



ORIGINAL ARTICLE

The role of internalizing problems on headache characteristics and pain coping strategies among adolescents diagnosed with episodic migraine

Epizodik migren tanısı olan ergenlerde baş ağrısı karakteristikleri ve ağrıyla başa çıkma stratejileri üzerinde içe yönelim sorunlarının rolü

Ozan KAYAR,¹ Fevziye TOROS,² Gülen Güler AKSU,² Aynur ÖZGE³

Summary

Objectives: The aim of this study is to investigate the correlational processes and possible mediation mechanisms between internalizing problems and significant indicators of headache (pain frequency, duration, and intensity) and pain coping strategies among adolescents diagnosed with episodic migraine.

Methods: The study sample included 143 adolescents diagnosed with episodic migraine in compliance with the diagnostic criteria specified in ICHD-3. In collecting data, Sociodemographic Information Form, Headache Questionnaire Form, Pain Coping Questionnaire, Children's Depression Questionnaire, and Screen for Child Anxiety-Related Disorders: Child Form were used. Statistical analyses of the study were carried out using the "SPSS for Windows Package Program."

Results: The findings of the study indicate that adolescents suffer from a higher headache frequency per month in parallel with higher levels of depression ($r=0.28, p<0.05$), total anxiety ($r=0.19, p<0.05$), panic disorder/somatic symptoms ($r=0.22, p<0.05$), and school avoidance ($r=0.21, p<0.05$). In addition, the higher the levels of internalizing problems among adolescents are, the more common is the use of coping strategies that give rise to feelings of helplessness in the face of pain ($r=0.27, p<0.01$). On the other hand, the study findings concerning mediation mechanisms show that the level of depression is a full mediator in correlations between the levels of panic disorders/somatic symptoms and school avoidance and both monthly headache frequency and use of coping strategies that give rise to feelings of helplessness in the face of pain among adolescents.

Conclusion: The results of the study also offer an insight into the age-related phenotypic variation and chronicity of migraine.

Keywords: Adolescence; anxiety states; depressive symptoms; migraine headache; pain coping skills.

Özet

Amaç: Bu çalışmanın amacı, epizodik migren tanısı olan ergenlerde, içe yönelim sorunları ile baş ağrısıyla ilişkili bazı önemli göstergeler (ağrı sıklığı, süresi ve şiddeti) ve ağrıyla başa çıkma stratejileri arasındaki ilişkileri ve bu ilişkilerde olası aracı mekanizmaların rolünü incelemektir.

Gereç ve Yöntem: Çalışmaya, ICHD-3 kriterleri göz önünde bulundurularak epizodik migren tanısı olan 143 ergen dahil edildi. Veri toplama sürecinde Sosyodemografik Bilgi Formu, Baş Ağrısı Anket Formu, Ağrıyla Başa Çıkma Ölçeği, Çocuklar İçin Depresyon Ölçeği ve Çocuklarda Anksiyete Bozukluklarını Tarama Ölçeği: Çocuk Formu kullanıldı. Çalışmanın istatistiksel analizleri ise "SPSS Windows Paket Programı" aracılığıyla yapıldı.

Bulgular: Araştırmanın bulguları epizodik migren tanısı olan ergenlerin, depresyon ($r=0,28, p<0,05$), toplam anksiyete ($r=0,19, p<0,05$), panik bozukluk/somatik yakınmalar ($r=0,22, p<0,05$) ve okul fobisi ($r=0,21, p<0,05$) düzeyleri arttıkça aylık ağrı sıklıklarının da arttığını göstermektedir. Ayrıca ergenlerde içe yönelim sorunları düzeyleri arttıkça, ağrıyla başa çıkmada işlevsel olmayan bir strateji olarak kabul edilen ağrı karşısında çaresizlik hissettiren tutumlarla başa çıkma stratejisi kullanımının da anlamlı olarak arttığı bulundu ($r=0,27, p<0,01$). Öte yandan çalışmanın aracılık analizi sonuçlarına göre ergenlerde panik bozukluk/somatik yakınmalar ve okul fobisi düzeyleri ile hem aylık ağrı sıklığı hem de ağrı karşısında çaresizlik hissettiren tutumlarla başa çıkma stratejisi kullanımı arasındaki ilişkilerde depresyon düzeyinin tam aracı rolünün varlığı söz konusudur.

Sonuç: Çalışmadan elde edilen sonuçların migrenin yaşa bağlı fenotipik değişiminin ve kronikleşmesinin anlaşılması açısından araştırmacılara ve uygulamacılara ışık tutacak özellikte olduğu düşünülmektedir.

Anahtar sözcükler: Ağrıyla başa çıkma yöntemleri; anksiyete durumları; ergenlik; depresif semptomlar; migren baş ağrısı.

¹Department of Psychology, Çankırı Karatekin University Faculty of Letters, Çankırı, Türkiye

²Department of Child and Adolescent Psychiatry, Mersin University Faculty of Medicine, Mersin, Türkiye

³Department of Neurology, Mersin University Medical Faculty, Mersin, Türkiye

Submitted (Başvuru) 24.11.2021 Accepted (Kabul) 23.05.2022 Available online (Online yayımlanma) 14.07.2023

Correspondence: Dr. Ozan Kayar. Çankırı Karatekin Üniversitesi, Edebiyat Fakültesi, Psikoloji Bölümü, Çankırı, Türkiye.

Phone: +90 - 376 - 218 95 00 / 7581 **e-mail:** ozankayar@karatekin.edu.tr

© 2023 Turkish Society of Algology

Introduction

Literature notes that during adolescence, an individual suffering from migraine, at times a stressor by itself, may encounter even further difficulties.^[1] Migraine affects 10% of adolescents, causing these individuals significant problems at home, at school, and socially.^[2,3] Despite the high prevalence of migraine in childhood and adolescence, less is known about the biopsychosocial factors associated with migraine for this group than for those experienced in adulthood.^[4] Recently, research has started to investigate pediatric migraine in the context of correlation with emotional, behavioral, and social variables, and to address various psychobiological areas that may impact the occurrence of headaches among children and adolescents.^[5-7] On the other hand, in the literature, researchers have identified benefits in classifying pediatric and adolescent mental health disorders and identified a series of behavioral abnormalities as internalizing and externalizing problems.^[8] This classification makes the assessment of internalizing problems easier to analyze as these problems are grouped under either a single heading or under separate headings due to the prevalent concurrence of these problems. It also facilitates a more comprehensive examination of correlations between internalizing problems and other variables. Internalizing problems include depression, anxiety disorders, and medically unexplained somatic symptoms, all of which give rise to a plethora of symptoms, in which individuals generally experience internally. Externalizing problems include attention deficiency hyperactivity disorder (ADHD), conduct disorder, and oppositional defiant disorder (ODD), all of which cause symptoms that negatively affect others rather than the individual themselves.^[9]

Epidemiological and clinical studies in the literature show that a pediatric sample of individuals diagnosed with migraine reported a significantly higher incidence of both internalizing and externalizing problems in general, but a higher incidence of internalizing problems in particular and these experiences created a negative impact on their life functionality.^[10-13] Relevant studies in a pediatric sample indicate the presence of internalizing problems to be the cause of increased pain frequency, intensity, and duration, all of significance in the evaluation of headache characteristics, as well as of phenotypic variations attributed to chronic migraine and

a delayed response to treatment.^[14-16] Correlations between headache characteristics and internalizing problems are reported to be more complicated among children and adolescents, with headaches and internalizing problems affecting each other alternately and coping strategies being associated with both phenomena.^[17] Moreover, there is an emphasis in the literature on the importance of coping strategies due to the potential for behavior adopted during adolescence to be internalized and become permanent behavioral patterns.^[18]

The present study focuses on two main aims. The primary aim of the study is to investigate correlations between internalizing problems and significant characteristics relating to headache (pain frequency, duration, and intensity) among adolescents diagnosed with episodic migraine, and their pain coping strategies. In the context of the research studies in the literature, however, when authors address these correlations, it is observed that they tend to overlook the nuances in primary headache categories (e.g., migraine and tension-type headaches) and inclined to examine these correlations mostly under an umbrella heading (such as "Pediatric individuals presenting with headaches or chronic pain").^[14,15,19-21] Furthermore, authors tend to address pediatric groups in a broader age range, that is, in a combined group of individuals in childhood and adolescence taking into consideration age-related variations that can emerge in distinct developmental areas.^[22,23] Besides, the episodic or chronic nature of headache characteristics among patients may also affect study results. Literature indicates that pain characteristics, comorbidities with mental disorders, and coping strategies will vary in quantity and quality in line with the episodic or chronic nature of headache diagnosis among adolescents.^[24-26] Therefore, a decision was taken to limit the sample of this study to a specific age range and group of diagnoses. In addition, the study addresses another focal point concerning the presence or absence of other factors that trigger internalizing problems in an effort to scrutinize a range of hypotheses and thus to have wider perspectives in this field. This course of action aims to contribute to shedding light on the correlations between the emotional aspect of migraine (internalizing problems) and the phenotypic presentation and behavioral aspect of pain (coping strategies) among adolescents diagnosed with episodic migraine.

Material and Methods

Participants

One hundred and eighty-one adolescents in total presented at Mersin University Pediatric and Adolescent Headache Polyclinic symptoms of headache in the data collection time period for the study. Subsequent neurological assessment excluded 38 of these from the study due to either ineligibility of headache type such as primary and secondary headaches, chronic migraine, and tension-type headache) or compliance criteria issues. A further eight adolescents were excluded from the dataset due to incomplete questionnaires. Ultimately, 143 adolescents diagnosed with episodic migraine (with or without aura) in line with the ICHD-3 criteria were included in the study. The inclusion and exclusion criteria for the study sample ensured that the study only included adolescents with parental approval for their inclusion in the study; with auditory and visual abilities sufficient to complete study forms; with cognitive capacities sufficient to conduct the study; whose additional mental disorders had been diagnosed in line with the DSM-V diagnostic criteria; who had not suffered any major head trauma or any stress disorder following a major head trauma or had any hospital visit with symptoms associated with any of such occurrences in the past 1 month; who did not have any other medical condition that might account for the headache; who had not abused any headache medication (painkillers, etc.) or any other substance; and who were not pregnant at the time of the study.

Data Collection Tools

Sociodemographic Information Form

Sociodemographic characteristics of adolescents diagnosed with episodic migraine were explored using a form providing information on such variables as sex, economic level, family structure, parental educational background, and parental togetherness or lack thereof.

Headache Questionnaire Form

Information required for the neurological assessment of adolescents was collected through a questionnaire prepared by Özge et al.^[27] with consideration for the ICHD-3 diagnostic criteria. This information was reviewed by a headache specialist (AÖ) and corroborated through face-to-face interviews, family interviews, and medical examination.

Pain Coping Questionnaire (PCQ)

A "PCQ" was used to identify the coping strategies used by adolescents diagnosed with episodic migraine. The scale was developed by Kleinke^[28] to establish pain-specific affective and behavioral patterns, and later translated into Turkish by Karaca et al.^[29] The PCQ evaluates patterns adopted by patients with a variety of symptoms to cope with organic or psychogenic pain. It consists of four subscores covering both functional and non-functional pain coping strategies. These subscores are comprised the self-management, which includes items on coping styles such as the tendency of individuals to adopt distracting behaviors to move away from negative thoughts, communication skills, relaxation training, and the level of individual know-how on pain; the conscious coping attempts, which includes factors on mental coping process such as diverting attention away from pain cognitively, reinterpreting pain, and daydreaming; helplessness, which is showing attitudes that give rise to feelings of helplessness to cope with pain, which is defined as catastrophizing or the feeling of having experienced a catastrophe and inefficacy in coping with pain effectively. This subscore involves items on cognitive distortions adopted by individuals in the context of selective abstraction, overgeneralization, and personalization. The fourth subscore is the medical remedies that entail items on how individuals cope with medical treatment and the use of painkillers in pain management. The 29-item scale was based on self-reporting and scored on a 4-point Likert scale with each item scored between 0 and 3.

Children's Depression Questionnaire (CDQ)

Two questionnaires were employed to identify the levels of depression among the adolescents diagnosed with episodic migraine to assess their internalizing problems. The first of these questionnaires was "CDQ." This self-assessment questionnaire applicable for children in the age range of 6–17 years was developed by Kovacs.^[30] Validity and reliability of the questionnaire was undertaken by Öy^[31] and found the cutoff point for psychopathology as 19. The 27-item questionnaire includes three options for every item and asks the responding child or adolescent to choose the sentence that best describes their feelings during the past 2 weeks. Each item on the questionnaire is scored with "0, 1, or 2 points" depending on the severity of the corresponding symptom. The maximum score possible on the questionnaire was 54 and the higher the score, the more severe the depression.

Screen for Child Anxiety-related Disorders (SCARED)

Child form: For the purposes of the study, the other scale employed to identify the levels of anxiety among the adolescents diagnosed with episodic migraine to assess their internalizing problems was the "SCARED." This was developed by Birmaher et al.^[32] The screen was investigated by Çakmakçı^[33] for validity and reliability. There are two forms of the screen, namely, one for parents and one for children. Specifically, a 41-item form developed for children was applied in the study. The screen asks the responding child/adolescent to select the item that best describes their situation to assess their anxiety. Each item on the screen is scored with "0, 1, or 2 points." The evaluation results in a total score with a cutoff point at 25 and the scores under five separate factors. The five subscores calculated separately on the screen have their own cutoff points and cover separation anxiety, generalized anxiety, panic disorder or somatic symptoms, social anxiety, and school avoidance.^[32]

Procedure

Approval for the study was obtained from Mersin University Social and Human Sciences Ethics Board (date of approval: February 04, 2019, protocol code: 018). The adolescents presenting at Mersin University Faculty of Medicine Pediatric and Adolescent Headache Polyclinic during the time period specified for the study were assessed by Prof. Dr. Aynur Özge, a headache specialist. Assessments were done against ICHD-3 criteria and the aforementioned forms were used to identify their headache diagnoses, differential headache characteristics, and sociodemographic characteristics. The adolescents, who had either presented at the Pediatric and Adolescent Headache Polyclinic with symptoms of headache directly or been referred here by the pediatric psychiatry polyclinic for a neurological assessment, also undergone a mental health assessment conducted by assistants from the pediatric psychiatry polyclinic with consideration for the DSM-V diagnostic criteria. Adolescents found eligible for the study in line with the inclusion and exclusion criteria and their parents were informed about the aims of the study and were asked to read and sign the voluntary consent form. All respondents indicated their willingness to take part in the study voluntarily. The respondents were provided

with detailed explanations on completing the questionnaires and the purposes of data collection. They were then asked to complete the CDQ and SCARED to identify levels of anxiety, and the PCQ for the study to determine strategies to cope with headache. Respondents were provided with breaks between the questionnaires. The adolescents were given the questionnaires in alternating orders to contain the sequence effect during the completion of the questionnaires.

Statistical Analysis

For the statistical analysis, the "SPSS for Windows" program was used to assess study data, together with the descriptive statistical methods. The Pearson Correlation Coefficient was used for the correlational analysis. Results were assessed in the 95% and 99% confidence range, with a significance level of $p < 0.05$ and $p < 0.01$. The mediation analyses of the study were carried out considering the mediation conditions suggested by Baron and Kenny.^[34]

Results

Descriptive Findings

A review of the sociodemographic characteristics of the study sample indicates their age range as 12–18 years; average age as 15.36 years; and standard deviation as 1.91. About 66.4% of the sample were female ($n=95$) and 33.6% male ($n=48$). When asked about their economic level, 25.9% of parents described it as poor ($n=37$), 58.7% as medium ($n=84$), and 15.4% as good ($n=22$). A detailed look into the information concerning parental educational background shows that 49% of the mothers are elementary school graduates ($n=71$), 30.8% high school graduates ($n=44$), 14.7% higher education graduates ($n=21$), and 4.9% undergraduates or postgraduates ($n=7$). For fathers, 50.3% are elementary school graduates ($n=72$), 28% high school graduates ($n=40$), 14% higher education graduates ($n=20$), and 7.7% undergraduates or postgraduates ($n=11$). Parents of 86% of the adolescents are still together ($n=123$), while 14% of the adolescents come from divorced or separated families ($n=20$) (Table 1).

The neurological assessment undertaken for the study diagnosed 66.4% of the adolescents with episodic migraine without aura ($n=95$) and 33.6% with

Table 1. Sociodemographic characteristics, headache characteristics, and comorbid psychiatric diagnoses of adolescents diagnosed with episodic migraine

	n	%
Gender		
Female	95	66.4
Male	48	33.6
Socioeconomic level		
Poor	37	25.9
Medium	84	58.7
Good	22	15.4
Maternal educational background		
Elementary school	71	49.7
High school	44	30.8
Higher education	21	14.7
Undergraduate and higher	7	4.9
Paternal educational background		
Elementary school	72	50.3
High school	40	28.0
Higher education	20	14.0
Undergraduate and higher	11	7.7
Parental togetherness		
Together	123	86.0
Divorced/separated	20	14.0
Neurological diagnosis		
Episodic migraine with aura	48	33.6
Episodic migraine without aura	95	66.4
Mental disorder		
One diagnosis	38	26.6
Comorbidity	37	25.9
No diagnosis	68	47.5
Primary mental disorder diagnosis		
ADHD	25	17.5
GAD	19	13.3
MDD	8	5.6
Other	22	17.3
Comorbidity status		
ADHD and other	12	21.1
MDD and other	5	8.8
SAD and other	2	3.5
SLD and other	2	3.5
Age (Mean±SD)	15.36	1.91
Pain frequency (per month) (Mean±SD)	9.93	3.85
Pain duration (minutes) (Mean±SD)	240.56	305.35
Pain intensity (1–10) (Mean±SD)	7.69	1.28

ADHD: Attention deficiency hyperactivity disorder; GAD: Generalized anxiety disorder; MDD: Major depressive disorder; SAD: Social anxiety disorder; SLD: Specific learning disorders; SD: standard deviation.

episodic migraine with aura (n=48). A headache questionnaire was employed to question significant headache characteristics of adolescents included in the study. A review of the number of headache attacks experienced in a month among the adolescents indicates the average as 9.93 (range: 2–15) and the standard deviation as 3.85. As for the duration of a headache attack from the beginning to the end, the average duration is 240.56 min (range: 14–1440 min) and the standard deviation is 303.35. Finally, the average intensity of headaches among the adolescents was found to be 7.69 (range: 4–10) and the standard deviation to be 1.28 (Table 1).

The study also examined the concurrence of comorbid mental disorders among adolescents diagnosed with episodic migraine. Results show that 26.6% of the adolescents had been diagnosed with a mental disorder accompanying migraine (n=38) and 25.9% had been diagnosed with at least one comorbid mental disorder (n=37), whereas results in 47.5% of the adolescents did not show any indication of mental disorder accompanying migraine (n=68). A review of the diagnoses of primary mental disorders accompanying migraine establishes that 17.5% of the adolescents suffered from ADHD (n=25); 13.3% from generalized anxiety disorder (GAD) (n=19); 5.6% from major depressive disorder (MDD) (n=8); 4.2% from obsessive compulsive disorder and social anxiety disorder (SAD) (n=6); 1.4% from specific learning disorders (SLD), post-traumatic stress disorder (PTSD), and panic disorder (n=2); and 0.7% from school avoidance, disruptive mood dysregulation disorder, tic disorder, and bipolar syndrome (n=1). Moreover, a close look at the other mental disorders comorbid with more common diagnoses of primary mental disorders among the adolescents shows that in 21.1% of the sample, ADHD is accompanied by GAD, separation anxiety disorder, ODD, MDD, SLD, panic disorder, school avoidance, and PTSD (n=12), related here in the order of prevalence. In addition, 8.8% of the adolescents are found to suffer most commonly from GAD, followed by panic disorder, along with MDD (n=5), whereas in 3.5% of the adolescents, the SAD diagnosis is accompanied most commonly by GAD, followed by school avoidance (n=2) and the SLD diagnosis is accompanied most commonly by ADHD, followed by GAD (n=2) (Table 1).

Table 2. Inter-variable correlation coefficients (n=143)

	1	2	3	4	5	6	7	8	9	10	11	12	13
1. SM	–												
2. Helplessness	-0.00	–											
3. CCA	0.79	0.13	–										
4. SMR	0.31	0.52	0.39	–									
5. Depression	-0.04	0.27	0.02	0.19	–								
6. Anxiety	0.03	0.21	0.05	0.13	0.55	–							
7. PD/SS	0.17	0.20	0.18	0.17	0.49	0.87	–						
8. GAD	-0.06	0.24	-0.06	0.15	0.55	0.82	0.63	–					
9. SeAD	-0.07	0.01	-0.07	-0.05	0.26	0.74	0.55	0.46	–				
10. SAD	-0.05	0.09	0.01	0.02	0.31	0.73	0.43	0.47	0.54	–			
11. SA	0.10	0.18	0.12	0.13	0.35	0.40	0.32	0.24	0.16	0.23	–		
12. PF	0.29	0.15	0.28	0.26	0.28	0.19	0.22	0.15	-0.02	0.16	0.21	–	
13. PD	-0.15	0.15	-0.11	0.15	0.01	-0.05	-0.05	0.09	-0.09	-0.15	0.03	-0.11	–
14. PI	-0.03	0.26	0.05	0.18	-0.07	0.01	0.04	0.05	-0.04	-0.06	0.01	-0.15	0.26

SM: Self-management; CCA: Conscious cognitive attempts; SMR: Seeking medical remedies; PD/SS: Panic disorder/somatic symptoms; GAD: Generalized anxiety disorder; SeAD: Separation anxiety disorder; SAD: Social anxiety disorder; SA: School avoidance; PF: Pain frequency; PD: Pain duration; PI: Pain intensity. Table values are spearman's rho correlation coefficients. Bold indicates $p < 0.05$ and italic bold indicates $p < 0.01$.

Findings of Correlations between Internalizing Problems and Headache Characteristics among Adolescents and Mediators Involved in these Correlations

The study examined the correlations between adolescent internalizing problems (total score in CDI; total score on SCARED and subscores) and certain headache characteristics of significance (pain frequency, duration, and intensity) among the clinical characteristics of migraine. According to the results of the correlation analysis undertaken, positive and significant correlations were identified between pain frequency and scores in depression ($r=0.28$, $p < 0.05$), total anxiety ($r=0.19$, $p < 0.05$), panic disorder/somatic symptoms ($r=0.22$, $p < 0.05$), and school avoidance ($r=0.21$, $p < 0.05$) among the adolescents (Table 2).

The study examined the presence or absence of any mediating mechanism involved in the correlations between internalizing problems and headache characteristics among the adolescents. Consideration was given to the conditions proposed by Baron and Kenny^[34] for mediation analysis. This process tested out multiple mediation hypotheses and established the involvement of two mediational mechanisms.

In the context of the first of these significant mediation findings, the analyses in line with the con-

ditions proposed by Baron and Kenny^[34] show that the scores of adolescents in panic disorder/somatic symptoms significantly predict their monthly pain frequency ($\beta=0.22$, $p=0.009$) and depression scores ($\beta=0.49$, $p=0.000$). On the other hand, depression scores of the adolescents significantly predict their monthly pain frequency ($\beta=0.28$, $p=0.001$). However, the significant correlation observed between panic disorder/somatic symptoms and pain frequency among the adolescents ($\beta=0.22$, $p=0.009$) disappears and loses its significance following the addition of depression ($\beta=0.10$, $p=0.266$) to the model (Table 3). Accordingly, depression is a full mediator in the correlation between the levels of panic disorder/somatic symptoms and the monthly frequency of pain attacks among adolescents diagnosed with episodic migraine (Fig. 1).

Another finding of significant mediation identified in the study was again examined with due consideration for the conditions proposed by Baron and Kenny^[34] for mediational mechanisms. According to the results of this examination, school avoidance scores were found to offer a significant prediction of monthly frequency of pain attacks ($\beta=0.21$, $p=0.013$) and depression scores ($\beta=0.35$, $p=0.000$). On the other hand, depression scores of the adolescents also significantly predict monthly frequency of pain

Table 3. The mediating role of depression in the association of panic disorder/somatic symptoms and school avoidance with pain frequency among adolescents

	B	SE	Beta	T	p
Model 1					
Constant	8.58	0.60		14.29	0.000
PD and SS	0.16	0.06	0.22	2.65	0.009
Model 2					
Constant	7.55	0.72		10.50	0.000
PD and SS	0.78	0.07	0.10	1.12	0.266
Depression	0.11	0.04	0.23	2.48	0.014
Model 1					
Constant	8.37	0.70		11.97	0.000
School avoidance	0.54	0.22	0.21	2.50	0.013
Model 2					
Constant	7.21	0.80		9.01	0.000
School avoidance	0.32	0.23	0.12	1.42	0.156
Depression	0.11	0.04	0.24	2.77	0.006

PD: Pain duration; SS: Somatic symptoms.

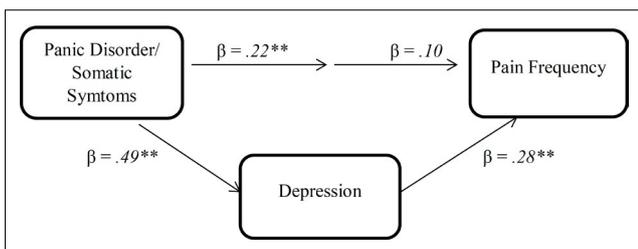


Figure 1. The mediating role of depression in the correlation between panic disorder/somatic symptoms and pain frequency among adolescents.

** : P<0.01.

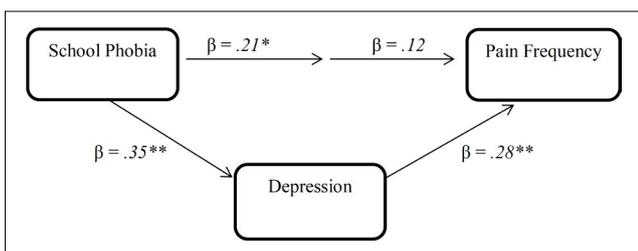


Figure 2. The mediating role of depression in the correlation between school avoidance and pain frequency among adolescents.

*: P<0.05; **: P<0.01.

attacks ($\beta=0.28$, $p=0.001$). However, the significant correlation observed between school avoidance and the frequency of pain attacks among the adolescents ($\beta=0.21$, $p=0.013$) disappears and loses its significance following the addition of depression ($\beta=0.12$, $p=0.156$) to the model (Table 3). Accordingly, depression is a full mediator in the correlation between

school avoidance and the monthly frequency of pain attacks among adolescents diagnosed with episodic migraine (Fig. 2). In a manner similar to the first finding, this result indicates that the level of school avoidance affects the monthly frequency of pain attacks through depression as the mediator among adolescents diagnosed with episodic migraine.

Findings of Correlations between Internalizing Problems and Pain Coping Strategies among Adolescents and Mediators Involved in these Correlations

The study examined the correlations between adolescent internalizing problems (total score in CDI; total score on SCARED and subscores) and pain coping strategies (PCQ subscores) and according to the results of the correlation analysis undertaken for this purpose, a positive and significant correlation was identified between the scores in self-management and panic disorder/somatic symptoms among adolescents ($r=0.17$, $p<0.05$). Positive and significant correlations are also observed between the scores in the use of coping attitudes giving rise to feelings of helplessness against pain and those in depression ($r=0.27$, $p<0.01$), anxiety (total) ($r=0.21$, $p<0.05$), panic disorder/somatic symptoms ($r=0.20$, $p<0.05$), GAD ($r=0.25$, $p<0.01$), and school avoidance ($r=0.18$, $p<0.05$) among adolescents. In addition, positive and significant correlations were also found between the

Table 4. The mediating role of depression in the correlation between panic disorder/somatic symptoms and school avoidance and the use of coping strategies based on attitudes giving rise to feelings of helplessness against pain among adolescents

	B	SE	Beta	T	p
Model 1					
Constant	19.12	0.73		26.34	0.000
PD and SS	0.18	0.07	0.20	2.38	0.019
Model 2					
Constant	17.87	0.87		20.54	0.000
PD and SS	0.07	0.08	0.08	0.86	0.390
Depression	0.14	0.05	0.23	2.51	0.013
Model 1					
Constant	18.98	0.85		22.42	0.000
School avoidance	0.56	0.26	0.18	2.13	0.035
Model 2					
Constant	17.57	0.97		18.13	0.000
School avoidance	0.29	0.27	0.09	1.06	0.293
Depression	0.14	0.05	0.24	2.80	0.006

PD: Pain duration; SS: Somatic symptoms.

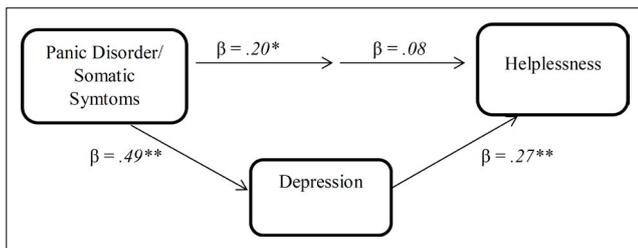


Figure 3. The mediating role of depression in the correlation between panic disorder/somatic symptoms and the use of coping attitudes giving rise to feelings of helplessness against pain among adolescents.

*: $P < 0.05$; **: $P < 0.01$.

scores in conscious cognitive attempts and those in panic disorder/somatic symptoms ($r=0.18$, $p < 0.05$) among adolescents. Finally, the correlations between the scores in seeking medical remedy and those in depression ($r=0.18$, $p < 0.05$) and panic disorder/somatic symptoms ($r=0.18$, $p < 0.05$) among adolescents are positive and significant (Table 2).

The study also examined the presence or absence of any mediating role of other internalizing problems in the correlations between internalizing problems and in the use of coping attitudes giving rise to feelings of helplessness against pain among adolescents. To this end, this process tested out multiple mediation hypotheses and established the involvement of two mediational mechanisms.

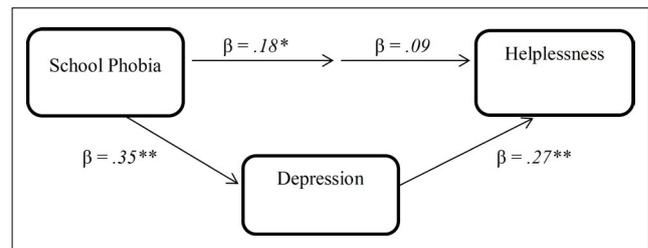


Figure 4. The mediating role of depression in the correlation between school phobia and the use of coping strategies based on attitudes giving rise to feelings of helplessness against pain among adolescents.

*: $P < 0.05$; **: $P < 0.01$.

In the context of the first of these significant mediation findings, the analyses undertaken in line with the conditions proposed by Baron and Kenny^[34] for mediational mechanisms show that scores of adolescents with panic disorder/somatic symptoms significantly predict their scores in the use of coping attitudes giving rise to feelings of helplessness against pain ($\beta=0.20$, $p=0.019$) and in depression ($\beta=0.49$, $p=0.000$). Depression scores of the adolescents also significantly predict their scores in the use of coping attitudes giving rise to feelings of helplessness against pain ($\beta=0.27$, $p=0.001$). However, the significant correlation observed between panic disorder/somatic symptoms and the use of coping attitudes giving rise to feelings of helplessness against pain among the adolescents ($\beta=0.20$,

$p=0.019$) disappears and loses its significance following the addition of depression ($\beta=0.08$, $p=0.390$) to the model (Table 4). Accordingly, depression is a full mediator in the correlation between panic disorder/somatic symptoms and the use of coping attitudes giving rise to feelings of helplessness against pain among adolescents diagnosed with episodic migraine (Fig. 3).

Another finding of significant mediation identified in the study was again examined with due consideration for the conditions proposed by Baron and Kenny.^[34] This examination found that scores of the adolescents in school avoidance significantly predicted their scores in the use of coping attitudes giving rise to feelings of helplessness against pain ($\beta=0.18$, $p=0.035$) and depression ($\beta=0.35$, $p=0.000$). On the other hand, the scores of the adolescents in depression significantly predict their scores in the use of coping attitudes giving rise to feelings of helplessness against pain ($\beta=0.27$, $p=0.001$). However, the significant correlation observed between school avoidance and the use of coping attitudes giving rise to feelings of helplessness against pain among the adolescents ($\beta=0.18$, $p=0.035$) disappears and loses its significance following the addition of depression ($\beta=0.09$, $p=0.293$) to the model (Table 4). Therefore, depression is observed yet again to act as a full mediator in the correlation between school avoidance and the use of coping attitudes giving rise to feelings of helplessness against pain among the adolescents diagnosed with episodic migraine (Fig. 4). In other words, the level of school avoidance appears to have an impact on the use of coping strategies based on attitudes giving rise to feelings of helplessness against pain through the mediating role of depression in a manner similar to the other mediation findings of the present study.

Discussion

Discussion of Correlations among Internalizing Problems, Headache Characteristics, and Pain Coping Strategies

The findings acquired through the present study with respect to the correlations between internalizing problems and headache characteristics (pain frequency, duration, and intensity) indicate that monthly pain frequency increases in direct pro-

portion with the levels of depression, total anxiety, panic disorder/somatic symptoms, and school avoidance among adolescents diagnosed with episodic migraine. No significant correlation was found between internalizing problems and other headache characteristics in the present study. A review of the literature did not identify any study that focused directly on adolescent migraine examining correlations between internalizing problems and the above headache characteristics including pain frequency, duration, and intensity or examining relations between episodic and chronic migraine diagnoses. Nevertheless, research studies conducted with adolescents carrying headache symptoms offering results similar to the aforementioned finding are noted to have identified more consistent, positive, and significant correlations between internalizing problems and headache frequency, in particular among adolescents. The finding of the present study is similar to those in the existing literature.^[24,35-37] This finding suggests that adolescents diagnosed with episodic migraine and suffering from frequent headache attacks should be monitored closely during their clinical assessment and treatment for any indication of internalizing problems such as depression, anxiety, and adolescent episodic migraine may be accompanied by these two internalizing problems. Some authors have highlighted common genetic and environmental factors in connection with the notion of comorbidity.^[38,39]

In line with the other main aim addressed by the study, an examination was directed also to the correlations between internalizing problems and pain coping strategies (PCQ subscores) among adolescents diagnosed with episodic migraine. The first finding of this examination found a positive correlation between the subscore in the use of coping strategies based on attitudes giving rise to feelings of helplessness against pain and the total scores in depression and anxiety among adolescents, as well as a number of subscores in SCARED (panic disorder/somatic symptoms, GAD, and school avoidance). This finding may indicate that the higher the levels of internalizing problems among adolescents diagnosed with episodic migraine, the more common the use of coping strategies based on attitudes giving rise to feelings of helplessness against

pain, which is considered to be a non-functional coping strategy against pain. The general impression arising from the current results highlights the role of non-functional pain coping strategies employed by adolescents diagnosed with episodic migraine as an important component of their internalizing problems. A review of the relevant literature indicates that similar research studies, in terms of research question and sample, identified positive correlations between internalizing problems and the use of non-functional pain coping strategies among adolescents presenting with a variety of pain symptoms. These results are consistent with the finding of the present study.^[20,21,23]

A further finding of the study shows that the higher the levels of depression among adolescents, the more common the use of the strategy of seeking medical remedies including painkillers to cope with pain as indicated by the relevant questionnaire item. This finding suggests that an increase in the use of painkillers among adolescents diagnosed with episodic migraine might be associated with the comorbidity of depression. A literature review of similar research studies reports a higher probability of increased pain symptoms among adolescents showing depressive symptoms^[40,41] and these adolescents tend to use painkillers more frequently.^[42,43] It is worth noting that authors in the literature emphasize that both the common concurrence of depression with headaches and the widespread use or abuse of painkillers in coping with depression among adolescents diagnosed with migraine may create particular risks for these individuals in the future and this combined condition should be taken seriously.^[16,42,44] The continued use or abuse of painkillers by adolescents is argued to have the potential to prevent these individuals from learning healthier strategies to cope with pain-induced symptoms of stress and depression in adulthood.^[45]

Another striking finding of the study relates to the correlation found between an increase in the scores of adolescents in panic disorder/somatic symptoms and all subscores of the PCQ. An evaluation of these findings, the common use of multiple pain coping strategies, functional and non-functional among adolescents diagnosed with

episodic migraine in the presence of panic disorder/somatic symptoms, suggests that adolescents are yet to decide on the most functional pain coping strategy for themselves. It is reported that pain coping strategies are more likely to become permanent patterns toward the end of adolescence^[18] and adolescents diagnosed with headache disorders during this process are in a trial-and-error phase to discover, in which pain coping strategies are more functional for themselves and continue to use a combination of active and passive strategies in the meantime.^[46] Such rise in variability or diversity in pain coping strategies at times of increased panic disorder/somatic symptoms among adolescents may be argued to be affected by multiple individual or situational factors. It should also be noted here that a direct interpretation of the results may be misleading as these factors may also serve as mediating variables in explaining these unexpected positive correlations and the variability in pain coping strategies among adolescents.^[17] Authors commonly underline how several factors may assume considerably significant roles in the use of specific pain coping strategies among adolescents suffering from distinct headache disorders, and these factors include pain intensity, frequency or duration,^[22,47] the presence and severity of other accompanying psychological problems (persistent anxiety and depression in particular),^[20–23] age and cognitive development level,^[48] perceptual processes concerning the controllability of pain,^[49] and self-assessment of pain and past coping experiences.^[46,50] Consequently, further contributions to a better interpretation of this result of the study are considered possible through an increased number of studies examining the mediating roles of the said factors.

A Discussion of the Mediation Findings

The complex processes involved in the common concurrence of internalizing problems such as anxiety disorders and depression in adolescents diagnosed with migraine^[19,35,38] may complicate the understanding of the correlations between internalizing problems and headache characteristics specifically, the use of non-functional pain coping strategies that commonly accompany such problems. Moreover, the authors in the literature appear not to have reached a consensus on the causality

of these correlations or the possible mechanisms of action of internalizing problems in these correlations. For example, some research studies emphasize that anxiety-related problems experienced by adolescents affect the prognosis negatively by leading both to depression and persistence in migraine. There is a stronger correlation between pain frequency in particular and non-functional pain coping strategies when compared to depression.^[11,17,51] Based on the syndromic correlations put forward by these research studies, it is possible to suggest that anxiety-related problems are a more important determinant than depression in predicting the long-term persistence of migraine and headache-related disability. However, a recent multivariate analysis of 3968 patients provided a comprehensive review of 23 studies and evaluated the risk factors in pediatric and adolescent episodic headaches. This analysis found no correlation between negative emotional states such as anxiety and depression and the onset of episodic headaches.^[52] Some authors reported that depression increased the risk of anxiety disorders among children with migraine, exhibiting a higher comorbidity for depression compared to healthy controls.^[53] Considering the variability of diagnostic stability in pediatric and adolescent mental disorders^[54] in addition to these contradictory results observed in the literature, it may be meaningful to conduct further analyses to shed light on the complex correlations among the said variables. Accordingly, this study focuses on the possible predictor effects of varying levels of internalizing problems such as depression or anxiety on important headache characteristics (pain frequency, duration, and intensity) and the use of non-functional pain coping strategies among adolescents diagnosed with episodic migraine and aims to offer an understanding as to whether or not any other internalizing problem might act as a mediator/triggering factor. For this purpose, multiple mediation hypotheses were also tested out in the context of the study. A literature review indicates that no previous study has examined whether any other internalizing problems act as a mediator in the correlations between the relevant variables or done so in the sample addressed in the present study. On the other hand, the mediation findings of the study show that, among adolescents diagnosed with episodic migraine, the levels

of panic disorder/somatic symptoms and school avoidance, as subscores in SCARED, affect both their monthly frequency of headache attacks and their use of coping strategies based on attitudes giving rise to feelings of helplessness against pain through their levels of depression. Since the variable of the levels of depression among adolescents acts as a full mediator in all correlations tested out and found significant for mediation in the study and this observation is considered to represent a striking finding, it appears more appropriate to interpret the available results in tandem.

Before moving on to a discussion of the mediation findings, it is worth emphasizing that the variables included in the mediation analyses of the study are commonly observed in combination, and some symptoms are shared among these variables. For example, authors report the common concurrence of internalizing problems such as anxiety disorders and depression among adolescents diagnosed with migraine as stated before.^[10,11,13,36] Moreover, it is also expressed that patients may become anxious or depressed in time due to their experience of frequent headaches, but this experience may cause headaches within the psychosomatic integrity of a patient in the presence of anxiety and depression.^[55] Moreover, the research studies in the literature report that since somatic symptoms frequently observed in adolescent panic disorder overlap with specific clinical characteristics of migraine (such as frequent, intense, and long-lasting headaches, vomiting, and nausea), other symptoms associated with internalizing problems are observed more frequently and commonly in tandem among these individuals than healthy controls.^[14,56] In addition, school avoidance is yet another internalizing problem associated with anxiety that is mostly observed concurrently with other internalizing problems such as other anxiety disorders and depression among adolescents.^[57] Adolescents diagnosed with migraine and suffering from intense headache attacks may face certain situations that lead to anxiety and potentially motivate individuals to avoid academic activities such as the school starting, the pressure of passing upcoming examinations, or a record of poor academic performance.^[23,58,59] Even though the internalizing problems addressed through mediation analyses in the study

in the context of comorbidities and symptoms are commonly observed in tandem and the literature offers only a limited number of studies that address the correlations between distinct categories of anxiety disorders and other variables separately like our present study, specific possible causes may be suggested for the current findings. For instance, depression is reported to accompany migraines more commonly than panic disorder and school avoidance among adolescents.^[10,51,54,58] In addition, the present study shows the diagnoses of mental disorders among adolescents that the incidence of depression accompanying episodic migraine is higher than that of panic disorder and school avoidance. The research studies in the relevant literature are observed to report depression to have a predictor effect on both pain frequency and the use of non-functional coping strategies against pain among adolescents diagnosed with varying types of headaches;^[16,44,60] however, no study finding has been identified to offer an idea as to the presence or absence of similar observations concerning panic disorder and school avoidance. Therefore, based on a combined assessment of these results, it is possible to state that it is more reasonable to expect a more substantial predictor effect from depression on pain frequency and the use of coping strategies based on attitudes giving rise to feelings of helplessness against pain among adolescents when compared to that of either subscore of anxiety disorders and these mediational mechanisms identified through the study represent a primary finding. This result suggests that efforts to alleviate the risk of depression or to treat depression may be a priority and an important step in eliminating the effect of the levels of panic disorder/somatic complaints and school avoidance on monthly pain frequency and the use of non-functional pain coping strategies among adolescents diagnosed with episodic migraine.

Limitations

There are certain limitations concerning the assessment and evaluation process and the methodology of the present study. The study's research methodology was planned in a cross-sectional order, which does not allow the elimination of team-patient compatibility and possible subjective variables associated with this phenomenon.

Moreover, it is not possible to reach any conclusion on causality or the direction of the correlations between variables merely based on the correlational findings obtained through the study. Conducting longitudinal studies with different samples and in a manner as to cover different developmental periods will contribute to a better understanding of this topic.

The present study assessed internalizing problems among adolescents not in the context of psychiatric diagnoses, but through questionnaire scores, that is, on a symptomatic level, to provide for an examination of the correlations between variables. Even though mental assessments were carried out for the adolescents at a pediatric psychiatry clinic for the study, the levels of consistency between psychiatric diagnoses and questionnaire scores were not assessed due to the abnormal distribution arising from the limited nature of the sample. The number of adolescents diagnosed with depression is higher than those diagnosed with panic disorder and school avoidance in the study sample. Another point of significance relates to the fact that considerably high levels of comorbidity were identified between adolescent episodic migraine and panic disorder and school avoidance diagnoses. In contrast, the SCARED subscores associated with migraine-related variables such as pain frequency and the use of strategies based on attitudes giving rise to feelings of helplessness to cope with pain were panic disorder/somatic symptoms and school avoidance. This observation may suggest that using questionnaire scores as the primary basis, as has been done in the present study, is not sufficient for an examination of variables and directions of action and sufficient consistency may not be achieved between dimensional and categorical assessments, which, when combined, may affect the generalizability of results. Consequently, further contributions to a better understanding of which mental disorder may be responsible for a primary effect or a mediating role for the correlations addressed in the present study are considered possible through future studies taking into consideration such important factors as the normal distribution of adolescent diagnoses of mental disorders and the consistency between diagnoses of mental disorders and relevant questionnaire scores.

Conclusion

The considerably high incidence of mental disorders accompanying adolescent episodic migraine, as observed in the present study, may confirm the importance of clinicians in such fields as pediatric neurology, pediatric psychiatry, and family medicine taking into consideration comorbidities with mental disorders and adopting multidisciplinary principles in the clinical evaluation and treatment of these individuals. The focus on the use of pharmacological and medical modalities in the treatment of adolescent migraine usually leads to the psychological and social condition of individual patients being overlooked. A primary care physician in family medicine could adopt a holistic approach during patient evaluation, rather than focusing only on the presenting symptoms. While examining the etiology of an adolescent case with headache-related complaints, a more holistic approach could be instrumental in avoiding excessive examinations and in reducing the number of unnecessary referrals to secondary and tertiary care. More meaningful contributions could thus be achieved toward improving quality of life and responses to treatment for individuals living with headaches securing early diagnosis and treatment for patients, thereby reducing the possibility of persistent headaches advancing to the chronic stage.

The psychological treatment of migraine represents an essential component of the biopsychosocial approach particularly for adolescents restricted in life by frequent intense headaches and those exhibiting symptoms of mental disorders and excessive use of medication. The cognitive-behavioral therapy approach, in particular, is employed by psychotherapists working in multidisciplinary collaboration with neurology specialists. The variables addressed in this study, such as pain coping strategies and internalizing problems, overlap with variables associated with cognitive, emotional, and behavioral mechanisms accompanying migraine. These represent the main focus for adaptations of cognitive-behavioral therapy for children and adolescents diagnosed with migraine. Accordingly, this study offers an additional potential contribution to the theoretical basis and practical aspects of this approach.

Peer-review: Externally peer-reviewed.

Ethics Committee Approval: The Mersin University Social and Human Sciences Ethics Board granted approval for this study (date: 04.02.2019, number: 018).

Conflict-of-interest issues regarding the authorship or article: None declared.

References

1. Matarese CA, Mack KJ. Management considerations in the treatment of migraine in adolescents. *Adolesc Health Med Ther* 2010;1:21–30. [CrossRef]
2. Aytaçoğlu H, Özge A, Köstekçi İ, Taşdelen B, Öksüz N, Toros F. The effects of daily variables on primary headache disorders in high-school children; A proposal for a cut-off value for study/leisure time regarding headache types. *J Neurol Sci (Turk)* 2011;28:453–64.
3. Wöber-Bingöl C. Epidemiology of migraine and headache in children and adolescents. *Curr Pain Headache Rep* 2013;17:341. [CrossRef]
4. Orr SL, Christie SN, Akiki S, McMillan HJ. Disability, quality of life, and pain coping in pediatric migraine: An observational study. *J Child Neurol* 2017;32:717–24. [CrossRef]
5. Guidetti V, Faedda N, Siniatchkin M. Migraine in childhood: Biobehavioural or psychosomatic disorder? *J Headache Pain* 2016;17:82. [CrossRef]
6. Kandemir G, Hesapcioglu ST, Kurt ANC. What are the psychosocial factors associated with migraine in the child? Comorbid psychiatric disorders, family functioning, parenting style, or mom's psychiatric symptoms? *J Child Neurol* 2018;33:174–81. [CrossRef]
7. Williams ACC, Craig KD. Updating the definition of pain. *Pain* 2016;157:2420–3. [CrossRef]
8. Achenbach TM, Ivanova MY, Rescorla LA. Empirically based assessment and taxonomy of psychopathology for ages 1½-90+ years: Developmental, multi-informant, and multicultural findings. *Compr Psychiatry* 2017;79:4–18. [CrossRef]
9. Kotov R, Krueger RF, Watson D, Achenbach TM, Althoff RR, Bagby RM, et al. The Hierarchical Taxonomy of Psychopathology (HiTOP): A dimensional alternative to traditional nosologies. *J Abnorm Psychol* 2017;126:454–77. [CrossRef]
10. Balottin U, Fusar Poli P, Termine C, Molteni S, Galli F. Psychopathological symptoms in child and adolescent migraine and tension-type headache: A meta-analysis. *Cephalalgia* 2013;33:112–22. [CrossRef]
11. Margari F, Lucarelli E, Craig F, Petruzzelli MG, Lecce PA, Margari L. Psychopathology in children and adolescents with primary headaches: Categorical and dimensional approaches. *Cephalalgia* 2013;33:1311–8. [CrossRef]
12. Öztöp DB, Taşdelen Bİ, Poyrazoğlu HG, Özsoy S, Yılmaz R, Şahin N, et al. Assessment of psychopathology and quality of life in children and adolescents with migraine. *J Child Neurol* 2016;31:837–42. [CrossRef]
13. Smitherman TA, McDermott MJ, Buchanan EM. Negative impact of episodic migraine on a university population: Quality of life, functional impairment, and comorbid psychiatric symptoms. *Headache* 2011;51:581–9. [CrossRef]

14. Anttila P, Sourander A, Metsähonkala L, Aromaa M, Helenius H, Sillanpää M. Psychiatric symptoms in children with primary headache. *J Am Acad Child Adolesc Psychiatry* 2004;43:412–9. [\[CrossRef\]](#)
15. Just U, Oelkers R, Bender S, Parzer P, Ebinger F, Weisbrod M, et al. Emotional and behavioural problems in children and adolescents with primary headache. *Cephalalgia* 2003;23:206–13. [\[CrossRef\]](#)
16. Zwart JA, Dyb G, Hagen K, Ødegård KJ, Dahl AA, Bovim G, et al. Depression and anxiety disorders associated with headache frequency. The Nord-Trøndelag Health Study. *Eur J Neurol* 2003;10:147–52. [\[CrossRef\]](#)
17. Bandell-Hoekstra I, Abu-Saad HH, Passchier J, Knipschild P. Recurrent headache, coping, and quality of life in children: A review. *Headache* 2000;40:357–70. [\[CrossRef\]](#)
18. Eccleston C, Maleson P. Managing chronic pain in children and adolescents. We need to address the embarrassing lack of data for this common problem. *BMJ* 2003;326:1408–9.
19. Arruda MA, Bigal ME. Behavioral and emotional symptoms and primary headaches in children: A population-based study. *Cephalalgia* 2012;32:1093–100. [\[CrossRef\]](#)
20. Simons LE, Smith A, Ibagón C, Coakley R, Logan DE, Schechter N, et al. Pediatric Pain Screening Tool: Rapid identification of risk in youth with pain complaints. *Pain* 2015;156:1511–8. [\[CrossRef\]](#)
21. Vervoort T, Eccleston C, Goubert L, Buysse A, Crombez G. Children's catastrophic thinking about their pain predicts pain and disability 6 months later. *Eur J Pain* 2010;14:90–6.
22. Eccleston C, Crombez G, Scotford A, Clinch J, Connell H. Adolescent chronic pain: Patterns and predictors of emotional distress in adolescents with chronic pain and their parents. *Pain* 2004;108:221–9. [\[CrossRef\]](#)
23. Tran ST, Jastrowski Mano KE, Hainsworth KR, Medrano GR, Anderson Khan K, Weisman SJ, et al. Distinct influences of anxiety and pain catastrophizing on functional outcomes in children and adolescents with chronic pain. *J Pediatr Psychol* 2015;40:744–55. [\[CrossRef\]](#)
24. Blaauw BA, Dyb G, Hagen K, Holmen TL, Linde M, Wentzel-Larsen T, et al. Anxiety, depression and behavioral problems among adolescents with recurrent headache: The Young-HUNT study. *J Headache Pain* 2014;15:38. [\[CrossRef\]](#)
25. Dao JM, Qubty W. Headache diagnosis in children and adolescents. *Curr Pain Headache Rep* 2018;22:17. [\[CrossRef\]](#)
26. Youssef PE, Mack KJ. Episodic and chronic migraine in children. *Dev Med Child Neurol* 2020;62:34–41. [\[CrossRef\]](#)
27. Özge A, Büyükdacı R, Şaşmaz T, Kaleğasi H, Kurt O, Karakelle A, et al. The sensitivity and specificity of the case definition criteria in diagnosis of headache: A school-based epidemiological study of 5562 children in Mersin. *Cephalalgia* 2003;23:138–45. [\[CrossRef\]](#)
28. Kleinke CL. How chronic pain patients cope with pain: Relation to treatment outcome in a multidisciplinary pain clinic. *Cogn Ther Res* 1992;16:669–85. [\[CrossRef\]](#)
29. Karaca S, Demir O, Aşkın R, Şimşek İ. Ağrı ile başa çıkma ölçeği geçerlilik ve güvenilirliği. Antalya: 5. Türk-Alman Fiziksel Tıp ve Rehabilitasyon Kongresi; 1996.
30. Kovacs M. Rating scales to assess depression in school-aged children. *Acta Paedopsychiatr* 1981;46:305–15.
31. Öy B. Çocuklar için depresyon ölçeği: Geçerlik ve güvenilirlik çalışması. *Türk Psikiyatri Derg* 1991;2:132–6.
32. Birmaher B, Khetarpal S, Brent D, Cully M, Balach L, Kaufman J, et al. The Screen for Child Anxiety Related Emotional Disorders (SCARED): Scale construction and psychometric characteristics. *J Am Acad Child Adolesc Psychiatry* 1997;36:545–53. [\[CrossRef\]](#)
33. Çakmakçı FK. Çocuklarda anksiyete bozukluklarını tarama ölçeği geçerlik ve güvenilirlik çalışması. Uzmanlık Tezi. Kocaeli: Kocaeli Üniversitesi; 2004.
34. Baron RM, Kenny DA. The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *J Pers Soc Psychol* 1986;51:1173–82. [\[CrossRef\]](#)
35. Fielding J, Young S, Martin PR, Waters AM. Headache symptoms consistent with migraine and tension-type headaches in children with anxiety disorders. *J Anxiety Disord* 2016;40:67–74. [\[CrossRef\]](#)
36. Güler G, Kütük MÖ, Toros F, Özge A, Taşdelen B. The high level of psychiatric disorders associated with migraine or tension-type headache in adolescents. *J Neurol Sci (Turk)* 2017;34:312–21. [\[CrossRef\]](#)
37. White KS, Farrell AD. Anxiety and psychosocial stress as predictors of headache and abdominal pain in urban early adolescents. *J Pediatr Psychol* 2006;31:582–96. [\[CrossRef\]](#)
38. Beghi E, Bussone G, D'Amico D, Cortelli P, Cevoli S, Manzoni GC, et al. Headache, anxiety and depressive disorders: The HADAS study. *J Headache Pain* 2010;11:141–50. [\[CrossRef\]](#)
39. Sheftell FD, Atlas SJ. Migraine and psychiatric comorbidity: From theory and hypotheses to clinical application. *Headache* 2002;42:934–44. [\[CrossRef\]](#)
40. Borgman S, Ericsson I, Clausson EK, Garmy P. The relationship between reported pain and depressive symptoms among adolescents. *J Sch Nurs* 2020;36:87–93. [\[CrossRef\]](#)
41. Sansone RA, Watts DA, Wiederman MW. Being bullied in childhood, and pain and pain perception in adulthood. *Int J Soc Psychiatry* 2014;60:449–53. [\[CrossRef\]](#)
42. Dyb G, Stensland S, Zwart JA. Psychiatric comorbidity in childhood and adolescence headache. *Curr Pain Headache Rep* 2015;19:5. [\[CrossRef\]](#)
43. Shrier LA, Harris SK, Kurland M, Knight JR. Substance use problems and associated psychiatric symptoms among adolescents in primary care. *Pediatrics* 2003;111:e699–705.
44. Hena M, Leung C, Clausson EK, Garmy P. Association of depressive symptoms with consumption of analgesics among adolescents. *J Pediatr Nurs* 2019;45:e19–23. [\[CrossRef\]](#)
45. Skarstein S, Lagerløv P, Kvarme LG, Helseth S. Pain and development of identity in adolescents who frequently use over-the-counter analgesics: A qualitative study. *J Clin Nurs* 2018;27:3583–91. [\[CrossRef\]](#)
46. Skogvold L, Magnussen LH. Chronic tension-type headache and coping strategies in adolescents: A qualitative interview study. *Physiother Res Int* 2019;24:e1778. [\[CrossRef\]](#)
47. Bandell-Hoekstra IE, Abu-Saad HH, Passchier J, Frederiks CM, Feron FJ, Knipschild P. Coping and quality of life in

- relation to headache in Dutch schoolchildren. *Eur J Pain* 2002;6:315–21. [\[CrossRef\]](#)
48. Huitt W, Hummel J. Piaget's theory of cognitive development. *Educ Psychol* 2003;3:1–5.
49. Huguet A, Miró J, Nieto R. The factor structure and factorial invariance of the Pain-Coping Questionnaire across age: Evidence from community-based samples of children and adults. *Eur J Pain* 2009;13:879–89. [\[CrossRef\]](#)
50. Folkman S. Personal control and stress and coping processes: A theoretical analysis. *J Pers Soc Psychol* 1984;46:839–52. [\[CrossRef\]](#)
51. Breslau N, Davis GC. Migraine, major depression and panic disorder: A prospective epidemiologic study of young adults. *Cephalalgia* 1992;12:85–90. [\[CrossRef\]](#)
52. Huguet A, Tougas ME, Hayden J, McGrath PJ, Chambers CT, Stinson JN, et al. Systematic review of childhood and adolescent risk and prognostic factors for recurrent headaches. *J Pain* 2016;17:855–73.e8. [\[CrossRef\]](#)
53. Antonaci F, Nappi G, Galli F, Manzoni GC, Calabresi P, Costa A. Migraine and psychiatric comorbidity: A review of clinical findings. *J Headache Pain* 2011;12:115–25. [\[CrossRef\]](#)
54. Costello EJ, Mustillo S, Erkanli A, Keeler G, Angold A. Prevalence and development of psychiatric disorders in childhood and adolescence. *Arch Gen Psychiatry* 2003;60:837–44. [\[CrossRef\]](#)
55. Kocabaş Z, Çelebi A. Migren ve gerilim baş ağrısında anksiyete, depresyon ve nörotik eğilim düzeyleri. *Dusunen Adam* [Article in Turkish] 1997;10:17–21.
56. Chakravarty A, Mukherjee A, Roy D. Trigger factors in childhood migraine: A clinic-based study from eastern India. *J Headache Pain* 2009;10:375–80. [\[CrossRef\]](#)
57. Patel RR. A study of school phobia of upper primary school students in context of gender. *Int J Res Subj Multi Lang* 2019;7:49–51.
58. Arruda MA, Bigal ME. Migraine and migraine subtypes in preadolescent children: Association with school performance. *Neurology* 2012;79:1881–8. [\[CrossRef\]](#)
59. Hesketh T, Zhen Y, Lu L, Dong ZX, Jun YX, Xing ZW. Stress and psychosomatic symptoms in Chinese school children: Cross-sectional survey. *Arch Dis Child* 2010;95:136–40. [\[CrossRef\]](#)
60. Sciruicchio V, Simeone M, Foschino Barbaro MG, Tanzi RC, Delussi MD, Libro G, et al. Pain catastrophizing in childhood migraine: An observational study in a tertiary headache center. *Front Neurol* 2019;10:114. [\[CrossRef\]](#)