



Association between eating behavior and lifestyle habits and increase in migraine attacks in university students during Covid-19 pandemic

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Abstract

Background

The Covid-19 pandemic caused changes in the population's lifestyle and dietary patterns which are important triggers for migraine crises.

Objective

Evaluating the association between eating behavior and lifestyle habits and the increase of migraine attacks in university students during the Covid-19 pandemic.

Methods

Descriptive, cross-sectional, retrospective study carried out with university students from Salvador, Bahia, Brazil, between December/2020 and June/2021. The university students were invited by *WhatsApp*® and institutional email and then directed to the free and informed consent form and questionnaire, filled through the research management application. This research was approved by the Research Ethics Committee under evaluation report 4.351.573. Data were analyzed by descriptive analysis.

Results

A sample of 83 individuals, 89.2% women, 45.8% sedentary, 51.8% gained weight recently, 73.4% had low water intake, 59.0% had difficulty to conciliate and 50.6% had difficulty to maintain the sleep. Before the pandemic, 7.3% reported 7-14 days of migraine per month and, after, this figure increased to 24.1%. 36.1% of students associated food with migraine attacks, the main triggers were: coffee (20.5%), chocolate (14.5%), sausages (12.0%), alcohol (9.6%) and sugar (6.0%). The increase in migraine days was associated with difficulty in maintaining sleep ($p < 0.002$).

Conclusion

Despite the statistically significant result only between difficulty to conciliate the sleep and greater frequency of migraine, changes in lifestyle and eating behavior caused by the Covid-19 pandemic also seem to imply in an increase in days with migraine in university students.

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Introduction

With the onset of the Covid-19 pandemic, caused by the emergence of the Sars-CoV-2 virus and made official by the World Health Organization (WHO) in March 2020, measures have been enacted to contain the spread of the virus.¹ Thus, in face of the health crisis that was installed, social isolation was required, which caused direct impacts on the lifestyle of the population around the world. Therefore, there were impacts on the health and quality of life of the general public, including individuals with migraine.²

Migraine is a type of primary headache, considered an incapacitating disease. This clinical condition, recognized by the International Classification of Diseases (ICD), presents multifactorial etiology and, among its triggers are stress, unhealthy eating habits, dehydration, physical inactivity, hormonal changes, insomnia, and others. The symptomatology generated by migraine may vary among individuals, for instance nausea, vomiting, intolerance to sensorial stimuli (such as light, noise and smell), tinnitus and vertigo.³

The pandemic caused changes in the lifestyle and eating habits of the population, which are important triggers for migraine crises. Therefore, in the pandemic period, some changes could be observed in the onset of crises, driven by changes in sleep patterns, physical exercise, changes in diet and water intake, and a possible increase in inflammatory status with weight gain, which is associated with the onset of migraine.^{4,5} Therefore, it can be seen that migraine patients were largely affected by these changes.

Considering the impact of the pandemic period, it is imperative to study the relationship between Covid-19 and eating behavior and lifestyle in the migraine population in order to contribute to prevention and better treatment of migraine attacks. Thus, the aim of this study was to evaluate the association between eating behavior and lifestyle and increased migraine attacks in university students during the Covid-19 pandemic.

Methods

An observational, cross-sectional, retrospective study, with descriptive approach, carried out with students from the Universidade do Estado da Bahia (UNEB), Campus I, located in Salvador, Brazil, whose data collection occurred from December 2020 to June 2021. The students were summoned through the *WhatsApp*® app and an institutional e-mail and, subsequently, directed via link to

access the informed consent form, with the need to fill it out. After filling out the consent form, the university student had access to the questionnaire through a research management application.

We included only participants aged 18 years old or above, from undergraduate courses in the health area belonging to the Department of Life Sciences- Departamento de Ciências da Vida (DCV) of the UNEB. Academics from other areas not belonging to the DCV and from graduate courses, as well as professors and employees, pregnant or nursing women, were not included.

A structured questionnaire was used to collect demographic information - sex and age (stratified as <20 years old, 20 to 59 years old); marital status (single, married/stable union, and divorced); color/race (white, mixed black, black, indigenous), socioeconomic - monthly family income (<1 minimum wage, between 1 and 2 minimum wages, or ≥3 minimum wages); and lifestyle - physical activity frequency, smoking, alcohol consumption, and sleep pattern (difficulty in reconciling and maintaining sleep). Anthropometric data were collected as weight in kilograms and height in meters. The body mass index (BMI = weight/height²) was calculated from the weight and height data. We followed the criteria of the Ministry of Health (2014)⁶ and the World Health Organization (1998)⁷, for classification of nutritional status of adolescents and adults, respectively. In addition, they were asked about weight gain during the pandemic period.

Regarding dietary habits, we asked about daily water intake (0 - 500 ml, 500-1,000 ml, 1,000-1,500 ml, and >2,000 ml), which was later recoded as up to 1.5 liters and ≥2 liters; fasting time (up to 3 hours, between 4 and 6 hours, and >6 hours); and positive association between specific foods and increased migraine attacks (coffee, chocolate, tea, soft drinks, sausages, alcoholic beverages, sugar, milk, and others). We also asked about the frequency of coffee consumption (1 to 2 times a week, 3 to 4 times a week, 5 to 7 times a week, 1 to 2 times a month, and rarely).

Clinical information regarding the diagnosis of migraine was collected, using as a parameter the guidelines of the International Headache Society³. In addition, results were obtained on the monthly frequency of migraine attacks (1 to 7 days, 7 to 14 days, more than 15 days, and daily) in the period before and after the start of the pandemic, which broke out on March 17, 2020.



For categorical variables, absolute frequencies (n) and relative frequencies (%) were used. For quantitative variables, the results were presented as means and standard deviations, considering the normal distribution of data. Pearson's chi-square test and Fisher's exact test for categorical variables were used to detect significant differences with p-value <0.05. SPSS Statistics version 20.0.0 statistical software was used for data analysis.

This research was approved by the Research Ethics

Committee of UNEB, under opinion number 4.351.573.

Results

The sample consisted of 83 individuals, 89.2% were female, aged between 18 and 43, with a mean of 25.4 ± 6.9 (SD) years old. Regarding lifestyle habits 45.8% were sedentary, 32.5% were alcoholics and 4.8% smokers, 59% and 50.6% stated, in respective order, difficulty in reconciling and maintaining sleep.

Table 1. Demographic, socioeconomic and life habit characterization of university students (n=83) with migraine in the Covid-19 pandemic. Salvador-Bahia, 2020-2021.

Variable	n	%
Sex		
Female	74	89.2
Male	9	10.8
Age		
<20	9	10.8
20 to 59	74	89.2
Color/Race		
White	15	18.1
Mixed black	26	31.3
Black	34	41
Indigenous	6	7.2
Prefer not to declare	2	2.4
Marital Status		
Single	68	81.9
Married/Unmarried (stable union)	12	14.5
Divorced	3	3.6
Family income (in minimum wage)		
<1	14	16.9
1-3	55	66.3
4-5	8	9.6
7-10	3	3.6
>10	3	3.6
Physical activity		
Yes	45	54.2
No	38	45.8
Alcohol Consumption		
Yes	27	32.5
No	56	67.5
Smoking		
Yes	4	4.8
No	79	95.2
Difficulty reconciling sleep		
Yes	49	59
No	34	41
Difficulty maintaining sleep		
Yes	42	50.6
No	41	49.4



Regarding the nutritional status of the research participants, although most of them were not overweight according to the BMI, 50.6% of the respondents reported weight gain in recent months, and among these the majority gained between 5 and 10 kg (42.9%). Regarding the daily hydric intake, 73.4% of the respondents reported a hydric volume intake of 0-1,500 ml/day. About fasting periods,

74.7% of the college students with migraine reported frequent fasting intervals of up to 3 hours (24.2%), 4-6 hours (54.8%), and more than 6 hours (21%).

Regarding eating behavior, 38.6% responded positively when asked about the increase in migraine attacks being associated with some food. The most common food triggers

Table 2. Characterization of eating behavior and nutritional status of university students (n=83) with migraine in the Covid-19 pandemic. Salvador-Bahia, 2020- 2021.

Variables	n	%
BMI		
Not overweight (≤ 24.9 kg/m ²)	56	67.4
Overweight (≥ 25.0 kg/m ²)	27	32.6
Weight gain in the last 3 months		
Yes	42	50.6
No	41	49.4
Amount of weight gain in kg		
0-4.9	15	35.7
5-9.9	18	42.9
10-15	7	16.7
>15	2	4.7
Water intake		
0 – 1,500 mL/day	61	73.4
>1,500 mL/day	22	26.5
Fasting		
Yes	62	74.7
No	21	25.3
Fasting Frequency		
Up to 3 hours	15	24.2
4-6 hours	34	54.8
>6 hours	13	21
Food is a trigger for crises		
Yes	32	38.6
No	51	61.4
Frequency of trigger foods		
Coffee		
Chocolate	17	20.5
Sausages	12	14.5
Alcoholic beverage	10	12
Sugar	8	9.6
Others*	5	6
Soda	5	6
Milk	4	4.8
Coffee consumption		
Yes	67	80.7
No	16	19.3
Coffee intake frequency		
1 to 2 times a week	10	14.9
3 to 4 times a week	8	12.0
5 to 7 times a week	39	58.2
1 to 2 times a month	1	1.5
Rarely	9	13.4

* Popcorn, avocado, orange, tangerine, and onion.

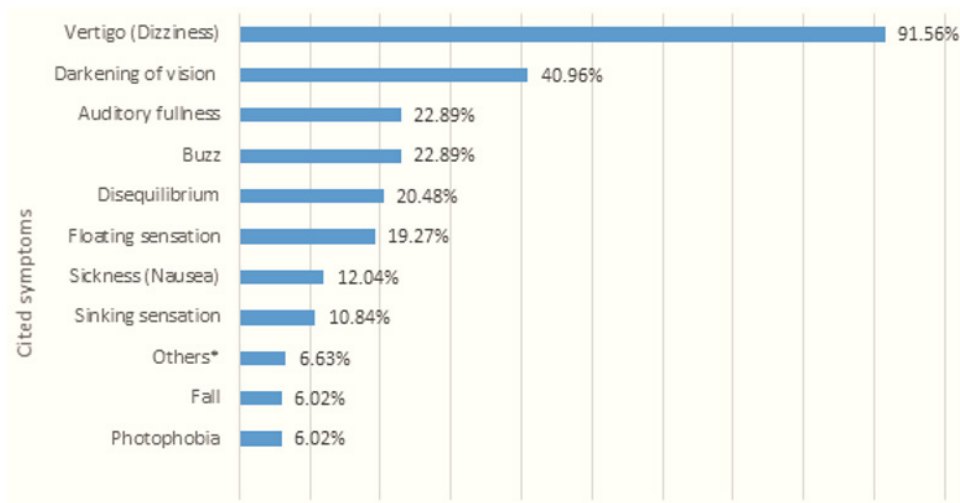


were coffee (20.5%), chocolate (14.5%), sausages (12%), alcoholic beverages (9.6%), sugar (6%), milk (4.8%), and cola (4.8%). The other foods mentioned less frequently were popcorn, avocado, and citric fruits. As for the intake of coffee, 80.7% said they consumed the beverage with a frequency of 5 to 7 times a week (58.2%), followed by 1 to 2 times a week (14.9%), 3 to 4 times a week (12%), 1 to 2 times a month (1.5%), and rarely (13.4%).

Regarding the number of days with migraine, before the pandemic 84.3% of the undergraduates claimed to have an average of 1-7 days with migraine crisis, 7.3% reported

7-14 days of crisis per month, and 8.4% reported more than 15 days, also considering the period of one month. After the beginning of the health crisis caused by Sars-CoV-2, 65.1% of the students reported 1-7 days of migraine headache per month, 24.1% and 8.4% reported on average, 7-14 days, and more than 15 days per month of migraine attacks, respectively, and the remaining, 24.4% of the respondents, reported to have migraine headache on a daily basis.

About the main symptoms cited, 91.56% of the undergraduates reported vertigo (dizziness), 40.96%



*Others: Lateral field loss, irritability, eye pain, smell irritability, and hearing loss

Figure 1. Monthly frequency of symptoms presented by university students (n=83) in Salvador, Bahia, Brazil during 2020-2021.

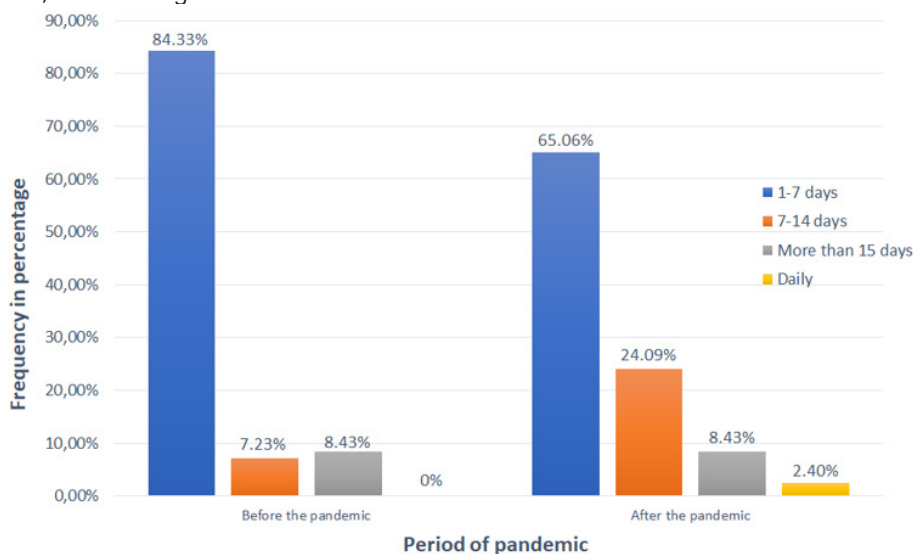


Figure 2. Frequency of presentation symptoms (%) by university students in Salvador, Bahia, Brazil during 2020-2021.



"darkening" of vision, 22.89% hearing fullness, 22.89% tinnitus, 20.48% imbalance, 19.27% floating sensation, 12.04% nausea, 10.84% sinking sensation, 6.02% photophobia, 6.02% falling, 6.02% others, and 3.61% hearing loss (Figure 1).

Most individuals, who had an increase in the days of migraine attacks during the pandemic, consumed coffee (78.3%), fasted (69.6%), gained weight (65.2%), consumed less than 1,500ml of water per day (69.6%), had difficulty

reconciling sleep (73.9%), difficulty maintaining sleep (78.3%), and did not practice physical activity (52.2%). Nevertheless, we only identified statistical significance for the relationship between increased migraine attacks and difficulty in maintaining sleep during the pandemic ($p=0.002$).

Discussion

In this study, the respondents reported an increase in the number of days of monthly migraine attacks during the pandemic, and behavioral changes were identified in the research participants. In this period, college students predominantly had difficulty in reconciling and maintaining sleep, reported weight gain in recent months, low water intake, and an important number remained sedentary. Regarding eating behavior, there was a prevalence of participants who fasted and responded positively when asked about the emergence of migraine attacks associated with some food.

The Covid-19 pandemic brought significant consequences

Table 3. Increased migraine attacks of university students (n=83) with migraine in the Covid-19 pandemic according to nutritional and lifestyle variables.

Variable	Increased number of days with migraine		p Value
	No	Yes	
Coffee consumption			
Yes	81.7% (49)	78.3% (18)	0.760*
No	18.3% (11)	21.7% (5)	
Fasting			
Yes	76.7% (46)	69.6% (16)	0.505**
No	23.3% (14)	30.4% (7)	
Nutritional status			
Not overweight	73.3% (44)	52.2% (12)	0.066**
Overweight	26.7% (16)	47.8% (11)	
Weight gain in the last 3 months			
Yes	45% (27)	65.2% (15)	0.099**
No	55% (33)	34.8% (8)	
Water intake			
≤1500 mL/day	75% (45)	69.6% (16)	0.616*
>1500 mL/day	25% (15)	30.4% (7)	
Difficulty reconciling sleep			
Yes	53.3% (32)	73.9% (17)	0.088**
No	46.7% (28)	26.1% (6)	
Difficulty maintaining sleep			
Yes	40% (24)	78.3% (18)	0.002**
No	60% (36)	21.7% (5)	
Physical exercise			
Yes	56.7% (34)	47.8% (11)	0.469**
No	43.3% (26)	52.2% (12)	
Alcohol Consumption			
Yes	77.8% (21)	22.2% (6)	0.438**
No	65% (39)	73.9% (17)	

*Fisher's exact test.

**Pearson's chi-square test.



to the population, changing lifestyle, and eating habits. The reduced activity level, imposed by the mandatory lockdown, along with the large amount of information and the uncertainties about the pandemic led to changes in sleep patterns, increased stress and anxiety and, concomitantly, increased consumption of more palatable foods as a comforting strategy to mitigate the emotional and psychological impact that the health crisis has caused, which may consequently result in weight gain.⁵

Still regarding food, during the pandemic period we observed an increase in the consumption of foods commonly considered triggers for migraine attacks, especially coffee, chocolate, sausages, and alcoholic beverages. In addition, it was noted that coffee was predominantly consumed by respondents, with a high weekly frequency, i.e., coffee consumption on a daily basis (7 days a week).

It is known that the eating behavior of each person is influenced by internal and external issues, such as food preferences, cultural, physiological, emotional, social factors, among others.^{8,9} Thus, in face of the SARS-CoV-2 outbreak and the emotional impact it caused, there was an expression of emotional eating, leading to the adoption of food consumption in order to deal with negative emotions. The food choices, therefore, are mostly for high-fat, carbohydrate-rich, and sugary foods, giving the consumption of these foods a greater sense of pleasure.¹⁰

Despite the pleasurable sensation inherent to the consumption of more palatable foods, in individuals with migraine, such foods and their respective substances may be responsible for triggering migraine attacks, such as coffee (caffeine) chocolate (caffeine, tyramine, sucrose, and sweeteners), alcoholic beverages (alcohol, histamine, and tyramine), sugar (sucrose), sausages (nitrite and nitrate, tyramine and sodium chloride, and excess fat), soda (caffeine and monosodium glutamate), and milk (tyramine).¹¹

The cause-and-effect relationship between trigger foods and migraine would be associated with the fact that, in individuals with migraine, the substances present in such foods act as proinflammatory compounds that stimulate the trigemino-vascular system, causing its activation, and consequently a cascade of reactions that trigger migraine episodes.¹²

It is noteworthy that the increase in migraine days per month during the health crisis was related not only to college students who consumed coffee, but also to those who fasted for a long time, did not practice physical activity, and had

low water intake, as well as those who gained weight and had difficulty reconciling and maintaining sleep, although with statistical significance only for difficulty maintaining sleep.

As for sleep, it is possible to associate its irregularity with the increased level of anxiety caused by the pandemic¹³, along with reduced physical activity and increased consumption of palatable foods. The result obtained in this study is in line with data presented by Di Stefano and coworkers⁵ which showed an increase in the Insomnia Severity Index (ISI) score due to the positive correlation between sleep quality and frequency and intensity of migraine during the coronavirus outbreak. In this study, it was observed that patients with worsening migraine had greater difficulty falling asleep ($p < 0.001$), maintaining sleep ($p = 0.001$), and a higher level of dissatisfaction with their sleep pattern ($p = 0.002$).^{5,14}

Individuals who are anxious and less physically active may develop a state of hyperexcitability of the sympathetic system, generating fragmented sleep, frequent awakenings during the night, and reduction of deep sleep. In the case of foods, the substances found in them can increase the secretion of serotonin, which reduces the secretion of melatonin (which is also reduced because of the worsening of sleep quality), influencing migraine. In addition, the neurotransmitter can lead to migraine attacks from the direct activation of the trigeminovascular nerve.^{10,11}

Another factor related to decreased sleep is associated with the irregular sleep pattern induced by increased secretion of pro-inflammatory cytokines due to excess adipose tissue, commonly present in cases of overweight/obesity, a nutritional state that has become more prevalent in the pandemic due to, among other factors, altered eating behavior and increased emotional eating.^{15,16}

Regarding nutritional status, in this sample, there was a predominant report of weight gain and increase in the number of days with migraine, which may favor the emergence of overweight/obesity. According to the study, there was a worsening of migraine attacks during the pandemic related, amongst others, to the consumption of food and/or beverages considered triggers for the neurological disorder, thus highlighting the relationship between the emotional state, and eating behavior with a tendency to consume more caloric, fatty, and sugary foods.¹¹

Considering the pandemic context, it is possible to hypothesize that the increased consumption of more



palatable foods, as a result of emotional eating, in association with the reduction of physical activity, may have corroborated to the higher weight gain, fact that generates a predominantly inflammatory state, influencing the emergence of migraine, considering that this feature is common between both clinical conditions: migraine and obesity.¹⁵

Regular exercise may be beneficial in cases of migraine due to improved vagal tone as well as heart rate variability.⁵ Besides, it could be an ally to avoid weight gain by balancing the proportion between energy expenditure and daily caloric intake, which, if excessive, can favor weight gain, mainly due to the foods that are usually consumed, which could potentiate the inflammatory state and influence the occurrence of migraines.¹¹

According to an Italian study¹⁷, migraine improvement was more frequent among patients who increased the level of physical exercise compared with those who reduced the activity. Such result is convergent with the data found from the sample evaluated, that 52.2% of non-exercising individuals reported an increase in the number of days with migraine.

On the other hand, fasting, by increasing the number of hours without eating, can also be a contributing factor to trigger migraine crises, due to lower rates of brain glucose that will be offered and the depolarization of neurons¹⁸. The practice of fasting was reported by most of the students who had an increase in the number of days with migraine in this research.

As well as the importance of regular meals in association with adequate quality and quantity, the correct hydric intake is also necessary, especially to prevent migraine attacks. The low intake, often cited by respondents, culminates in a state of dehydration, which is also one of the factors responsible for causing migraine attacks.^{11,12} In the participants of this research, most individuals with a daily water intake of less than 1,500 ml reported an increase in the number of days with migraine, thus emphasizing the association between low water intake and migraine attacks.

This study has limitations since it is retrospective and cross-sectional, which does not determine cause-and-effect relationships. The number of participants in the research can also be characterized as a limitation, and in addition, the questionnaire applied was filled out by self-report, which may influence the results of the research. More robust studies are needed to demonstrate the association between the eating behavior and lifestyle habits of individuals with

migraine in the face of the Covid-19 pandemic, but it does not invalidate the observations reported here and important findings.

The changes in lifestyle and eating behavior caused by the Covid-19 pandemic had repercussions in the increased number of days with migraine per month in college students. It was identified that individuals who consumed coffee, fasted for a long time, did not practice physical activity, had low water intake, as well as those who gained weight and had difficulty in reconciling and maintaining sleep increased the days of monthly migraine attacks during the pandemic. Thus, we highlight the importance of conducting studies to understand the repercussions of the Covid-19 pandemic on the lifestyle habits of the migraine population and propose intervention measures that encourage the recovery of healthy habits and assist in the control of migraine attacks increased during this period and, consequently, contribute to improve the quality of life of this public.

Conflicts of interest: The authors deny.

Authors' contribution: LOL designed the study and analyzed the data. HMSS, NHS, APPQA, MGCS, ACJS, ABLP, ESC, and LOL tabulated the data, interpreted, discussed, and wrote the results. All authors contributed to the revision of the manuscript and LOL approved the final version.

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References

1. Saúde OMD. **WHO Director-General's opening remarks at the media briefing on COVID-19 - 11 March 2020 2020** [Available from: <https://www.who.int/director-general/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19--11-march-2020>].
2. Mayasari NR, Ho DKN, Lundy DJ, Skalny AV, Tinkov AA, Teng IC, . . . Chang JS. **Impacts of the COVID-19 Pandemic on Food Security and Diet-Related Lifestyle Behaviors: An Analytical Study of Google Trends-Based Query Volumes.** *Nutrients* 2020;12(10):Doi:10.3390/nu12103103
3. **Headache Classification Committee of the International Headache Society (IHS) The International Classification of Headache Disorders, 3rd edition.** *Cephalalgia* 2018;38(1):1-211 Doi:10.1177/0333102417738202
4. Currò CT, Ciacciarelli A, Vitale C, Vinci ES, Toscano A, Vita G, . . . Autunno M. **Chronic migraine in the first COVID-19 lockdown: the impact of sleep, remote working, and other life/psychological changes.** *Neurol Sci* 2021;42(11):4403-4418 Doi:10.1007/s10072-021-05521-7
5. Di Stefano V, Ornello R, Gagliardo A, Torrente A, Illuminato E, Caponnetto V, . . . Brighina F. **Social Distancing in Chronic Migraine during the COVID-19 Outbreak: Results from a Multicenter Observational Study.** *Nutrients* 2021;13(4):Doi:10.3390/nu13041361
6. **Caderneta de Saúde do Adolescente: Ministério da Saúde 2014** [Available from: https://bvsm.s.saude.gov.br/bvs/publicacoes/caderneta_saude_adolescente_masculino.pdf].
7. report WHOJtwh. **Life in the 21st century, A vision for all.** 1998;
8. Grozeva V, Mínguez-Olaondo A, Vila-Pueyo M. **Experiment in vivo: How COVID-19 Lifestyle Modifications Affect Migraine.** *Front Neurol.* 2021;12:744796. Published 2021 Oct 5. doi:10.3389/fneur.2021.744796
9. Di Renzo L, Gualtieri P, Pivari F, et al. **Eating habits and lifestyle changes during COVID-19 lockdown: an Italian survey.** *J Transl Med.* 2020;18(1):229. Published 2020 Jun 8. doi:10.1186/s12967-020-02399-5
10. Elmacıoğlu F, Emiroğlu E, Ülker MT, Özyılmaz Kırçali B and Oruç S. **Evaluation of nutritional behaviour related to COVID-19.** *Public Health Nutr* 2021;24(3):512-518 doi:10.1017/s1368980020004140
11. Felipe M, Campos A, Vechi G and Martins LJC. **Implicações da alimentação e nutrição e do uso de fitoterápicos na profilaxia e tratamento sintomático da enxaqueca—uma revisão.** *J. Brazilian Soc. Food Nutr.* 2010;35(2):165-179.
12. Slavin M and Ailani J. **A Clinical Approach to Addressing Diet with Migraine Patients.** *Curr Neurol Neurosci Rep* 2017;17(2):17 Doi:10.1007/s11910-017-0721-6
13. Al-Hashel JY and Ismail, II. **Impact of coronavirus disease 2019 (COVID-19) pandemic on patients with migraine: a web-based survey study.** *J Headache Pain* 2020;21(1):115 Doi:10.1186/s10194-020-01183-6
14. Aleyeidi NA, Alqahtani RS, Alotaibi HF, Alotaibi AH, Alotaibi KM, Alnofiey RM. **Exploring the Impact of the COVID-19 Quarantine on the Severity of Headache, Migraine, and Stress in Saudi Arabia.** *J Pain Res.* 2021;14:3827-3835. doi: 10.2147/JPR.S332886.
15. Chai NC, Bond DS, Moghekar A, Scher AI and Peterlin BL. **Obesity and headache: Part II—potential mechanism and treatment considerations.** *Headache* 2014;54(3):459-471 Doi:10.1111/head.12297
16. Smith M, Nakamoto M, Crocker J, Tiffany Morden F, Liu K, Ma E, et. al. **Early impact of the COVID-19 pandemic on outpatient migraine care in Hawaii: Results of a quality improvement survey.** *Headache.* 2021;61(1):149-156. doi: 10.1111/head.14030. Epub 2020 Dec 14.
17. Schiano di Cola F, Caratozzolo S, Di Cesare M, Liberini P, Rao R and Padovani A. **Migraine Monitoring in the Time of COVID-19: Triggers and Protectors During a Pandemic.** *Pain Med* 2021;22(11):2728-2738 Doi:10.1093/pm/pnab202
18. Dalkara T and Kiliç K. **How does fasting trigger migraine? A hypothesis.** *Curr Pain Headache Rep* 2013;17(10):368 Doi:10.1007/s11916-013-0368-1