claros (Protocol # 4.200.389/2020).

2.2. Questionnaire

The questionnaire was built on the Google Forms survey management application (Google LLC; Menlo Park, CA, USA), a free tool that allows for the collection of information through a customized survey or questionnaire. The information was automatically linked to a Microsoft® Excel® spreadsheet (Microsoft Corporation; Redmond,

WA, USA), which ultimately contained the responses of the participants. The questionnaire included 144 questions related to sociodemographic variables, working conditions, overall health, and lifestyle. Some questions solicited responses before and during the pandemic for the same scenario. The invitation to participate in the research and the questionnaire were sent to teachers by email sent by the State Secretariat of Education of Minas Gerais.

2.3. Variables

A validated questionnaire used in a Brazilian population-based survey, called *Vigilância de Fatores de Risco e Proteção para Doenças Crônicas não Transmissíveis por Inquérito Telefônico* (VIGITEL - Risk Factor Surveillance for Non-Transmissible Chronic Diseases by Telephone Survey), was used to evaluate food consumption [23]. The questionnaire had good reproducibility and adequate validity for most of the indicators evaluated [23].

The dependent variable "food consumption profile" assessed in this study was defined as the changes in the consumption frequencies of healthy foods (vegetables, fruits, legumes, and whole grain products) and unhealthy foods (processed meats, fast foods, snack packs, sweets, soft drinks, and artificial juices) by comparing the periods before and during the pandemic.

This profile was created in three stages: 1) calculation of the average consumption frequencies of healthy and unhealthy foods (obtained by adding the frequencies and dividing by the number of foods in the group) for the periods before and during the pandemic; 2) recategorization of the groups; and 3) identification of the food consumption profile.

In the first stage, after obtaining the average values, the differences between consumption during and before the pandemic were calculated. For the healthy food group, the value obtained from this difference was categorized as "code 0" if there was an increase in the consumption frequency, "code 1" if there was no change, and "code 2" if there was a decrease. For the unhealthy group, "code 0" indicated decreased consumption frequency, "code 1" indicated no change, and "code 2" indicated increased consumption frequency.

Thus, a healthy profile was adopted when healthy and unhealthy food consumption were both categorized as (0), healthy and unhealthy food consumption was categorized as (0) and (1), respectively, or healthy and unhealthy food consumption was categorized as (1) and (0), respectively.

An unhealthy profile was adopted when healthy and unhealthy food consumption was categorized as (0) and (2), respectively; or healthy and unhealthy food consumption was categorized as (1) and (2), respectively; or healthy and unhealthy food consumption was categorized as (2) and (0), respectively; healthy and unhealthy food consumption was categorized as (2) and (1), respectively; healthy and unhealthy food consumption were both categorized as (2).

An unaltered profile, on the other hand, occurred when the change in consumption of healthy and unhealthy foods was categorized as (1).

The independent variables evaluated included sociodemographic, behavioral, and stressful conditions. For data analysis, the variables were categorized according to the following: Sociodemographic variables included sex, age in years ($\leq$43 years and $>$43 years), income during the pandemic (the same or increased, decreased, or lost income; using the current minimum wage at the time of data collection of R$ 1.045.00/month), number of children (do not have children, 1 or 2 and 3 or more), and the number of residents per household (1, 2 to 4, and 5 or more); behavioral variables included changes in alcohol consumption (does not consume or no change, not currently drinking or drinking less, and consuming more or started to drink), changes in cigarette consumption, physical activity, and body weight (did not change, decrease, or increase). Regarding the stressful conditions, variables included being part of the high-risk group for COVID-19 (presence of any of the following: age $\geq$60 years and diagnosed with comorbid conditions like hypertension, diabetes, heart disease, obesity, autoimmune disease, chronic respiratory diseases, or being in an immunocompromised state), separated from spouse during the pandemic; family member, close friend, or co-worker experiencing severe symptoms of COVID-19 or death due to COVID-19; and if there was a change in mental health; the parameters under these variables are answered with Yes or No.

The questions that generated the variable change in mental health were positive responses to questions about anxiety and nervousness, sadness, and depression, psychological or psychiatric monitoring during the pandemic, and a medical diagnosis of anxiety or depression during the COVID-19 pandemic, with corresponding negative responses for the same questions before the pandemic.

Notably, for this study, we considered the responses from both time periods (before and during the pandemic) when evaluating the changes in the variables mentioned above.

2.4. Statistical analysis

The variables were analyzed using descriptive statistics, and the results are presented as simple (n) and relative (%) frequencies. The chi-square test was used to verify the association between the food consumption profile and independent variables. Univariate and multivariate binary Poisson regression analyses were performed to analyze the factors that influenced the likelihood of changes in the food consumption profile during the pandemic.

The results of the Poisson regression analyses are expressed as gross or adjusted prevalence ratios (PRs), 95% confidence intervals (95% CIs), and p-values. To assess the quality of the model's fit, Pearson's chi-square proportion test value was divided by the degrees of freedom [24]. The model is considered well-adjusted if there is no

overdispersion, and for this reason, this proportion will be close to 1. For all analyses, statistical significance was set at $p \leq 0.05$. Analyses were performed using the Statistical Package for the Social Sciences software (version 18.0; IBM Corporation, NY, USA).

3. Results

The questionnaire was completed by 15,641 teachers from the state school system in Minas Gerais. Of these, questionnaires from 269 individuals were excluded from the analysis, as 246 were answered by pregnant women and 23 did not contain complete information, resulting in a final sample of 15,372 questionnaires. The emotional aspects, lifestyle, food consumption, and sociodemographic characteristics of the participants are shown in Table 1.

Table 1 shows that the majority of the participants were women (81.8%), were part of the group at risk for COVID-19 (65.0%), had one to two children (59.1%), gained weight during the pandemic (58.1%), and were younger adults (52.7%). More participants adopted an unhealthy food consumption profile (41.3%), and 35.8% reported changes in mental health. A small amount reported an increased consumption of alcoholic beverages (7.5%) and cigarettes (2.6%).

Table 2 shows the distribution of participants according to the food consumption profiles practiced during the pandemic. Except for separation from spouse during the pandemic and the number of residents in the home, all assessed variables differed statistically (p-values) between the periods studied according to the food consumption profiles.

Greater adherence to the healthy consumption profile showed a statistically significant association with several of the independent variables analyzed; however, the ones that had the greatest impact were decreased weight (PR = 1.58; p = 0.000), decreased physical activity (PR = 1.27; p = 0.000), reduced income (PR = 1.26; p = 0.000), reduced alcohol consumption (PR = 1.22; p = 0.000), and changes in mental health (PR = 1.19; p = 0.000) (Table 3).

Similar to the healthy consumption profile, the unhealthy profile was significantly correlated with several of the independent variables analyzed; however, the ones that impacted this profile the most were weight gain (PR = 1.54; p = 0.000), increased alcohol consumption or initiation of alcohol usage during the pandemic (PR = 1.44; p = 0.000), increased physical activity (PR = 1.43; p = 0.000), increased cigarette consumption (PR = 1.17; p = 0.000), and being a younger adult (PR = 1.17; p = 0.000) (Table 4).

Table 1 Sociodemographic characteristics, lifestyle, food consumption, and emotional aspects of the participants.

Variables evaluated	n	%
Sex		
Female	12,568	81,8
Male	2804	18,2
Age (years)		
≤43	8094	52,7
˃43	7278	47,3
Income during the pandemic		
The same or increased	9098	59,2
Decreased or lost income	6274	40,8
Separated during the pandemic		
No	12,137	79,0
I have no spouse	2890	18,8
Yes	345	2,2
Number of children		
Do not have children	4181	27,2
1 or 2	9081	59,1
3 or more	2110	13,7
Number of residents per household		
1	1019	6,6
2 to 4	12,553	81,7
5 or more	1800	11,7
It is part of the risk group for COVID-19		
Yes	9992	65,0
No	5380	35,0
Any family member, close friend, or co-worker developed severe symptoms of COVID-19		
Yes	5540	36,0
No	9832	64,0
Any family member, close friend, or co-worker died because of COVID-19		
Yes	3151	20,5
No	12,221	79,5
Changes in alcohol consumption during the pandemic		
Does not consume or no change	11,036	71,8
Not currently drinking or drinking less	3185	20,7
Consuming more or started to drink	1151	7,5
Changes in cigarette consumption during the pandemic		
Did not change	14,885	96,8
Decreased	81	0,5
Increased	406	2,6
Changes in physical activity during the pandemic		
Did not change	7835	51,0
Decreased	5028	32,7
Increased	2509	16,3
Changes in body weight during the pandemic		
Did not change	4838	31,5
Decreased	1610	10,5
Increased	8924	58,1
Changes in food consumption		
Increased consumption of healthy food	2145	14,0
Did not change	6871	44,7
Increased consumption of unhealthy food	6356	41,3
Change in mental health		
Yes	5500	35,8
No	9872	64,2

4. Discussion

This research was conducted during the first six months of the COVID-19 pandemic, and the results indicate that the pandemic changed teachers' lifestyles, psychological aspects, and food consumption profiles.

Among the participants, 14% reported consuming predominantly healthy foods, while 41.3% reported consuming unhealthy foods. These results differ from studies that

Table 2 Food consumption profile during the COVID-19 pandemic according to independent variables.

Variables evaluated	Food consumption profile during the COVID-19 pandemic			
	Maintained consumption	Healthy consumption	Unhealthy consumption	*p*-value*
Sex				
Female	5529 (80,5)	1743 (81,3)	5286 (83,3)	
Male	1342 (19,5)	402 (18,7)	1060 (16,7)	0,000
Age (years)				
≤43	3284 (47,8)	1121 (52,3)	3689 (58,0)	
˃43	3587 (52,2)	1024 (47,7)	2667 (42,0)	0,000
Income during the pandemic				
The same or increased	4351 (63,3)	1159 (54,0)	3588 (56,5)	
Decreased or lost income	2520 (36,7)	986 (46,0)	2768 (43,5)	0,000
Separated from spouse during the pandemic				
No	5444 (79,2)	1672 (77,9)	5021 (79,0)	
I have no spouse	1277 (18,6)	423 (19,7)	1190 (18,7)	
Yes	150 (2,2)	50 (2,3)	145 (2,3)	0,786
Number of children				
Do not have children	1720 (25,0)	604 (28,2)	1857 (29,2)	
1 or 2	4124 (60,0)	1246 (58,1)	3711 (58,4)	
3 or more	1027 (14,9)	295 (13,8)	788 (12,4)	0,000
Number of residents per household				
1	440 (6,4)	139 (6,5)	440 (6,9)	
2 to 4	5623 (81,8)	1735 (80,9)	5195 (81,7)	
5 or more	808 (11,8)	271 (12,6)	721 (11,3)	0,417
It is part of the high-risk group for COVID-19				
Yes	4584 (66,7)	1348 (62,8)	4060 (63,9)	0,000
No	2287 (33,3)	797 (37,2)	2296 (36,1)	
Any family member, close friend, or co-worker developed severe symptoms of COVID-19				
Yes	4680 (68,1)	1316 (61,4)	3836 (60,4)	0,000
No	2191 (31,9)	829 (38,6)	2520 (39,6)	
Any family member, close friend, or co-worker died because of COVID-19				
Yes	1218 (17,7)	481 (22,4)	1452 (22,8)	0,000
No	5653 (82,3)	1664 (77,6)	4904 (77,2)	
Changes in alcohol consumption during the pandemic				
Does not consume or no change	5310 (77,3)	1512 (70,5)	4214 (66,3)	
Not currently drinking or drinking less	1307 (19,0)	516 (24,1)	1362 (21,4)	
Consuming more or started to drink	254 (3,7)	117 (5,5)	780 (12,3)	0,000
Changes in cigarette consumption during the pandemic				
Did not change	6711 (97,7)	2087 (97,3)	6084 (95,7)	
Decreased	33 (0,5)	13 (0,6)	35 (0,6)	
Increased	127 (1,8)	45 (2,1)	234 (3,7)	0,000
Changes in physical activity during the pandemic				
Did not change	4083 (59,4)	1073 (50,0)	2679 (42,1)	
Decreased	1907 (27,8)	773 (36,0)	2348 (36,9)	
Increased	881 (12,8)	299 (13,9)	1329 (20,9)	0,000
Changes in body weight during the pandemic				
Did not change	2837 (41,3)	639 (29,8)	1362 (21,4)	
Decreased	622 (9,1)	290 (13,5)	698 (11,0)	
Increased	3471 (49,7)	1216 (56,7)	4296 (67,6)	0,000
Change in mental health				
Yes	4749 (69,1)	1322 (61,6)	3801 (59,8)	
No	2122 (30,9)	823 (38,4)	2555 (40,2)	0,000

*p-value obtained by the chi-square test.

observed positive changes in food intake during the pandemic, in which 57.2% of participants opted for fresh foods and only 25.6% for fast foods [1], while 34% and 19% perceived an improvement and worsening in diet quality, respectively [16].

Another study conducted on the Brazilian population during the first months of the pandemic showed that there was a favorable change in the participants, identified by the increased consumption of healthy food (vegetables, fruits, and legumes) and a minimal change in the indicators of unhealthy eating during the pandemic, except for in the North and Northeast regions [25].

Several changes were initiated in the professional lives of many workers, especially the teachers. Aside from restructuring the act of staying home from being associated with pleasure and relaxation into the extension of the professional environment that needs to be balanced with the domestic life, teachers had to deal with a lack of privacy, extended working hours, lack of infrastructure and skills with electronic resources, the need for the

Table 3 Prevalence of a healthy food consumption profile during the COVID-19 pandemic, crude and adjusted analysis, according to independent variables.

Variables	Healthy consumption vs. Not changed		Healthy consumption vs. Not changed	
	Gross PR* (95% CI)	*p*-value	Adjusted PR* (95% CI)	*p*-value
Sex				
Feminine	1		–	
Male	0,96 (0,87; 1,06)	0,420		
Age (years)				
≤43	1,15 (1,06; 1,23)	0,000	1,11 (1,03; 1,20)	0,009
›43	1		1	
Income during the pandemic				
The same or increased	1		1	
Decreased or lost income	1,34 (1,24; 1,44)	0,000	1,26 (1,17; 1,36)	0,000
Separated from spouse during the pandemic				
No	1		–	
I have no spouse	1,06 (0,96; 1,16)	0,225		
Yes	1,06 (0,83; 1,36)	0,618		
Number of children				
Do not have children	1		1	
1 or 2	0,89 (0,82; 0,97)	0,008	0,91 (0,84; 0,99)	0,033
3 or more	0,86 (0,76; 0,97)	0,014	0,91 (0,80; 1,03)	0,143
Number of residents per household				
1	1			
2 to 4	0,98 (0,84; 1,14)	0,815	–	
5 or more	1,05 (0,88; 1,25)	0,619		
It is part of the high-risk group for COVID-19				
Yes	0,88 (0,82; 0,95)	0,001	0,89 (0,82; 0,96)	0,003
No	1		1	
Any family member, close friend, or co-worker developed severe symptoms of COVID-19				
Yes	1,25 (1,16; 1,35)	0,000	1,14 (1,05; 1,25)	0,003
No	1		1	
Any family member, close friend, or co-worker died because of COVID-19				
Yes	1,24 (1,14; 1,36)	0,000	1,08 (0,97; 1,19)	0,143
No	1		1	
Changes in alcohol consumption during the pandemic				
Does not consume or no change	1		1	
Not currently drinking or drinking less	1,28 (1,17; 1,39)	0,000	1,22 (1,12; 1,32)	0,000
Consuming more or started to drink	1,42 (1,22; 1,66)	0,000	1,21 (1,03; 1,41)	0,019
Changes in cigarette consumption during the pandemic				
Did not change	1		–	
Decreased	1,19 (0,75; 1,89)	0,458		
Increased	1,10 (0,86; 1,42)	0,449		
Changes in physical activity during the pandemic				
Did not change	1		1	
Decreased	1,39 (1,28; 1,50)	0,000	1,27 (1,17; 1,38)	0,000
Increased	1,22 (1,09; 1,36)	0,001	1,15 (1,03; 1,28)	0,014
Changes in body weight during the pandemic				
Did not change	1		1	
Decreased	1,73 (1,54; 1,95)	0,000	1,58 (1,40; 1,78)	0,000
Increased	1,43 (1,31; 1,56)	0,000	1,30 (1,19; 1,42)	0,000
Change in mental health				
Yes	1		1	
No	1,28 (1,19; 1,38)	0,000	1,19 (1,10; 1,28)	0,000

Model adjustment parameters: X^2 = 6853,58 and value of X^2/degree of freedom = 0,761. *Prevalence ration.

reformulation of didactics, and, in many cases, lack of support for the adequate improvement of pedagogical practices and internet capabilities. These conditions have simultaneous oppressive potential and promote intense emotions [18], which directly correlate with our findings that changes in mental health are found in more than a third of teachers (35.8%).

Experiencing stressful situations can lead to both positive and negative behavioral changes. Regarding eating behavior, it is common to increase the consumption of foods rich in energy, foods containing a high amount of fats and/or sugars, which are present in fast foods, sweets, soft drinks, and other ultra-processed products [26–29]. The increased consumption of these foods is rationalized

Table 4 Prevalence of unhealthy food consumption profile during the COVID-19 pandemic, crude and adjusted analysis, according to independent variables.

Variables evaluated	Comparison unhealthy vs. Not changed		Comparison unhealthy vs. Not changed	
	Gross PR (95% CI)	*p*-value	Adjusted PR (95% CI)	*p*-value
Sex				
Feminine	1		1	
Male	0,90 (0,86; 0,95)	0,000	0,88 (0,84; 0,93)	0,000
Age (years)				
≤43	1,24 (1,19; 1,29)	0,000	1,17 (1,13; 1,21)	0,000
›43	1		1	
Income during the pandemic				
The same or increased	1		1	
Decreased or lost income	1,16 (1,12; 1,20)	0,000	1,09 (1,06; 1,13)	0,000
Separated from spouse during the pandemic				
No	1			
I have no spouse	1,00 (0,96; 1,05)	0,871	–	
Yes	1,02 (0,91; 1,15)	0,688		
Number of children				
Do not have children	1		1	
1 or 2	0,91 (0,88; 0,95)	0,000	0,95 (0,91; 0,98)	0,006
3 or more	0,84 (0,79; 0,89)	0,000	0,92 (0,86; 0,98)	0,006
Number of residents per household				
1	1		–	
2 to 4	0,96 (0,89; 1,03)	0,251		
5 or more	0,94 (0,87; 1,03)	0,175		
It is part of the high-risk group for COVID-19				
Yes	0,94 (0,90; 0,97)	0,001	0,93 (0,90; 0,96)	0,000
No	1		1	
Any family member, close friend, or co-worker developed severe symptoms of COVID-19				
Yes	1,19 (1,15; 1,23)	0,000	1,10 (1,06; 1,14)	0,000
No	1		1	
Any family member, close friend, or co-worker died because of COVID-19				
Yes	1,17 (1,12; 1,22)	0,000	1,04 (0,99; 1,09)	0,065
No	1		1	
Changes in alcohol consumption during the pandemic				
Does not consume or no change	1		1	
Not currently drinking or drinking less	1,15 (1,10; 1,20)	0,000	1,10 (1,06; 1,15)	0,000
Consuming more or started to drink	1,71 (1,64; 1,78)	0,000	1,44 (1,38; 1,51)	0,000
Changes in cigarette consumption during the pandemic				
Did not change	1		1	
Decreased	1,08 (0,86; 1,36)	0,504	1,05 (0,84; 1,33)	0,660
Increased	1,36 (1,26; 1,47)	0,000	1,17 (1,08; 1,26)	0,000
Changes in physical activity during the pandemic				
Did not change	1		1	
Decreased	1,39 (1,34; 1,45)	0,000	1,23 (1,18; 1,28)	0,000
Increased	1,52 (1,45; 1,59)	0,000	1,43 (1,37; 1,50)	0,000
Changes in body weight during the pandemic				
Did not change	1		1	
Decreased	1,63 (1,52; 1,74)	0,000	1,45 (1,36; 1,55)	0,000
Increased	1,72 (1,64; 1,80)	0,000	1,54 (1,47; 1,61)	0,000
Change in mental health				
Yes	1		1	
No	1,23 (1,19; 1,27)	0,000	1,11 (1,07; 1,15)	0,000

Model adjustment parameters: X^2 = 13,636,39 and value of X^2/degree of freedom = 1032.

because they positively affect mood by increasing the production of serotonin and dopamine [30]. With social distancing, the ability to buy food may represent the only freedom granted during this period, amplifying the relationship between food and emotion thus inhibiting individuals from restricting their food intake [10].

Opting for obesogenic foods, such as comfort foods and eating more meals, positively correlates with emotional eating [31], defined as the impulsive consumption of food resulting from emotional triggers, such as stress, boredom, and negative thinking bias [10]. This practice is greater among women because they have a higher prevalence of anxiety and depression [10,31].

The results of this study corroborate these findings. Our respondents were primarily women with increased frequency of the consumption of unhealthy foods (41.3%) and

weight gain (58.1%), in line with other studies that identified weight gain during the pandemic in 38.8% [1] and 44.5% [15] of respondents.

Remarkably, weight gain among the participants in this study occurred among individuals who adhered to both food consumption profiles, but with a higher prevalence among those who adopted an unhealthy profile.

Of the total sample, 40.8% had decreased income during the pandemic, which can be a contributing factor in the adoption of an unhealthy consumption profile, as addressed in recent research [3,6,15], but was not observed in this study. Adopting a healthy consumption profile may have been a strategy used by teachers to strengthen their immune systems to avoid the deleterious effects of COVID-19 in the event of infection by SARS-CoV-2.

Other studies [6,16,18] have identified that living with a spouse and having children may favor greater the consumption of unhealthy foods, a fact that was not confirmed in this study. These results may indicate that although these teachers had an exacerbation of their routine professional chores, they may be more concerned with the health and well-being of their families and the appropriate development of their own children.

The results of this study indicate a worrisome reality: a high percentage of teachers (65%) belong to the high-risk group for COVID-19. Being part of the high-risk group was a protective factor for both consumption profiles in this study; however, it exhibited greater protection for the healthy profile. This may be explained by the frequent release of the results of studies confirming that the most critical cases of COVID-19 occur in the elderly and those with cardiovascular and pulmonary disease, diabetes, or obesity, and that obesity seems to increase the chances of severe symptoms and a negative prognosis [30,32,33].

Experiencing stressful conditions such as having a family member, close friend, or co-worker with severe symptoms of COVID-19 (36%) or who expired due to COVID-19 (20.5%), contributed to 14% and 8% of teachers adopting a healthy food consumption profile, respectively. It is noteworthy, that these conditions can generate an increase in fear and anxiety and contribute to unhealthy lifestyle behaviors such as a reduction in physical activity. Among teachers, 16.3% and 37.2% reported an increase and decrease in physical activity, respectively. Higher values of reductions in physical activity were recorded by other researchers [6,15,16], who observed a reduction in physical activity in 43%–68% of the participants. Furthermore, a survey [3] identified increased physical activity in 38.3% of participants.

This study showed that increased intake of alcohol and cigarettes during the pandemic was associated with unhealthy eating practices. It is common to increase the use of alcoholic beverages, snacks, and fast foods, which may have occurred with the participants in this study. Other studies have also evaluated changes in lifestyle and the effects on food consumption during the pandemic [6,34]. However, these studies did not evaluate teachers.

To the best of our knowledge, this study is the first to assess the influence of the COVID-19 pandemic on the food consumption profiles of primary education teachers in a state network. Other studies have evaluated general populations [16], children [35], adolescents [36], university students [37], and health professionals [38]. Furthermore, the data collection method remotely increased the research scope, giving visibility to a greater diversity of contexts and manifestations of numerous respondents regarding the blockade effects, which, in addition to ensuring anonymity, reduced the bias of social desirability [4].

This study has some limitations. First, we used an online survey; second, a previous publication discussed this issue [39]. However, considering that COVID-19 is relatively new [40], online surveys offer excellent opportunities to collect real-time data to monitor and understand this disease in various scenarios [41]. Third, self-report bias cannot be excluded; however, this bias is shared with all the studies that have used online research during the pandemic. Furthermore, psychological changes may have influenced the responses, personal motivation, or dissatisfaction due to working conditions. Finally, establishing causal relationships was impossible because this was a cross-sectional study.

In conclusion, the COVID-19 pandemic influenced the food profiles of primary education teachers in the Minas Gerais state education system in a bidirectional manner, favoring the practice of consuming healthy or unhealthy foods. However, the simultaneous association of harmful lifestyle behaviors, such as reduced physical activity, increased intake of alcoholic beverages and cigarettes, and changes in mental health, were not only associated with adherence to an unhealthy diet profile, but also favored weight gain and individual susceptibility to unhealthy outcomes. Maintaining healthy lifestyle behaviors is paramount during this pandemic.

Financial disclosure statement

None declared.

Declaration of competing interest

None declared.

References

[1] López-Moreno M, López MTI, Miguel M, Garcés-Rimon M. Physical and psychological effects related to food habits and lifestyle changes derived from COVID-19 home confinement in the Spanish population. Nutrients 2020;12(11):3445.

[2] World Health Organization. Novel coronavirus (2019-nCoV): situation report, 19. Geneva, Switzerland: World Health Organization; 2020. https://apps.who.int/iris/handle/10665/330988?locale-attribute=pt&.

[3] Di Renzo L, Gualtieri P, Pivari F, Soldati L, Attinà A, Cinelli G, et al. Eating habits and lifestyle changes during COVID-19 lockdown: an Italian survey. J Transl Med 2020a;18(11):229.

[4] Ismail LC, Osaili TM, Mohamad MN, Marzouqi AA, Jarrar AH, Jamous DOA, et al. Eating habits and lifestyle during COVID-19 lockdown in the United Arab Emirates: a cross-sectional study. Nutrients 2020;12(11):3314.

[5] Zhao A, Li Z, Ke Y, Huo S, Ma Y, Zhang Y, et al. Dietary diversity among Chinese residents during the COVID-19 outbreak and its associated factors. Nutrients 2020;12(6):1699.
[6] Górnicka M, Drywień ME, Zielinska MA, Hamulka J. Dietary and lifestyle changes during COVID-19 and the subsequent lockdowns among polish adults: a cross-sectional online survey PLifeCOVID-19 study. Nutrients 2020;12(8):2324.
[7] Wilder-Smith A, Freedman DO. Isolation, quarantine, social distancing and community containment: pivotal role for old-style public health measures in the novel coronavirus (2019-nCoV) outbreak. J travel Med 2020;27(2). taaa020.
[8] Sidor A, Rzymski P. Dietary choices and habits during COVID-19 lockdown: experience from Poland. Nutrients 2020;12(6):1657.
[9] Zarah AB, Enriquez-Marulanda J, Andrade JM. Relationship between dietary habits, food attitudes and food security status among adults living within the United States three months post-mandated quarantine: a cross-sectional study. Nutrients 2020; 12(11):3468.
[10] Di Renzo L, Gualtieri P, Cinelli G, Bigioni G, Soldati L, Attiná A, et al. Psychological aspects and eating habits during COVID-19 home confinement: results of EHLC-COVID-19 Italian online survey. Nutrients 2020b;12(7):2152.
[11] Opie RS, O'Neil A, Itsiopoulos C, Jacka FN. The impact of whole-of-diet interventions on depression and anxiety: a systematic review of randomised controlled trials. Publ Health Nutr 2015;18(11): 2074–93.
[12] Murray CJL. Global, regional, and national incidence, prevalence, and years lived with disability for 354 diseases and injuries for 195 countries and territories, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017. Lancet 2018;392(10159): 1789–858.
[13] Firth J, Gangwisch JE, Borsini A, Wootton RE, Mayer EA. Food and mood: how do diet and nutrition affect mental wellbeing? BMJ 2020;369. m2382.
[14] Stanton R, To QG, Khalesi S, Williams SL, Alley SJ, Thwaite TL, et al. Depression, anxiety and stress during COVID-19: associations with changes in physical activity, sleep, tobacco and alcohol use in Australian adults. Int J Environ Res Publ Health 2020;17(11):4065.
[15] Matsungo TM, Chopera P. Effect of the COVID-19-induced lockdown on nutrition, health and lifestyle patterns among adults in Zimbabwe. BMJ Nutr Prev Health 2020;3(2):205–12.
[16] Cancello R, Soranna D, Zambra G, Zambon A, Invitti C. Determinants of the lifestyle changes during COVID-19 pandemic in the residents of northern Italy. Int J Environ Res Publ Health 2020; 17(17):6287.
[17] Błaszczyk-Bębenek E, Jagielski P, Bolesławska I, Jagielska A, Nitsch-Osuch A, Kawalec P. Nutrition behaviors in polish adults before and during COVID-19 lockdown. Nutrients 2020;12(10):3084.
[18] Haddad C, Zakhour M, Bou Kheir M, Haddad R, Hachach MA, Sacre H, et al. Association between eating behavior and quarantine/confinement stressors during the coronavirus disease 2019 outbreak. J Eat Disord 2020;8:40.
[19] Gasmi A, Noor S, Tippairote T, Dadar M, Menzel A, Bjørklund G. Individual risk management strategy and potential therapeutic options for the COVID-19 pandemic. Clin Immunol 2020;215: 108409.
[20] Jacka FN, Cherbuin N, Anstey KJ, Butterworth P. Dietary patterns and depressive symptoms over time: examining the relationships with socioeconomic position, health behaviours and cardiovascular risk. PLoS One 2014;9(1). e87657.
[21] Lassale C, Batty GD, Baghdadli A, Jacka F, Sánchez-Villegas A, Kivimäki M, et al. Healthy dietary indices and risk of depressive outcomes: a systematic review and meta-analysis of observational studies. Mol Psychiatr 2019;24(7):965–86.
[22] Secretaria de Estado de Saúde de Minas Gerais. Boletim Epidemiológico Coronavírus. Acesso em 25 de outubro de. 2021. Disponível em, https://coronavirus.saude.mg.gov.br/boletim.
[23] Monteiro CA, Moura EC, Jaime PC, Claro RM. Validity of food and beverage intake data obtained by telephone survey. Rev Saúde Pública 2008;42(4). https://doi.org/10.1590/S0034-89102008000400002.
[24] Heck RH, Thomas SL, Tabata LN. Multilevel and longitudinal modeling with IBM SPSS. New York, NY: Routledge; 2012. p. 439p.
[25] Steele EM, Rauber F, Costa CS, Leite MA, Gabe KT, Louzada MLC, et al. Mudanças alimentares na coorte NutriNet Brasil durante a pandemia de covid-19. Rev Saude Publica 2020;54:91.
[26] Born JM, Lemmens SGT, Rutters F, Nieuwenhuizen AG, Formisano E, Goebel R, et al. Acute stress and food-related reward activation in the brain during food choice during eating in the absence of hunger. Int J Obes 2010;34(1):172–81.
[27] Lemmens SG, Rutters F, Born JM, Westerterp-Plantenga M. Stress augments food "wanting" and energy intake in visceral overweight subjects in the absence of hunger. Physiol Behav 2011; 103(2):157–63.
[28] Ulrich-Lai YM, Fulton S, Wilson M, Petrovich G, Rinaman L. Stress exposure, food intake, and emotional state. Stress 2015;18(4): 381–99.
[29] Van Strien T, Gibson EL, Baños R, Cebolla A, Winkens LHH. Is comfort food actually comforting for emotional eaters? A (moderated) mediation analysis. Physiol Behav 2019;211:112671.
[30] Muscogiuri G, Pugliese G, Barrea L, Savastano S, Colao A. Commentary: obesity: the "achilles heel" for COVID-19? Metabolism 2020;108:154251.
[31] Al-Musharaf S. Prevalence and predictors of emotional eating among healthy young saudi women during the COVID-19 pandemic. Nutrients 2020;12(10):2923.
[32] Zhou F, Yu T, Du R, Fan G, Liu Y, Liu Z, et al. Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. Lancet 2020;395(10229): 1054–62.
[33] Yang J, Zheng Y, Gou X, Pu K, Chen Z, Guo Q, et al. Prevalence of comorbidities and its effects in coronavirus disease 2019 patients: a systematic review and meta-analysis. Int J Infect Dis 2020;94: 91–5.
[34] Rodríguez-Muñoz PM, Carmona-Torres JM, Rodríguez-Borrego MA. Influência do consumo de tabaco e álcool, de hábitos alimentares e atividade física em estudantes de enfermagem. Rev Latino-Am Enferm 2020;28. e3230.
[35] Philippe K, Chabanet C, Issanchou S, Monnery-Patris S. Child eating behaviors, parental feeding practices and food shopping motivations during the COVID-19 lockdown in France: (How) did they change? Appetite 2021;161:105132.
[36] Ruíz-Roso MB, Padilha PC, Matilla-Escalante DC, Brun P, Ulloa N, Acevedo-Correa D, et al. Changes of physical activity and ultra-processed food consumption in adolescents from different countries during Covid-19 pandemic: an observational study. Nutrients 2020;12(8):2289.
[37] Romero-Blanco C, Rodríguez-Almagro J, Onieva-Zafra MD, Parra-Fernández ML, Prado-Laguna MDC, Hernández-Martínez A. Physical activity and sedentary lifestyle in university students: changes during confinement due to the COVID-19 pandemic. Int J Environ Res Publ Health 2020;17(18):6567.
[38] De Boni RB, Balanzá-Martínez V, Mota JC, Cardoso TA, Ballester PL, Atienza-Carbonell B, et al. Depression, anxiety, and lifestyle among essential workers: a web survey from Brazil and Spain during the COVID-19 pandemic. J Med Internet Res 2020;22(10): e22835.
[39] Nayak MSDP, Narayan KA. Strengths and weakness of online surveys. IOSR J Humanit Soc Sci 2019;24(5):31–48.
[40] Grech V. Unknown unknowns - COVID-19 and potential global mortality. Early Hum Dev 2020;144:105026.
[41] Geldsetzer P. Use of rapid online surveys to assess people's perceptions during infectious disease outbreaks: a cross-sectional survey on COVID-19. J Med Internet Res 2020;22(4):e18790.