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ORIGINAL ARTICLE

Headache disability, lifestyle factors, health perception, and mental disorder symptoms: a cross-sectional analysis of the 2013 National Health Survey in Brazil

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Abstract

Objective To evaluate the past 2-week headache disability and explore its association with lifestyle factors, health perception, and mental disorder symptoms in the PNS 2013 survey.

Background The prevalence of headache disorders has been associated with lifestyle factors, mental disorders, and health perception. However, less is known regarding their influence on headache-related disability.

Methods In a cross-sectional analysis, chi-squared tests and logistic regression models computed the associations between headache-related disability (defined as days lost from work, school, or household chores in the past 2 weeks) and the variables of interest, compared to other disease-related disabilities groups or no day lost group. The adjusted models controlled for the effects of age, sex, income, and educational levels.

Results In the sample aged ≥ 18 years ($n = 145{,}580$), 10,728 (7.4%) participants reported any disease-related disability in the past 2 weeks (median interquartile range (IQR) for age = 47 (33–59) years, 62% women), with the median (IQR) days lost = 5 (2–14). Headache disability represented 5.3% (572/10,728) of all diseases, constituting the 4th most prevalent disease-related disability [median (IQR) days lost = 3 (3–4)]. Among people aged 18–25 years, headache disorders ranked 2nd as the most prevalent disability (13%), headache-related disability positively associated with physical inactivity, poorer health perception, and frequent mental disorders symptoms, and negatively associated with overweight, obesity, and alcohol consumption.

Conclusion Headache disability represents a leading cause of disease-related disability in Brazil and associates with unhealthy lifestyle factors, poorer health perception, and frequent mental disorder symptoms.

Keywords Headache disorders · Disability · Healthy lifestyle · Depression · Physical activity

Introduction

The impact of headache disorders on society is still an overlooked public health issue, yet it is a fast-growing research subject. Indeed, headache disability rates are increasing over time [1]. Regardless of the use of different methodologies, data from Europe, China, Brazil, and the USA have shown that headache-related disability is among the most prevalent disease-related disability and translate into higher direct and indirect costs [2–7].

The prevalence of headache disorders is influenced by lifestyle factors such as physical activity, smoking, sleeping, alcohol consumption, and TV viewing time [8–14]. Also, psychiatric comorbidities [15–17] and low well-being and health perception [18] are associated with the most prevalent primary headache disorders.

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Notwithstanding these findings, little is known about the associations between lifestyle factors, mental disorder symptoms, health perception, and the disability generated by the headache disorders. A previous analysis of the 2013 National Health Survey database in Brazil (in Portuguese: Pesquisa Nacional de Saúde—PNS 2013) revealed that headache or migraine was the 4th cause of disability among the economically active population in terms of days lost from work, school, or household chores in the past 2 weeks [2]. In this study, our aim was to estimate the headache-related disability frequency in the PNS 2013 sample and explore its association with lifestyle factors, health perception, and mental disorder symptoms, comparing with other disease-related disabilities.

Methods

Study design and sampling

This is a cross-sectional analysis of the PNS 2013 database. The survey was conducted between August 2013 and February 2014 by the Ministry of Health in conjunction with the Oswaldo Cruz Foundation and the Brazilian Institute of Geography and Statistics (Instituto Brasileiro de Geografia e Estatísticas, IBGE). The survey applied door-to-door interviews, with data collected in 64,348 households, with 205,546 people interviewed, after the exclusion of losses and non-responders (20.8% and 8.1%, respectively) [19]. We included in our analyses only the population aged ≥ 18 years, from both sexes. The survey's sampling used cluster sampling with a 3-step stratification process to identify Census-based household unity areas; therefore, this sample is geographically representative of the Brazilian population.

Outcomes

The primary outcome was to estimate the frequency of headache-related disability among people aged 18 years or more reporting any disease-related disability in the past 2 weeks in days lost from work, school, or household chores. Secondary outcomes were the relationship between headache disability, lifestyle variables (physical activity, smoking, alcohol consumption, TV viewing time, BMI), health self-perception, and mental disorder symptoms.

Headache-related disability

Disease-related disability was determined according to a set of 3 questions inquiring the number of days lost from work, school, or household chores due to disease or health condition in the past 2 weeks. The response options for the attributed cause included 22 major diseases or health conditions groups, including "headache or migraine". Table 1 shows the questions and response options with the list of diseases.

Lifestyle factors

The lifestyles variables analysed in our study included leisure-time physical activity (LTPA), television (TV) viewing time, smoking, alcohol consumption, and obesity. LTPA levels were computed according to the current weekly frequency and duration of recreational physical activity, exercise, or sports. The International Physical Activity Questionnaire (IPAQ) was used to collect LTPA data, and the levels were categorized as active, insufficiently active, and inactive, based on the WHO's physical activity recommendations [20]. Current TV viewing time levels were categorized as < 1 h/day, 1–3 h/day, and > 3 h/day. Participants provided self-reported data on weight and height, and obesity and other body weight categories were set according to WHO definitions based on body mass index (BMI): underweight

Table 1 Disability-related diseases questions in the PNS 2013 survey

Question	Answer options
1 - In the past 2 weeks, did you miss any habitual activities (work, school, or household chores) due to a health condition?	*Yes/no*
2 - In the past 2 weeks, how many days have you lost from your habitual activities due to health condition?	*"n"* days
3 - In the past 2 weeks, which was the main health condition that prevents you for doing your habitual activities?	*Back or neck pain (spine diseases), cold or flu, hypertension or heart disease, diabetes, cancer, stroke, headache or migraine, asthma bronchitis, or pneumonia, diarrhoea, nausea, vomit, gastritis, arthritis or rheumatism, upper limb pain, depression, other mental disorders, dental disease, work-related musculoskeletal pain, pregnancy complications, menstrual conditions, childbirth, dengue fever, injury by aggression or violence, injury by road accident, injury by other accident, other diseases, other health conditions*

(< 18.5 kg/m^2), normal weight (18.5–24.9 kg/m^2), overweight (≥ 25–29.9 kg/m^2), and obesity (> 30 kg/m^2) [21]. Alcohol consumption (no, < 1 drink/month, > 1 drink/month) and smoking (no, less than daily, daily) categories were set as the original response options.

Health perception and mental disorder symptoms

Health self-perception was assessed using the following question: "Overall, at which level do you rate your health?" Response options were as follows: "very good", "good", "regular", "bad", or "very bad". Questions on mental health addressed the frequency of the following symptoms in the past 2 weeks: sleep problems (sleep deprivation or oversleep), fatigue, anhedonia, concentration problems, abnormal eating patterns (eating too much or too little), lethargy or restless, agitated, depression, frustration, and suicidal ideation. The response options for the frequency of symptoms experienced were as follows: "never", "less than half the days", "more than half the days", or "almost every day".

Statistical analysis

Descriptive data are presented as percentage (%) for categorical variables and median (interquartile range—IQR) or mean (standard deviation—SD) for continuous variables.

For methodological purposes to deal with missing data and low counts among variables of interest, the disease-related disabilities were grouped into main disease categories based on their characteristics. Six groups were settled as follows: (1) headache or migraine; (2) other acute or chronic pain conditions (spine diseases, arthritis or rheumatism, upper limb pain, and work-related musculoskeletal pain); (3) major non-communicable diseases (hypertension or heart disease, diabetes, cancer, stroke, depression, and other mental disorders); (4) acute/injury/infectious diseases (cold or flu, asthma bronchitis, pneumonia, diarrhoea, nausea, vomit, gastritis, dental disease, dengue fever, injury by aggression or violence, injury by road accident, injury by other accident, childbirth, pregnancy complications, and menstrual conditions); (5) other diseases or health conditions; and (6) no day lost (for those reporting no day lost due to disease).

The asymmetry in proportions between groups for sociodemographic data, lifestyle factors, and mental disorder symptoms were calculated by chi-squared test, with Bonferroni's corrections. Differences between groups for continuous variables were assessed by median test with paired comparisons.

Multinomial logistic regression models computed the odds ratio (OR) and 95% confidence interval (95%CI) for disease-related disability according to lifestyle factors, health perception, and mental disorders symptoms. In these models, the "no day lost" group was set as the reference group in the dependent variable disease-related disability. Lifestyle variables, mental disorder symptoms, and health perception were modelled as the predictor variables. The adjusted models controlled for the effects of age, sex, education, and household income.

Missing data analysis was performed for checking missingness assumptions from variables of interest. There were no missing data for the primary outcome variable. The missing data for secondary outcome variables were classified as missing not completely at random. Therefore, we did not perform any multiple imputation technique but rather proceeded with all analyses using the observed data.

The calculations were run in the SPSS software (IBM SPSS Statistics for Windows, Version 24.0. Armonk, NY). p value < 0.05 (2-sided) was considered as statistically significant.

Results

From 145,580 respondents aged ≥ 18 years in the PNS 2013 survey (median (IQR) age = 39 (28–53) years, 52.2% women), a total of 10,728 (7.4%) reported at least 1 day lost due to disease-related disability in the past 2 weeks (median (IQR) age = 47 (33–59) years, 62% women), with the median (IQR) days lost = 5 (2–14). Spine diseases (12.7%), cold or flu (12.1%), hypertension or heart diseases (5.8%), headache or migraine (5.3%), and injury by other accident (4.1%) were the 5 most frequent causes of disease-related disability (Fig. 1). The most disabling conditions in terms of mean (SD) days lost in the past 2 weeks were stroke = 12 (4), cancer = 11 (4), other mental disorder = 11 (5), injury by road accident = 11 (4), and childbirth = 10 (5). The mean (SD) days lost due to headache or migraine was 4 (3) days in the past 2 weeks. Figure 2 illustrates the mean (SD) days lost by sex and disease groups.

Figure 3 shows the frequency of disability by disease and age range. Cold or flu and spinal diseases were the most frequent cause of disability in people under and above 45 years, respectively. Among people aged 18–25 years, headache disorders ranked 2nd as the most frequent disability (13%) (Fig. 3).

Regarding the analyses with pooled main disease category groups, Table 2 summarizes the descriptive and X^2 statistics regarding sociodemographic and lifestyle factors. Overall, compared to no day lost group, people with headache-related disability (i.e. the "headache or migraine" group) exhibited higher proportion of women, single or married, younger, Pardo, working, and lower socioeconomic status. Regarding lifestyle factors, this group also showed higher proportions of normal weight and lower proportion of alcohol consumption compared with no day lost group.

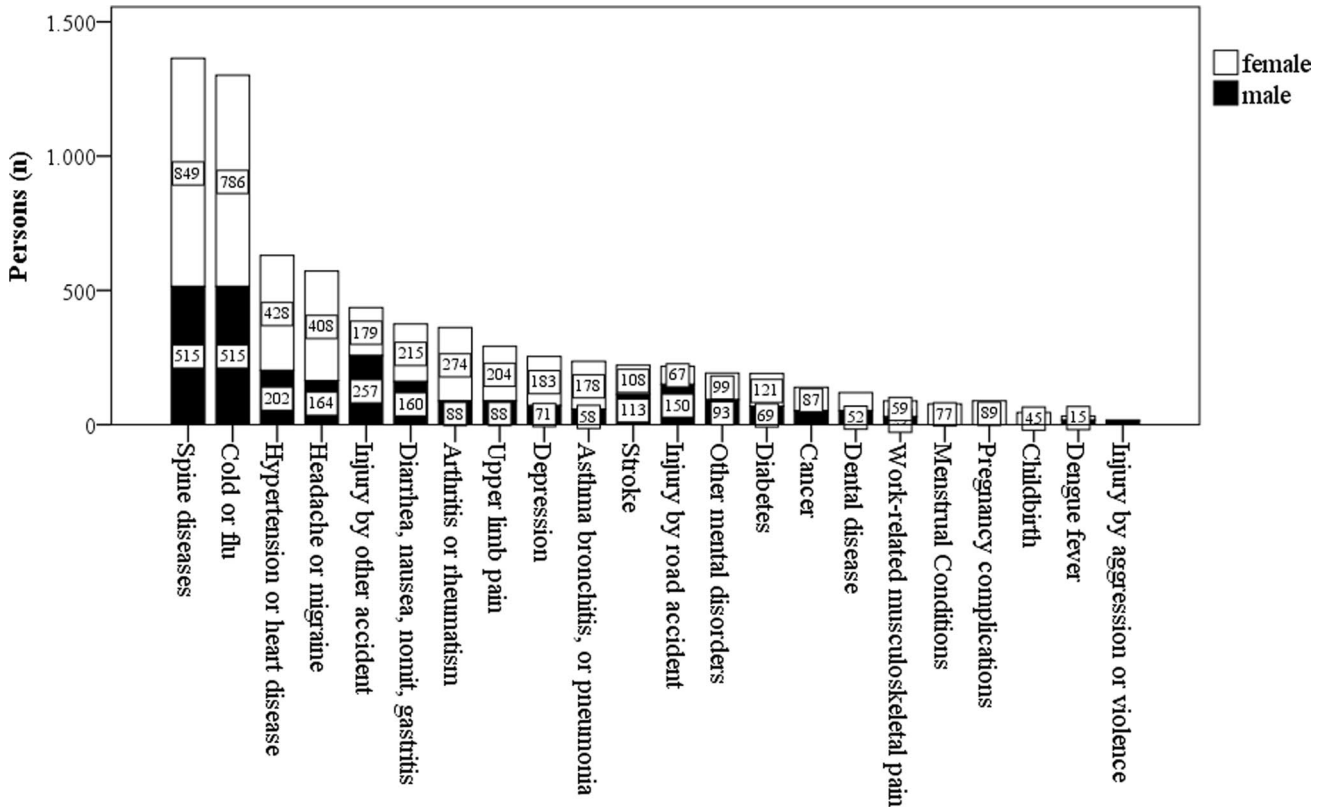

Fig. 1 Absolute cases of disease-related disability by sex and disease in the PNS 2013 survey ($n = 10{,}728$). "Other diseases" ($n = 945$) and "other health conditions" ($n = 2535$) are not included in the graph

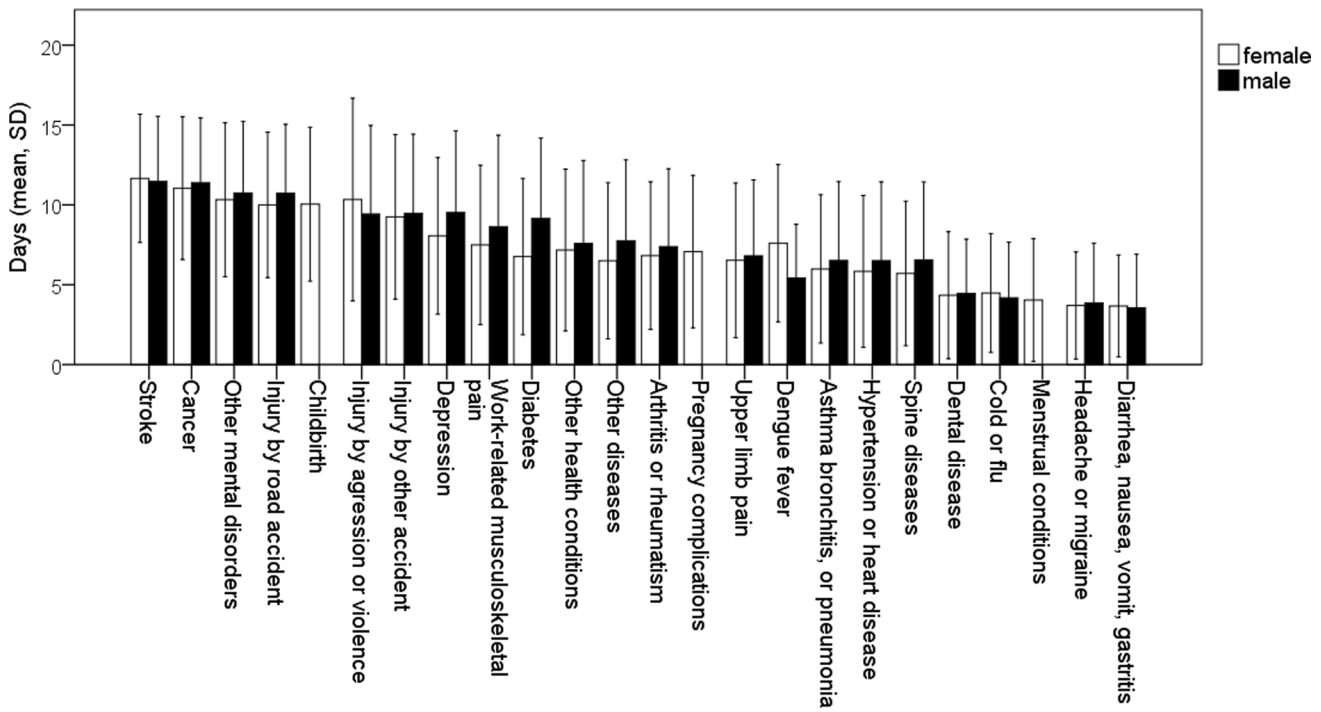

Fig. 2 Mean (standard deviation, SD) days lost in the past 2 weeks by sex and disease in the PNS 2013 survey ($n = 10{,}728$)

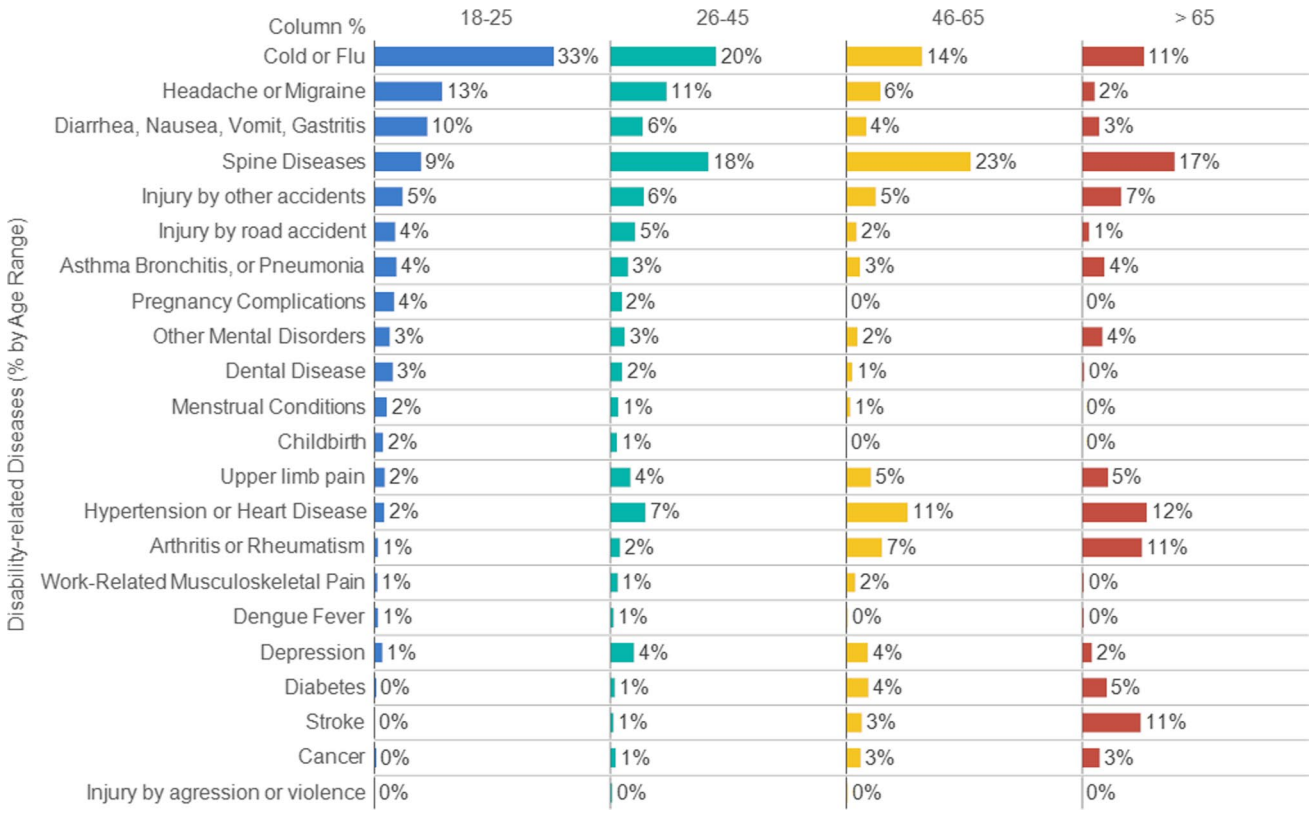

Fig. 3 Frequency of disease-related disability in the past 2 weeks by age range (years) in the PNS 2013 survey ($n = 7248$). "Other diseases" ($n = 945$) and "other health conditions" ($n = 2535$) are not included in this analysis

For the lifestyle factors, the adjusted logistic regression models showed higher odds ratio for physical inactivity (OR (95% CI): 3.11 (1.11–8.68), $p < 0.05$) in people with headache-related disability compared to no day lost group (Table 3). There were lower odds for overweight (OR (95% CI): 0.56 (0.35–0.89), $p < 0.05$), obesity (OR (95% CI): 0.41 (0.20–0.80), $p < 0.01$), and alcohol consumption > 1 drink/month (OR (95% CI): 0.57 (0.36–0.90), $p < 0.05$) in people with headache-related disability (Table 3). No significant associations were found for smoking or TV viewing time with headache disability (Table 3). The associations between lifestyle factors and the other disease-related disability groups are summarized in Supplemental Table 6.

For health perception and mental disorders symptoms, people in the headache or migraine group showed higher proportion of poorer health self-perception ratings and more frequent mental disorder symptoms compared to no day lost group (Table 4). The adjusted logistic regression models showed higher odds for the headache-related disability according to poorer health self-perception ratings and more frequent mental disorder symptoms compared to no day lost group. As shown in Table 5, the highest frequency level of all mental disorder symptoms ("almost every day") showed the highest odds for headache-related disability compared to no day lost group. The associations between mental disorder symptoms and the other disease-related disability groups are summarized in Supplemental Table 7.

Discussion

In this study, we investigated the frequency of headache disability and explored the data on lifestyle, health self-perception, and mental disorders symptoms in a nationwide sample reporting disease-related disability in the previous 2 weeks in terms of days lost from work, school, or household chores. The main findings of this study are as follows: (1) headache-related disability is among the most frequent disease-related disabilities in Brazil and (2) is associated with unhealthy lifestyle factors such as physical inactivity, (3) frequent mental disorders symptoms, and (4) poorer health self-perception, and, conversely, it dissociated from (5) alcohol consumption and (6) overweight/obesity.

The PNS 2013 survey confirms studies in Brazil [2] and in other countries [4, 6, 7], showing headache disorders as a leading cause of absenteeism either broadly in terms of days missed from work, school, household chores, or work-related absenteeism [3, 7]. Agreeably, the PNS 2013 data

Table 2 Sociodemographic and lifestyle data according to headache-related disability in the PNS 2013 survey

	Headache-related disability in the past 2 weeks	
	Yes	No
Age, median (IQR) years	38 (37–41)	39 (39–40)
Age range, *n* (%)		
18–25 years	110 (19)	26,475 (20)
26–45 years	263 (46)	58,589 (43)
46–65 years	172 (30)	36,926 (27)
> 65 years	27 (5) *	12,862 (10)
Gender, *n* (%)		
Female	408 (71) *	70,110 (52)
Ethnicity—self-reported, *n* (%)		
White	165 (29) *	53,081 (39)
Black	68 (12)	12,427 (9)
Pardo	323 (56)*	67,362 (50.0)
Other (yellow, indigenous, or ignored)	16 (3)	1982 (2)
Education, *n* (%)		
Up to incomplete high school	237 (52) *	48,473 (44)
High school. incomplete graduation	161 (36)	43,409 (39)
Complete graduation	54 (12)	18,932 (17)
Employment status, *n* (%)		
Working	338 (59)	82,271 (61)
Non-working	234 (41)	52,581 (39)
Income (US$)†, median (IQR)	323.1 (296.0–349.3)#	428.3 (419.2–436.6)
Marital status, *n* (%)		
Married	211 (36)	54,226 (40)
Separated	9 (2)	2615 (2)
Divorced	29 (5)	5011 (4)
Widowed	32 (6)	7320 (5)
Single	291 (51)	65,680 (49)
LTPA level, *n* (%)		
Inactive	60 (69)	9499 (57)
Insufficiently active	19 (22)	4773 (29)
Active	8 (10)	2349 (14)
BMI (kg/m^2), median (IQR)	23.8 (23.2–24.6) #	25.0 (24.9–25.1)
BMI, *n* (%)		
Normal weight	96 (51) *	16,036 (40)
Underweight	16 (9)	3387 (9)
Overweight	49 (26)	13,319 (34)
Obesity	26 (14)	6820 (17)
TV viewing time, *n* (%)		
< 1 h/day	83 (28)	11,990 (22)
1–3 h/day	132 (44)	26,822 (49)
> 3 h/day	81 (28)	16,123 (30)
Alcohol consumption, *n* (%)		
No drinking	220 (74) *	33,499 (61)
Less than once a month	36 (12)	7783 (14)
More than once a month	40 (14) *	13,653 (25)
Smoking, *n* (%)		
No smoking	257 (87)	47,040 (86)
Less than once a month	11 (4)	1270 (2)
More than once a month	28 (9)	6625 (12)

Yes, migraine or headache; *No*, no day lost, *IQR* interquartile range; *LTPA*, leisure-time physical activity; *BMI*, body mass index

†US dollar as for the study's reference month currency rate (2.29:1)

*p value < 0.05 vs no day lost, chi-squared, Bonferroni-adjusted

Table 2 (continued)

[#]*p* value < 0.05 vs no day lost, Bonferroni-adjusted pairwise comparisons of median test
Missing data for sociodemographic and secondary lifestyle variables ranged from 14.8 to 71.1%

Table 3 Odds ratio (OR) for headache-related disability according to lifestyle factors in the PNS 2013 survey

	Headache-related disability in the past 2 weeks	
	Crude OR (95% CI)	Adjusted OR (95% CI)
BMI (*n* = 43,178)		
Normal	Ref (1.0)	Ref (1.0)
Underweight	0.78 (0.46–1.34)	0.64 (0.30–0.35)
Overweight	**0.61 (0.43–0.86)****	**0.56 (0.35–0.89)***
Obesity	**0.63 (0.41–0.98)***	**0.41 (0.20–0.80)****
LTPA (*n* = 17,896)		
Active	Ref (1.0)	Ref (1.0)
Insufficiently active	1.16 (0.51–2.67)	2.04 (0.67–6.16)
Inactive	1.85 (0.88–3.88)	**3.11 (1.11–8.68)***
TV viewing time (*n* = 60,202)		
< 1 h/day	Ref (1.0)	Ref (1.0)
2–3 h/day	**0.71 (0.54–0.93)** *	0.99 (0.64–1.51)
> 3 h/day	**0.72 (.53–.98)***	1.14 (0.71–1.82)
Alcohol consumption (*n* = 60,202)		
No	Ref (1.0)	Ref (1.0)
< 1 drink/month	0.70 (0.49–1.00)	0.89 (0.56–1.42)
> 1 drink/month	**0.44 (0.31–0.62)*****	**0.57 (0.36–0.90)***
Smoking (*n* = 60,202)		
No smoking	Ref (1.0)	Ref (1.0)
< once/month	1.58 (0.86–2.90)	1.15 (0.42–3.15)
> once/month	0.77 (0.52–1.14)	1.03 (0.61–1.73)

Yes, migraine or headache; *No*, no day lost; bold odds ratio values reached statistically significant *p* values: *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$ vs no days lost group; *BMI*, body mass index; *LTPA*, leisure-time physical activity; the adjusted models were controlled for age, sex, income, and educational level

showed that the headache or migraine sample constitute predominantly by working, young women. As such, most of the headache-related disability in the PNS 2013 study might presumably be translated into work-related absenteeism.

Headache disorders are the 2nd cause of disability in terms of disease-adjusted lived years (DALYs) among people aged 10–24 years in the GBD study [22, 23]. Likewise, headache disability evaluated in the PNS 2013 survey reached the same position among all diseases in people aged 18–25 years. Furthermore, these primary headaches (majorly migraine) are also the most prevalent headache disorders in the primary care in Brazil [24].

However, the PNS 2013 provides data only on headache-related absenteeism and enquires on disability within a shorter time window than most studies (i.e. past 2 weeks vs past 3 months, respectively). The PNS 2013 survey does not provide data on presenteeism; thus, it ignores the presenteeism-related burden. Estimates from a nationwide database in Brazil have shown that presenteeism affects 26.2% of the employed population with headache disorders, with an average yearly loss of 22.8 days worked with ≥ 50% reduced productivity, representing an annual toll of Int$ 13.5 billion of indirect cost [2]. Indeed, in most studies, the largest share of headache burden stems from presenteeism rather than absenteeism [3, 4, 6, 7].

Yet, the disability assessed in the previous 2 weeks in the PNS 2013 may reduce recall bias, providing more reliable data on absenteeism as well as on lifestyle and mental health symptoms data. Importantly, considering the large sample size of the reference group in our analyses (i.e. the "no day lost" group), together with the high prevalence of primary headache disorders and their burden as presenteeism [2, 25, 26], which were not assessed in the PNS 2013, it is plausible to assume that the population with headache-related disability investigated here represents a narrowed range of the disability "spectrum" within the population with headache disorders in general. As such, it is relevant to characterize the lifestyle factors, health self-perception, and mental disorder symptoms related to this subpopulation.

Table 4 Comparisons of groups proportions for health self-perception ratings and mental disorders symptom frequency in the PNS 2013 survey

	Headache-related disability in the past 2 weeks	
	Yes	No
Health self-perception, *n* (%)		
Very good	18 (3)*	16,443 (12)
Good	115 (20) *	79,568 (59)
Regular	307 (54) *	33,331 (25)
Bad	109 (19) *	4711 (3)
Very bad	23 (4) *	799 (1)
Sleeping problems, *n* (%)		
Never	112 (38) *	40,033 (73)
< Half the days	61 (21) *	7575 (14)
> Half the days	39 (13) *	2766 (5)
Almost every day	84 (28) *	4561 (8)
Fatigue, *n* (%)		
Never	100 (34) *	39,240 (71)
< Half the days	94 (32) *	9961 (18)
> Half the days	37 (12) *	2656 (5)
Almost every day	65 (22) *	3078 (6)
Anhedonia, *n* (%)		
Never	130 (44) *	43,440 (79)
< Half the days	91 (301) *	7978(14)
> Half the days	31 (10) *	1757 (3)
Almost every day	44 (15) *	1760 (4)
Concentration problems, *n* (%)		
Never	166 (56) *	46,459 (85)
< Half the days	73 (25) *	5773 (10)
> Half the days	26 (9) *	1349 (2)
Almost every day	31 (10) *	1354 (3)
Eating behaviour changes, n (%)		
Never	149 (50) *	45,925 (84)
< Half the days	63 (22) *	5245 (9)
> Half the days	39 (13) *	1916 (4)
Almost every day	45 (15) *	1849 (3)
Lethargy or restless, agitated, *n* (%)		
Never	195 (66) *	48,452 (88)
< Half the days	50 (17) *	4121 (7)
> Half the days	18 (6) *	1155 (2)
Almost every day	33 (11) *	1207 (3)
Depression, *n* (%)		
Never	150 (51) *	43,944 (80)
< Half the days	77 (26) *	7326 (13)
> Half the days	25 (8) *	1939 (4)
Almost every day	44 (15) *	1726 (3)
Frustration, *n* (%)		
Never	193 (65) *	48,730 (89)
< Half the days	60 (20) *	4116 (8)
> Half the days	21 (7) *	1080 (2)
Almost every day	22 (8) *	1009 (2)
Suicidal ideation, *n* (%)		
Never	262 (88) *	53,114 (96)
< Half the days	18 (6) *	1201 (2)
> Half the days	5 (2)	322 (1)
Almost every day	11 (4) *	298 (1)

Yes, migraine or headache; *No*, no day lost; *p value < 0.05 vs no day lost, chi-squared, Bonferroni-adjusted; *LTPA*, leisure-time physical activity; *BMI*, body mass index; missing data for secondary (health perception and symptoms) variables ranged from 21.1 to 70.1%

Lifestyle factors

Physical inactivity

Our findings partly corroborate data from population-based prevalence studies, showing a similar pattern in terms of lifestyle factors and mental health among highly disabled headache subpopulations. Regarding physical activity levels, physical inactivity has been consistently associated with higher migraine and non-migraine headache prevalence [9, 13, 27]. The interpretation across studies considers the deleterious effects of physical inactivity on pain-processing functioning which could predispose to headache attacks or that avoidance behaviour towards the migraine-provoking effects of exercise could affect physical activity [28, 29]. That is, people with headache-related disability would not be able to engage in regular physical activity. Further studies are necessary to better understand this association.

BMI Regarding BMI, there are conflicting findings concerning its association with headache disorders. Obesity has been associated with higher headache/migraine prevalence and higher disability in clinical and epidemiological studies [12, 14, 30–36]. Notwithstanding, migraine has been positively associated with being underweight and inversely associated with being overweight in a Danish population [12]. As mentioned by the authors, these discrepant findings may be related to aberrant dietary patterns caused by migraine symptom attacks such as nausea and vomiting, or other factors affecting nutritional status [12]. As will be discussed later, abnormal dietary patterns related to mental disorder symptoms were associated with headache disability in the PNS 2013 study. However, our data indicate that people with headache disability in the PNS 2013 were mostly normal weight, therefore, inversely associated with overweight or obesity. Considering that weight and height data in the PNS 2013 were obtained by standardized anthropometric measurements [19], the explanation for this dis-

Table 5 Odds ratio (OR) for headache-related disability according to health self-perception ratings and mental disorders symptoms frequency in the PNS 2013 survey

	Headache-related disability in the past 2 weeks	
	Crude OR (95% CI)	Adjusted OR (95% CI)
Health self-perception ($n=145,580$)		
Regular	Ref (1.0)	Ref (1.0)
Very bad	3.12 (2.03–4.80) †	2.66 (1.07–6.57) *
Bad	2.51 (2.01–3.13) †	3.44 (2.43–4.85) †
Good	0.15 (0.12–0.19) †	0.13 (0.10–0.18) †
Very good	0.11 (0.07–0.19) †	0.06 (0.02–0.12) †
Sleep problems ($n=60,202$)		
Never	Ref (1.0)	Ref (1.0)
< Half the days	2.87 (2.10–3.93) †	2.40 (1.46–3.93) #
> Half the days	5.04 (3.49–7.27) †	5.77 (3.39–9.81) †
Almost every day	6.58 (4.95–8.75) †	8.56 (5.72–12.79) †
Fatigue ($n=60,202$)		
Never	Ref (1.0)	Ref (1.0)
< Half the days	3.70 (2.79–4.91) †	3.47 (2.28–5.27) †
> Half the days	5.46 (3.74–7.98) †	5.31 (3.05–9.22) †
Almost every day	8.28 (6.05–11.34) †	8.45 (5.36–13.32) †
Anhedonia ($n=60,202$)		
Never	Ref (1.0)	Ref (1.0)
< Half the days	3.81 (2.91–4.98) †	3.29 (2.2–4.87) †
> Half the days	5.89 (3.97–8.74) †	4.63 (2.53–8.47) †
Almost every day	8.35 (5.91–11.79) †	8.00 (4.82–13.28) †
Concentration problems ($n=60,202$)		
Never	Ref (1.0)	Ref (1.0)
< Half the days	3.53 (2.68–4.66) †	3.49 (2.35–5.19) †
> Half the days	5.39 (3.55–8.18) †	3.93 (1.96–7.87) †
Almost every day	6.40 (4.35–9.43) †	6.29 (3.46–11.41) †
Eating behaviour problems ($n=60,202$)		
Never	Ref (1.0)	Ref (1.0)
< Half the days	3.70 (2.75–4.97) †	3.31 (2.15–5.11) †
> Half the days	6.27 (4.39–8.952)†	5.18 (3.04–8.85) †
Almost every day	7.50 (5.35–10.50) †	5.48 (3.24–9.26) †
Lethargy or restless, agitated ($n=60,202$)		
Never	Ref (1.0)	Ref (1.0)
< Half the days	3.01 (2.20–4.12) †	3.29 (2.14–5.08) †
> Half the days	3.87 (2.38–6.29) †	3.17 (1.45–6.89)#
Almost every day	6.79 (4.67–9.86) †	6.43 (3.62–11.41) †
Depression ($n=60,202$)		
Never	Ref (1.0)	Ref (1.0)
< Half the days	3.07 (2.33–4.05) †	3.00 (2.01–4.46) †
> Half the days	3.77 (2.46–5.78) †	2.74 (1.35–5.53) †
Almost every day	7.46 (5.31–10.48) †	7.94 (4.80–13.14) †
Frustration ($n=60,202$)		
Never	Ref (1.0)	Ref (1.0)
< Half the days	3.68 (2.75–4.92) †	3.42 (2.23–5.25) †
> Half the days	4.90 (3.11–7.73) †	3.85 (1.85–8.01) †
Almost every day	5.50 (3.52–8.59) †	6.31 (3.41–11.70) †
Suicidal ideation ($n=60,202$)		
Never	Ref (1.0)	Ref (1.0)
< Half the days	3.03 (1.87–4.91) †	2.42 (1.12–5.23) †
> Half the days	3.14 (1.29–7.67)*	3.00 (0.73–12.31) †
Almost every day	7.48 (4.05–13.82) †	7.91 (3.14–19.92) †

Yes, migraine or headache; *No*, no day lost; *$p<0.05$, #$p<0.01$, †$p<0.001$ vs no day lost. The adjusted models controlled for age, sex, income, and educational level

crepant data here may be related to factors not accounted for on our models, such as the geographic distribution and its respective anthropometric characteristics of the headache disability sample. In fact, the sample with headache disability was majorly composed of participants from the North and Northeast regions of Brazil (66.7%), which are both the regions with the lowest prevalence of obesity in the PNS 2013 study [37]. Considering that both regions detain the lowest socioeconomic development indexes in Brazil, perhaps headache disability may be associated with other nutritional factors not necessarily related to obesity.

Alcohol consumption

Alcohol consumption was inversely associated with headache disability. Findings from population studies have shown both increased [9, 11, 18] or reduced [10, 14, 27] prevalence of headache disorders associated with alcohol consumption. A major limitation in these studies is the cross-sectional characteristics of data, which makes the interpretation of these data difficult. In one study, migraine-like hangover symptom was associated with lower alcohol consumption in 95 migraine patients [38]. Prospectively, a recent study with 98 episodic migraine patients showed that alcohol consumption up to 2 servings is not associated with headache attacks in the following day, but intake of ≥ 5 servings doubled the chances for headache attacks in the following day [39]. In our analysis, alcohol consumption > 1 dose per month negatively associated with headache disability. Although the cut-off in this alcohol consumption level is low in the PNS 2013 survey, which cluster a wide spectrum of consumption levels, the lower odds for headache disability with alcohol consumption observed here is in line with the current interpretation that fear of worsening or precipitating headache attacks due to drinking may discourage people to consume alcoholic beverages.

Health perception and mental disorder symptoms

We observed poorer health perception and more frequent mental disorder symptoms in people with headache-related disability compared to the general population. Anxiety and depression symptoms and poor mental health are associated with higher prevalence of headaches disorders, mostly migraine [15–18, 40, 41]. Depression is a predictor of headache and migraine chronification [17, 34, 42]. A growing line of evidence from symptom-based analyses indicate that anxiety and depressive symptoms are highly associated with migraine, regardless of the diagnosis of mental disorders [43, 44]. Here, the findings build on this relationship, showing that recent high headache disability is associated with frequent mental disorders symptoms, with stronger associations with depressive symptoms.

Of note, frequent sleep problems and suicidal ideation ("almost every day") showed the strongest associations with headache disability among all diseases' groups (Supplement Table 7). The emerging of these symptoms here is in line with growing body of evidence pointing to disruption of brain processes regulating circadian rhythms in the pathophysiology of primary headache such as migraine and cluster headache [45, 46]. Furthermore, the findings in the PNS 2013 are akin to previous studies showing association of these primary headaches with suicidal ideation [47, 48]. Nevertheless, it is likely that factors not evaluated here could have also influenced these associations, such as the presence of psychiatric comorbidities and sample size difference between groups. Moreover, there is evidence suggesting that depression and anxiety are undertreated in Brazil [49]. Therefore, it is likely that these conditions could substantially inflate mental disorder symptoms in this group.

Limitations and strengths

There are important limitations in our study. Firstly, there was a large proportion of missing data among the secondary outcome and sociodemographic variables. Because missingness analysis pointed to missing not completely at random, we did not run any imputation method. By analysing the observed data only, our findings may yield biased results. It is unknown which factors could explain this missingness pattern. The PNS 2013 is a very extensive survey, which could bring about exhaustion or constraints by responders to complete full data. Moreover, in populational studies, a considerable proportion of population may be unaware of diseases or other health-related outcomes. Thus, one should consider these findings only as hypothesis-generating results. Finally, as a cross-sectional analysis, the associations found here may not imply causality between variables. On the other hand, this study has strengths worth mentioning. The PNS 2013 survey comprises a large sample, which is representative of the Brazilian population. Also, the enquiries about the primary and secondary outcome variables in the past 2 weeks minimized recall bias.

Conclusion

Headache disorders represent a leading cause of disability in Brazil and are associated with unhealthy lifestyle habits carrying along severe mental disorder symptoms with negative impact on health perception. The population with headache disability in this study represents a highly disabled sample, which have missed on average a third of the days from work, school, or household chores days in the past 2 weeks. These data underscore the necessity for more public health surveillance and prevention policies to reduce headache burden.

The absence of such policies has been recently highlighted in the GBD study [1]. Moreover, considering the sociodemographic characteristics—comprising of young, working women of low socioeconomic status—the development of specific public health policies and research should prioritize this population [50]. Future national surveys should address headache prevalence and disability, adopting specific and validated instruments to accurately estimate the headache burden in Brazil.

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Data availability Not applicable.

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Declarations

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Conflict of interest The authors declare no competing interests.

References

1. Vos T, Lim SS, Abbafati C et al (2020) Global burden of 369 diseases and injuries in 204 countries and territories, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. Lancet 396:1204–1222. https://doi.org/10.1016/S0140-6736(20)30925-9
2. Oliveira AB, Queiroz LP, Rocha-Filho PS et al (2020) Annual indirect costs secondary to headache disability in Brazil. Cephalalgia 40:597–605. https://doi.org/10.1177/0333102419889357
3. Bonafede M, Sapra S, Shah N et al (2018) Direct and indirect healthcare resource utilization and costs among migraine patients in the United States. Headache 58:700–714. https://doi.org/10.1111/head.13275
4. Linde M, Gustavsson A, Stovner LJ et al (2012) The cost of headache disorders in Europe: the Eurolight project. Eur J Neurol 19:703–711. https://doi.org/10.1111/j.1468-1331.2011.03612.x
5. Peres M, Queiroz L, Rocha-Filho P et al (2019) Migraine: a major debilitating chronic non-communicable disease in Brazil, evidence from two national surveys. J Headache Pain 20:85. https://doi.org/10.1186/s10194-019-1036-6
6. Yu S, Liu R, Zhao G et al (2012) The prevalence and burden of primary headaches in China: a population-based door-to-door survey. Headache 52:582–591. https://doi.org/10.1111/j.1526-4610.2011.02061.x
7. Goetzel RZ, Long SR, Ozminkowski RJ et al (2004) Health, absence, disability, and presenteeism cost estimates of certain physical and mental health conditions affecting U.S. employers. J Occup Environ Med 46:398–412. https://doi.org/10.1097/01.jom.0000121151.40413.bd
8. Yokoyama M, Yokoyama T, Funazu K et al (2009) Associations between headache and stress, alcohol drinking, exercise, sleep, and comorbid health conditions in a Japanese population. J Headache Pain 10:177–185. https://doi.org/10.1007/s10194-009-0113-7
9. Molarius A, Tegelberg A, Ohrvik J (2008) Socio-economic factors, lifestyle, and headache disorders - a population-based study in Sweden. Headache 48:1426–1437. https://doi.org/10.1111/j.1526-4610.2008.01178.x
10. Winter AC, Hoffmann W, Meisinger C et al (2011) Association between lifestyle factors and headache. J Headache Pain 12:147–155. https://doi.org/10.1007/s10194-010-0286-0
11. Rasmussen B (1993) Migraine and tension-type headache in a general population: precipitating factors, female hormones, sleep pattern and relation to lifestyle. Pain 53:65–72. https://doi.org/10.1016/0304-3959(93)90057-V
12. Le H, Tfelt-hansen P, Skytthe A et al (2011) Association between migraine, lifestyle and socioeconomic factors: a population-based cross-sectional study. J Headache Pain 12:157–172. https://doi.org/10.1007/s10194-011-0321-9
13. Varkey E, Hagen K, Zwart J, Linde M (2008) Physical activity and headache: results from the Nord-Trøndelag Health Study (HUNT). Cephalalgia 28:1292–1297. https://doi.org/10.1111/j.1468-2982.2008.01678.x
14. Hagen K, Åsberg AN, Stovner L et al (2018) Lifestyle factors and risk of migraine and tension-type headache. Follow-up data from the Nord-Trøndelag Health Surveys 1995–1997 and 2006–2008. Cephalalgia 38:1919–1926. https://doi.org/10.1177/0333102418764888
15. Burch RC, Buse DC, Lipton RB (2019) Migraine: epidemiology, burden, and comorbidity. Neurol Clin 37:631–649. https://doi.org/10.1016/j.ncl.2019.06.001
16. Victor T, Hu X, Campbell J et al (2010) Association between migraine, anxiety and depression. Cephalalgia 30:567–575. https://doi.org/10.1111/j.1468-2982.2009.01944.x
17. Lipton RB, Seng EK, Chu MK et al (2020) The effect of psychiatric comorbidities on headache-related disability in migraine: results from the Chronic Migraine Epidemiology and Outcomes (CaMEO) Study. Headache 60:1683–1696. https://doi.org/10.1111/head.13914
18. Fernández-De-Las-Peñas C, Hernández-Barrera V, Carrasco-Garrido P et al (2010) Population-based study of migraine in Spanish adults: Relation to socio-demographic factors, lifestyle and co-morbidity with other conditions. J Headache Pain 11:97–104. https://doi.org/10.1007/s10194-009-0176-5
19. Instituto Brasileiro de Geografia e Estatística - IBGE (2014) Pesquisa Nacional de Saúde: Percepção do Estado de Saúde, Estilos de Vida e Doenças Crônicas. Ministério da Saúde 1–181
20. World Health Organization (2020) WHO guidelines on physical activity and sedentary behaviour. Geneva
21. WHO (2000) Obesity: preventing and managing the global epidemic. Geneva
22. Stovner LJ, Nichols E, Steiner TJ et al (2018) Global, regional, and national burden of migraine and tension-type headache, 1990–2016: a systematic analysis for the Global Burden of Disease Study 2016. Lancet Neurol 17:954–976. https://doi.org/10.1016/S1474-4422(18)30322-3
23. Feigin VL, Nichols E, Alam T et al (2019) Global, regional, and national burden of neurological disorders, 1990–2016: a systematic analysis for the Global Burden of Disease Study 2016. Lancet Neurol 18:459–480. https://doi.org/10.1016/S1474-4422(18)30499-X
24. Bigal ME, Bordini CA, Speciali JG (2000) Etiology and distribution of headaches in two Brazilian primary care units. Headache 40:241–247. https://doi.org/10.1046/j.1526-4610.2000.00035.x
25. Queiroz L, Peres M, Piovesan E et al (2009) A nationwide population-based study of migraine in Brazil. Cephalalgia: Int J Headache 29:642–649. https://doi.org/10.1111/j.1468-2982.2008.01782.x

26. Queiroz L, Peres MF, Piovesan EJ et al (2008) A nationwide population-based study of tension-type headache in Brazil. Headache 49:71–78. https://doi.org/10.1111/j.1526-4610.2008.01227.x
27. Lebedeva ER, Kobzeva NR, Gilev D v., Olesen J (2016) Factors associated with primary headache according to diagnosis, sex, and social group. Headache 56:341–356. https://doi.org/10.1111/head.12757
28. Farris SG, Thomas JG, Abrantes AM et al (2018) Intentional avoidance of physical activity in women with migraine. Cephalalgia Reports 1:1–8. https://doi.org/10.1177/2515816318788284
29. Farris SG, Thomas JG, Abrantes AM et al (2019) Anxiety sensitivity and intentional avoidance of physical activity in women with probable migraine. Cephalalgia 39:1465–1469. https://doi.org/10.1177/2515816318788284
30. Bond D, Buse D, Lipton R et al (2015) Clinical pain catastrophizing in women with migraine and obesity. Headache 55:923–933. https://doi.org/10.1111/head.12597
31. Kristoffersen ES, Børte S, Hagen K et al (2020) Migraine, obesity and body fat distribution – a population-based study. J Headache Pain 21:1–8. https://doi.org/10.1186/s10194-020-01163-w
32. Cindy Chai N, Scher AI, Moghekar A et al (2014) Obesity and headache: part I-a systematic review of the epidemiology of obesity and headache. Headache 54:219–234. https://doi.org/10.1111/head.12296.Obesity
33. Bigal ME, Rapoport AM (2012) Obesity and chronic daily headache. Curr Pain Headache Rep 16:101–109. https://doi.org/10.1007/s11916-011-0232-0
34. Cho SJ, Chu MK (2015) Risk factors of chronic daily headache or chronic migraine. Curr Pain Headache Rep 19:465. https://doi.org/10.1007/s11916-014-0465-9
35. Buse DC, Greisman JD, Baigi K, Lipton RB (2019) Migraine progression: a systematic review. Headache 59:306–338. https://doi.org/10.1111/head.13459
36. Cindy Chai N, Bond DS, Moghekar A et al (2014) Obesity and headache: part II - potential mechanism and treatment considerations. Headache 54:459–471. https://doi.org/10.1111/head.12297
37. Martins-Silva T, dos Santos VJ, de Mola CL et al (2019) Prevalence of obesity in rural and urban areas in Brazil: National Health Survey, 2013. Rev Bras Epidemiol 22:1–16. https://doi.org/10.1590/1980-549720190049
38. Zlotnik Y, Plakht Y, Aven A et al (2014) Alcohol consumption and hangover patterns among migraine sufferers. J Neurosci Rural Pract 5:128–134. https://doi.org/10.4103/0976-3147.131652
39. Mostofsky E, Bertisch SM, Vgontzas A et al (2020) Prospective cohort study of daily alcoholic beverage intake as a potential trigger of headaches among adults with episodic migraine. Ann Med 52:386–392. https://doi.org/10.1080/07853890.2020.1758340
40. Peres MFP, Oliveira AB, Mercante JP et al (2019) Optimism, pessimism, and migraine: a cross-sectional, population-based study. Headache 59:205–214. https://doi.org/10.1111/head.13471
41. Mercante J, Peres M, Bernik A (2011) Primary headaches in patients with generalized anxiety disorder. J Headache Pain 12:331–338. https://doi.org/10.1007/s10194-010-0290-4
42. Xu J, Kong F, Buse DC (2020) Predictors of episodic migraine transformation to chronic migraine: a systematic review and meta-analysis of observational cohort studies. Cephalalgia 40:503–516. https://doi.org/10.1177/0333102419883355
43. Lucchetti G, Peres MFP, Lucchetti ALG et al (2013) Generalized anxiety disorder, subthreshold anxiety and anxiety symptoms in primary headache. Psychiatry Clin Neurosci 67:41–49. https://doi.org/10.1111/j.1440-1819.2012.02405.x
44. Peres M, Mercante J, Tobo P et al (2017) Anxiety and depression symptoms and migraine: a symptom-based approach research. J Headache Pain 18:1–8. https://doi.org/10.1186/s10194-017-0742-1
45. Peres MF, Valença MM, Amaral FG, Cipolla-Neto J (2019) Current understanding of pineal gland structure and function in headache. Cephalalgia 39:1700–1709. https://doi.org/10.1177/0333102419868187
46. Peres MF, Sanchez del Rio M, Seabra ML et al (2001) Hypothalamic involvement in chronic migraine. J Neurol Neurosurg Psychiatry 71:747–751. https://doi.org/10.1136/jnnp.71.6.747
47. Pei JH, Wang XL, Yu Y et al (2020) Prevalence of suicidal ideation and suicide attempt in patients with migraine: a systematic review and meta-analysis. J Affect Disord 277:253–259. https://doi.org/10.1016/j.jad.2020.08.019
48. Ji Lee M, Cho SJ, Wook Park J et al (2019) Increased suicidality in patients with cluster headache. Cephalalgia 39:1249–1256. https://doi.org/10.1177/0333102419845660
49. Brunoni AR, Angélica M, Figueiredo R et al (2013) Patterns of benzodiazepine and antidepressant use among middle-aged adults. The Brazilian longitudinal study of adult health (ELSA-Brasil). J Affect Disord 151:71–77. https://doi.org/10.1016/j.jad.2013.05.054
50. Peres MFP, Oliveira AB, Sarmento EM et al (2020) Public policies in headache disorders: needs and possibilities. Arq Neuropsiquiatr 78:50–52. https://doi.org/10.1590/0004-282X20190144