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Original

Headache catastrophization and its relationship with disability, depression, anxiety, stress and sleep quality

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Abstract

Introduction
Cross-sectional studies on headache have not yet explored the influence of pain catastrophizing and associations with other psychosomatic comorbidities. The migraine-affected group of individuals was frequently associated with other clinical conditions such as depression, anxiety, stress, and poor sleep quality. These conditions exert a significant influence on carrier's coping with daily pain and helplessness, since disability hampers work and daily living activities and overly burden individual, their family, society and the health system. Identifying the elements that contribute to disability is crucial in assisting interventions that minimize these conditions.

Objective
The aim of this cross-sectional study was to evaluate how the combination of migraine and catastrophizing, associated with functional disability, depression, anxiety, stress, and sleep quality in college students, can influence the perception of pain.

Methods
The 340 participants were selected by drawing lots, in which individuals with primary headaches were assigned. Therefore, the final analysis sample consisted of 288 individuals. The sample was divided into Group with migraine and Group with other primary headaches, with the application of scales: HIT-6 and the scale of pain catastrophizing.

Results
Of the 360 participants, 20 losses were recorded due to inadequate completion of scales, leaving out 340 participants. Of these, 52/340 (15.25%) did not suffer from headaches. 288/340 (84.7%) participants that reported headaches were included in this study, of which 133/288 (46.2%) had migraine, and 155/288 (53.8%) had non-migraine headache. Women who had migraine attacks were those with the most intense anxious symptoms, worse sleep quality, and catastrophization. The odds ratio of catastrophizing was higher for the Migraine Group. Linear and multivariate logistic regression revealed that the greater the presence of catastrophizing, the greater the occurrence of migraine. Catastrophizing had a greater power of contribution related to the disability generated by the crises in the group of migrainous ($\beta = 0.564$). The migraine group has a greater perception of pain.

Conclusion
Higher catastrophization was also associated with a greater intensity of depressive and anxiety symptoms, higher perceived stress, and worse quality of sleep in headache-affected individuals in our study.

Keywords:
Catastrophization
Headache
Migraine disorder
Anxiety
Depression
Psychometrics
Pain

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Introduction

Pain catastrophization can be defined as a set of negative thought[1], in which there is an individual's tendency to overrate the painful feeling, often feeling unable or prevented from seeking a solution to relieve suffering. It is understood from the realms of amplification as an exaggerated perceived pain and rumination as a recurrence of negative thoughts about pain, helplessness, and lack of support since the individual feels unable to control the situation.[1,2]

Selective attention to body sensations, as in headache, triggers automatic threatening thoughts that influence expectation regarding health and its manifestations: physiological, such as muscular tension and pain; cognitive, such as concerns; affective, such as increased anxiety; and behavioral. These elements enhance threatening thoughts, contributing to deteriorated anxiety and pain conditions.[3]

Few studies evaluate the occurrence of catastrophization among individuals with migraine, as well as the association of migraine with functional disability and other frequent comorbidities such as depression and anxiety.[2,4-6] When catastrophizing their pain, these individuals perceive the painful crises in a more profound and incapacitating way, which may generate a negative impact on their quality of life.[4,5] Moreover, the wait for a possible headache attack is a process that generates high stress, permeated by catastrophic thoughts, and may exacerbate the expectation for the next crisis.[2,3]

Individuals with migraine affected by the sensation of the inability to overcome pain become more sensitive to the onset of other associated clinical conditions, such as depression and anxiety.[5,6] Furthermore, some psychosocial factors and their reflexes in migraine attacks are still rarely explored.[7]

This study built on the need to show new evidence on catastrophization in individuals with migraine and aimed to evaluate how combined migraine and catastrophization, associated with other clinical conditions, such as functional disability, depression, anxiety, stress, and sleep quality in university students, can influence pain perception.

Methods

Type of study and participants

This is a cross-sectional study. The population of enrolled students between 18 and 50 years of age consisted of 1,600 students enrolled at the Academic Center of a public university located in the city of Vitória de Santo Antão, Pernambuco, Brazil. The sample consisted of 360 university students in health, with a statistical measure of reference of frequency 50%, for a maximum value representative of sample size, a sampling error of 5%, and a confidence level of 95%. There was a loss of 5.6% of the sample. The power sample end was 95.7% when it was observed all the statistical measures calculated.

The selection process of the sample units considered the draw of classes that included more than 30 students from the Biological Sciences, Physical Education, Nursing, Nutrition, and Public Health courses, considering 10 classes and all students enrolled. Data collection tools were applied between January and April 2017. Participants who did not respond to a minimum of 10% of the questions on each scale used for data collection were excluded.

The Research Ethics Committee approved the study of the Health Sciences Center of the Federal University of Pernambuco (UFPE), Recife (PE), Brazil, under CAAE 57329616.7.0000.5208, receipt nº 061320/2016.

Data collection

The application of the seven self-referred psychometric scales, i.e., was performed with university students who accepted to participate in the research in the physical space of the classrooms. The completion of scales took about 30 minutes, under the supervision of the lead researcher.

We collected biodemographic information on sex, age, weight, and height. The presence of catastrophization was evaluated with the Pain Catastrophization Thoughts Scale (PCTS) validated for the Portuguese language[8] and based on the Pain Catastrophizing Scale (PCS)[1,6]. The PCTS measures the realms of rumination and hopelessness of catastrophization, consisting of 9 items, ranging from 0 to 5 points. No cutoff points are described in the literature to classify scoring scales. However, higher scores indicate a more significant presence of negative thoughts. In this study, we used a cutoff point of 1.08, which was the mean of the catastrophization values different zero calculated for each participant with a headache.

The Headache Impact Test (HIT-6) was used to assess the disability caused by headache. The combined responses total a value ranging from 36 to 78. The higher score

indicates a more significant impact of the headache on daily living. The results were classified as little or no impact: 38 to 49 points; some impact: 50 to 55 points; substantial impact: 56-59 points; very severe impact: 60 and over.[9,10] We used the criteria of the International Classification of Headache Disorders (ICHD)[11] to classify the headache types; individuals with non-migraine headache and migraine were divided into two groups and denominated: Group A (individuals with migraine) and B (students with other primary headaches).

The Beck Depression Inventory (BDI) is a 21-item psychometric self-assessment tool and was used to track the depression symptoms. Each category has four or five alternatives, which express the severity levels of depressive symptoms. The score ranges from zero to three, where zero is a lack of symptoms and three evidences the most intense ones. Scores up to 9 points suggest lack of depression or minimal symptoms; 10 to 18 points, mild to moderate depression; 19 to 29 points, moderate to severe depression; 30 to 63 points, severe depression. A score of 21 or more in the inventory is usually representative of a clinically significant depression.[12,13]

We used the 21-item Beck Anxiety Inventory (BAI) to elucidate anxiety symptoms. For each question, the individual should choose one of four levels of anxiety on a scale ranging from zero to three. The items added can achieve a total score ranging from 0 to 63, generated from the sum of the scores of individual items, which allows classification of anxiety intensity levels as mild, moderate, or severe.[14]

The Perceived Stress Scale (PSS) was used to evaluate stress, from 14 questions as answer alternatives, with a score ranging from 0 to 4 points. The scale total is the sum of the scores, and scores range from 0 to 56, and the higher the score, the greater the stress.[15,16]

The Pittsburgh Sleep Quality Index was applied to assess the sleep quality of the previous month. The global score ranges from 0 to 21 points, and the highest the score, the worse the quality of sleep. This scale classifies participants as the highest the score, the greater the tendency of bad sleep quality.[17]

Statistical Analysis

We performed analyses with measures and structuring elements, differences of means by t-test, chi-square, and odds ratio, as well as other appropriate statistical tests. Concerning statistical inferential analyses, simple linear regression, and generalized multivariate logistic regression techniques, as well as their analytical protocols[11,18] were used, evaluating the dependent variables: the presence of migraine or another type of headache, correlated with the HIT-6; and independent variables, such as age, sex, and PCTS, BDI, BAI, PSS and Pittsburgh scales.

Results

The sample was stratified according to the International Classification of Headache Disorders criteria, third edition[11], based on the definition of two groups. The first, classifying the participants with non-migraine headache, and the second, classifying those with migraine (Figure 1).

Of the 360 participants, 20 losses were recorded due to inadequate completion of scales, leaving out 340 participants. Of these, 52/340 (15.25%) did not suffer from headaches. Finally, 288/340 (84.7%) participants that reported headaches were included in this study, of which 133/288 (46.2%) had migraine, and 155/288 (53.8%) had non-migraine headache (Figure 1).

Women who had migraine attacks were those with the most intense anxious symptoms, worse sleep quality, and catastrophization (Table 1).

Table 2 shows the logistic regression for the occurrence of migraine between headache-affected individuals. It is observed that, among all variables in the model, catastrophization has a more significant impact on the changing values of probability of migraine, with an increase of 5.78 percentage points at every unit variance, with the other covariates remaining constant, with a statistically robust estimated association (odds ratio) with migraine. Depression and perceived stress were covariates that had a positive association with the occurrence of migraine. On the other hand, the interaction between catastrophization and perceived stress expressed a negative coefficient for a higher probability of occurrence of migraine.

The linear regression in Table 3 shows the association between the predictive variable, catastrophization, and other covariates, considering the absence and presence of migraine. It is noted that each unit variation in the catastrophization scale (PCTS) increases the impact of headache (HIT-6), the intensity of depressive (BDI) and anxiety symptoms (BAI), perceived stress (PSS) and sleep quality deterioration (Pittsburg Scale). Graphically, when the adjusted regression lines between migraine and non-migraine individuals are observed, differences are noted between the two situations, showing a more significant

Figure 1. Sample characterization

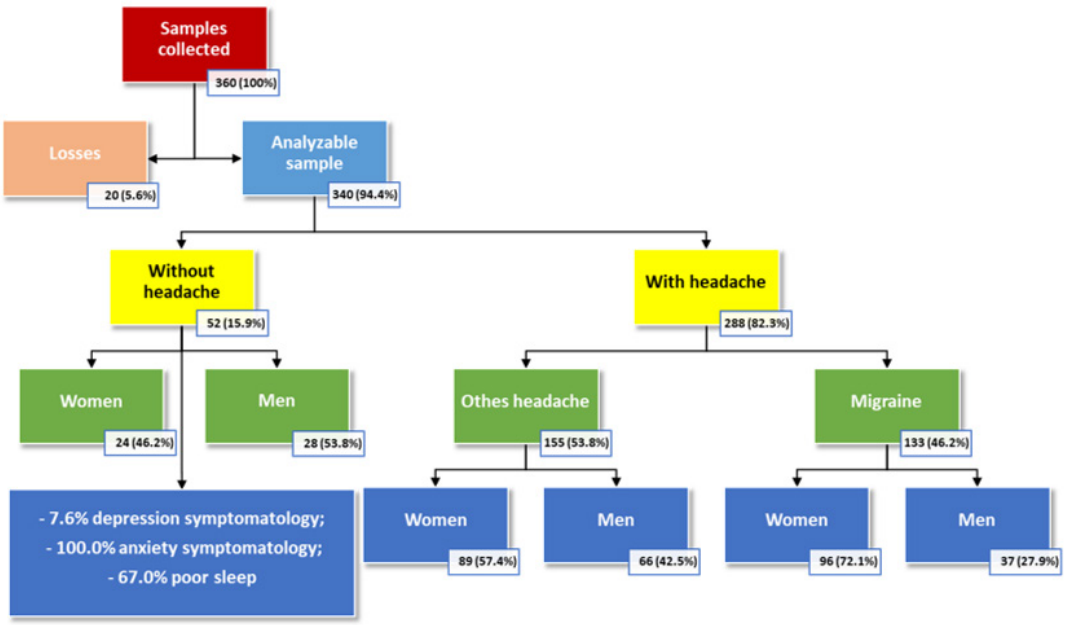


Table 1. Frequency distribution and odds ratio of clinical variables among the 288 university students with non-migraine headache (n= 155) or with migraine (n=133)

Variables	Non-migraine-related headache (n=155)		Migraine (n=133)		*Odds ratio* (95%C.I.)
Age group (yr)	**n**	**%**	**n**	**%**	
18-24	72	46.5	69	51.9	0.81 (0.51-1.28) †
25-43	83	53.5	64	48.1	
Sex					
Male	66/155	42.6	37	27.9	1.92 (1.17-3.16) †**
Female	89/155	57.4	96	72.1	
Depression BDI					
Absence	155	100.0	102	76.7	‡
BDI>	0/155	0.0	31	23.3	
Anxiety					
Mild	152	98.1	70	52.6	1.00§§***
Moderate	2	1.3	40	30.1	0.02 (0.005-0.098)
Severe	1	0.6	23	17.3	0.02 (0.003-0.151)
Sleep quality					
Good (<26)	37	23.8	16	12.1	2.29 (1.21-4.35) †**
Poor (≥26)	118	76.2	117	87.9	
Catastrophization§§§					
Absence	153	98.7	89	66.9	37.44 (10.42-234.6)
Any degree	2	1.3	44	33.1	§***

† χ^2 test without correction

‡ No odds ratios and no hypothesis testing, due to zero absolute frequency in one of the categories.

§ χ^2 test with Yates correction, due to the number of observations in one of the categories obtaining an absolute frequency < 5

§§ Linear trend χ^2 test with extension and Mantel-Haenszel: verifies the null hypothesis of increased or decreased odds ratio regarding the gradual reference of exposure of cases and controls.

§§§ Classification of the PCTS Scale with a cut-off point of 1.08 (mean of values with catastrophization different than zero included in this research).[9]

*p<0.05 **p<0.01 ***p <0.001

Table 2. Final model of the multiple logistic regression with variables associated with the presence and absence of migraine

Final model‡	Standardized Coefficient		Odds ratios	95%C.I. for OR	
				Lower	Upper
Intercept	a†	-2.866***	0.057	-	-
Catastrophization	β_1†	5.783***	324.641	12.753	8,264.222
Depression (BDI Scale)	β_2†	0.157***	1.170	1.031	1.326
Perceived Stress Scale (PSS)	β_3†	0.124***	1.131	1.059	1.209
Catastrophization and Perceived Stress Scale (PSS) interaction	β_4†	-0.157***	0.854	0.791	0.923

† a – Intercept or constant and β – Angular or slope coefficient
‡ Statistical decision parameters of the final model:
a) Omnibus test of coefficient models = 194.682 (ρ<0.001)
b) Log -2 likelihood = 202.888
c) Cox & Snell R2 = 0.491342044
d) Nagelkerke R2 = 0.656404474
e) Hosmer and Lemeshow test = 14.35 (p=0.073)
****ρ<0.001*

Table 3. Multiple linear regression models between catastrophization scale (PCTS) and Headache (Independent variables) and HIT-6, BDI, BAI, Pittsburg Scale and PSS (Dependent variables)

Dependent variables	Dependent variables	HIT6	Depression (BDI)		Anxiety (BAI)		Stress (PSS)		Sleep (Pittsburg Scale)	
Model (M)		95%CI β	M	95%CI β	M	95%CI β	M	95%CI β	M	95%CI β
Intercept (a) †	50.454*	49.621-51.288	0.999*	0.176-1.823	14.229*	13.388-15.069	9.238*	8.053-10.423	4.798*	4.487-5.109
PCTS (β_1) †	0.045*	0.036-0.054	0.022*	0.014-0.031	0.034*	0.025-0.043	0.043*	0.030-0.056	0.008*	0.005-0.012
Headache (β_2)	2.449*	1.011-3.887	5.616*	4.195-7.038	4.592*	3.141-6.042	11.041*	8.996-13.086	1.682*	1.146-2.219
R^2-*Adjusted*‡	**41.1%**		**37.7%**		**40.6%**		**52.2%**		**30.8%**	

† a – Intercept or constant and β – Angular or slope coefficient
‡ Statistical decision parameters of the final model
**ρ<0.001*

potential contribution of the scales to the migraine group (Figure 2). All slope coefficients (β) were positive and significant (ρ<0.05) in the multivariate linear regressions between catastrophization (PCTS) and headache scales with and without migraine associated with the dependent variables HIT-6, BDI, BAI, PSS, and Pittsburg Scale.

Table 4 shows the results of the multivariate linear regression of the impact of headache. Catastrophization is the variable with the most significant contribution to the process of producing disability from headache, with a strongly significant β value of 0.564 (ρ<0.001). Covariate anxiety had a negative slope coefficient with strong significance in the context of the contribution of the HIT-6 scale.

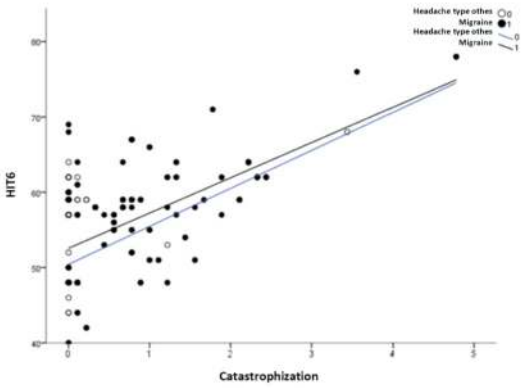
Discussion

Our study has shown that catastrophization is associated with migraine and a more significant impact of headache. This corroborates the catastrophic evidence that points to the realm of hopelessness as the most negative response to the noxious stimuli generated by pain, and suggests that this component is the most important predictor of disability and pain intensity for sufferers.[4-6,8,19]

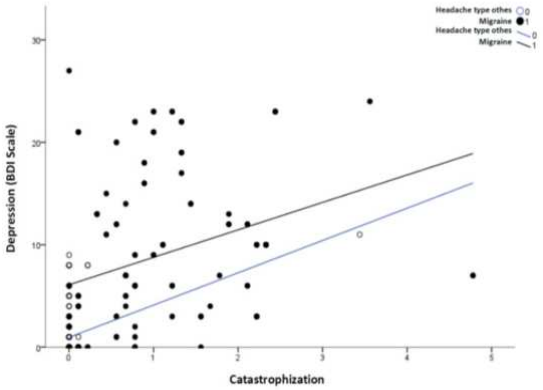
Higher catastrophization was also associated with a greater intensity of depressive and anxiety symptoms, higher perceived stress, and worse quality of sleep in headache-affected individuals in our study. The relationship between pain intensity, physical disability, and catastrophization can occur because catastrophic thoughts are oriented towards the most uncomfortable aspects at the moment of the painful experience, perceiving it in this way even more unpleasantly, which may generate less involvement in physical, social and labor activities, increasing physical deconditioning, contributing to disability. Also, there is evidence of the contribution of catastrophic thoughts to depression, anxiety, and indications that the relationship

Figure 2. Multivariate linear regressions charts between PCTS Catastrophization Scale and HIT6 (A), BDI (B), BAI (C), Pittsburg Scale (D) and PSS (E)

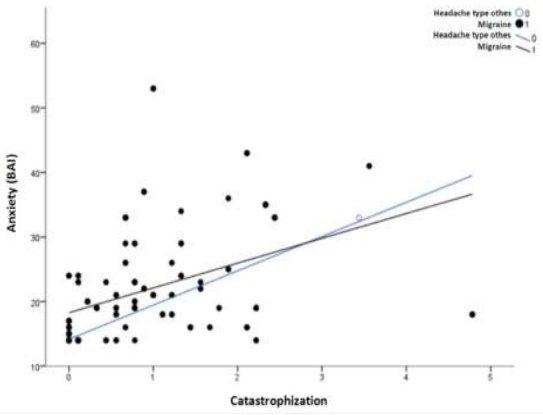
(A).



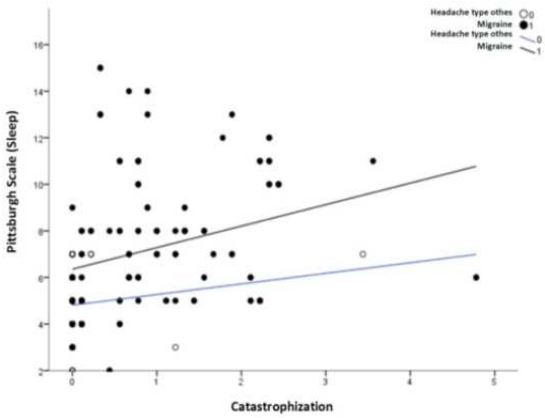
(B).



(C).



(D).



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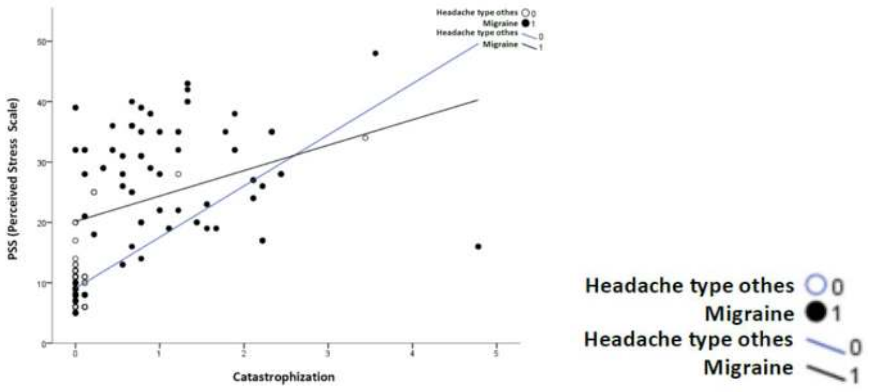


Table 4. Final multivariate logistic regression model of the variables associated with the impact on the evaluation of the headache's disability (HIT6)

Final model‡	Standardized Coefficients		95% CI Limits (β)	
			Lower	Upper
Intercept	a†	45.866***	41.952	49.780
Catastrophization	β_1†	0.564***	3.811	5.764
Migraine	β_2†	0.064	-0.735	2.489
PSS (Perceived Stress Scale)	β_3†	0.250***	0.055	0.261
Pittsburgh Scale (Sleep)	β_4†	0.164***	0.139	0.815
BAI (Anxiety)	β_5†	-0.278***	-0.414	-0.139
Age (in years)	β_6†	0.134***	0.065	0.298

† a – Intercept or constant and β – Angular or slope coefficient

‡ Statistical decision parameters of the final model:

a) Adjusted R^2 = 0.477 (Estimate standard error = 4.96), there was no significant change with the insertion of the migraine variable

b) Lack of Fit Test – ANOVA = 44.64 (p<0.001)

between these variables may contribute indirectly to physical disability.[1,3,5-7,20]

Women were more affected by migraine in this study and were more likely to have this condition than men, which corroborates most authors in previous studies.[21,22] The significant involvement of women can be partially explained by hormonal factors, in which headache plays an important role and is often potentiated and incapacitating in specific periods of the menstrual cycle.[21,22]

Depression is the comorbidity most frequently cited among individuals with migraine.[3] The process of depression can influence and enhance catastrophization, enabling an environment conducive to a favorable cycle of negative thoughts that interfere with the way crises are addressed, reducing their capacity for self-pain management.[3,5-7]

The presence of anxiety was observed in all participants, with the highest prevalence classified as severe in the migraine group. There was a strong tendency to stress that the higher the degree of anxiety, the greater the likelihood of catastrophic occurrence in migraine patients, in line with a previous study.[7] These associated factors in this population of university students can interfere significantly in productive activities, implying the varying attendance levels, trouble concentrating, which may influence the performance of academic activities.[22]

In this study, the measurement of stress and quality of sleep is shown for the first time in migraine-affected subjects, and these are essential contributors to those suffering from pain. Emotional stress is reported as one of the main factors that trigger migraine attacks, and is even correlated with their duration and intensity. Women suffering from tension-type headache and migraine have excessive levels of stress, anxiety, and depression, which directly interfered with the quality of life and the performance of daily activities.[22,23]

When the quality of sleep was evaluated, the proportion of "poor sleep" was higher and significant for migraine-affected individuals, who were more likely to be in this category, attuned to a previous study that mentions an association between depression and sleep disorders in headache-affected patients.[20]

When analyzing the contributions of catastrophic headaches associated with other clinical conditions, in this study, we confirmed the significance of catastrophization as a strong positive predictor in the occurrence of migraine, which is in line with previous studies.[5,7] Also, associations with other clinical conditions may potentiate functional disability, contributing to deteriorated suffering in times of crisis or those preceding it. Other studies also report that patients with chronic daily headache evidence low concentration and production capacity, anxiety, depression, and hopelessness, and also overlapping two or more psychological disorders.[16,22,24]

In this same direction, other research identified that patients diagnosed with migraine were more likely to show complaints related to mood, irritability, difficulties in performing daily tasks, with impaired functionality and quality of life aspects.[25,26] This finding considered pain catastrophization as a process that includes psychosocial factors and correlates with the individual's perception of pain intensity, together with a substantial self-reported functional disability.[1,2,10,22]

Catastrophization is described as a risk factor for pain progression in individuals suffering from chronic pain.[6,19] The study showed that among all variables, catastrophization provides an estimate with a more significant impact on the likelihood of migraine. Depression and perceived stress were covariates with also a positive association for migraine, corroborating with a previous study.[3]

On the other hand, the interaction between catastrophization and perceived stress expressed a negative coefficient to contribute to a higher likelihood of migraine. This is an atypical finding that diverges from the literature when it expresses that the presence of both enhances the occurrence of headaches.[3,23]

We highlight the scarce production of studies on the influence of catastrophization on patients with migraine, and this study shows that the variables associated with the impact on the assessment of headache-triggered disability from analyses reveal that catastrophization exerted a significant influence on the frequency, duration and pain sensitivity, more significant impact and reduced self-efficacy in the management of migraine crisis, which is in line with previous studies.[2,4,5,7,27]

The migraine-affected group was frequently associated with other clinical conditions such as depression, anxiety, stress, and poor sleep quality. These conditions exert a significant influence on carrier's coping with daily pain and helplessness[1,5] since disability hampers work and daily living activities and overly burden individual, their family, society and the health system. Identifying the elements that contribute to disability is crucial in assisting interventions that minimize these conditions.[6,22,27]

The main strengths of this study lie in the presentation of an analysis that ratifies pain catastrophization as significant predictive factor, and when associated with psychosocial factors such as depression, anxiety, perceived stress, and sleep quality, tends to deteriorate pain perception. The last two factors were measured for the first time in university students with migraine. An incapacitating condition, catastrophized migraine negatively reflects the quality of life of sufferers.

As limitations to the analytical study in the measurement scales, the categorized variables were less sensitive to variables in a quantitative format. Another point to highlight is that PCTS questions are not headache-specific, which has already been mentioned in a previous study.[7]

An important point that should be cited is that, in both groups, catastrophization, when associated with clinical conditions such as anxiety, perceived stress, and quality of sleep, has a significant influence on pain perception. However, in the group of people with migraine, it stands out with a more substantial impact on the perception of worsening pain.

Conclusion

In summary, the catastrophization of migraine associated with other clinical conditions evaluated in this study, such as depression, anxiety, stress, sleep quality, exerts a very significant influence on the pain-generated disability.

Public Health relevance

- Migraine expresses high magnitude in the global population that generates disabling processes with considerable impact on labor and social activities.
- People with migraines are more affected when exposed to processes that require intellectual capacity and concentration than the university population.
- The direct cost of migraine admissions in Brazil totals close to R$2.2 million (around $500,000) annually, with a growing trend throughout Brazilian regions.
- Migraine also has substantial impacts when associated with psychosomatic clinical conditions such as catastrophization, anxiety, stress, and poor quality of sleep, with more frequent evolution and the perception of the intensity of the crises.

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Author contributions: ERRS conceptualized the study; ERRS performed data curation; ERRS, AFBL performed the formal analysis; ERRS, DAO, MMV made a methodology; ERRS, AFBL, MMV managed the project; ERRS, MMV oversight the research activity, planning and execution; ERRS, AFBL validated the study; ERRS wrote the original draft; ERRS, MMV, PASRF performed the proofreading and editing.

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