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Evaluation of sleep problems, quality of life and chronotype characteristics in children with primary headache

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Abstract

Aim: Primary headaches are prevalent in children and negatively affects quality of life and sleep. This research aimed to compare the sleep, quality of life, and chronotype characteristics of children with primary headaches to healthy controls.

Materials and Methods: In this cross-sectional study, patients were selected based on a diagnosis according to the "International Headache Classification-3". The "Sleep Disorders Scale for Children (SDSC)" assessed sleep characteristics, the "Pediatric Quality of Life Inventory (PedsQL)" evaluated quality of life, and the "Childhood Chronotype Questionnaire (CCQ)" examined chronotype preferences of patients and controls. Statistical analysis considered a p-value less than 0.05 as significant.

Results: The study enrolled 50 patients with primary headaches and 50 healthy controls. Statistically significant differences were found between the groups in the physical, psychosocial, and total scores of the PedsQL, and in the sleep initiation, wakefulness transition, excessive sleepiness, and total scores of the SDSC ($p<0.05$). However, no significant difference was found between the groups regarding chronotype preferences ($p=0.401$). The SDSC sleep sweating score was a significant predictor of the CCQ score.

Conclusion: Our findings indicate that primary headaches in children and adolescents demonstrate an association with impaired quality of life and increased sleep problems, suggesting the need to address sleep and psychosocial issues in their evaluation. The lack of difference in chronotype preference may relate to the sample size and age range. Future studies with larger samples and specific age groups may provide more objective data.

Introduction

Headaches, commonly observed in children, become more prevalent during adolescence. Headache is among the five most common diseases affecting individuals between the ages of 10-24 [1]. While headaches are classified into two groups, primary and secondary, there are also some particular types [2]. The diagnosis of primary headache requires the absence of an underlying pathology. In a recent meta-analysis, the combined prevalence of primary headaches in childhood was 62% [3]. The "International Classification of Headache Disorders-3rd Edition (ICHD-3)", published in 2018, is frequently used to diagnose headaches. In this classification system, headaches are divided into 14 subcategories and primary headaches are classified as migraine, tension-type headaches, trigeminal autonomic headaches and other primary headache disorders [4]. Migraines and tension-type headaches are the most frequently encountered primary headache disorders. Among primary headaches, migraine is associated with the greatest functional impairment [5].

Sleep is a crucial necessity for children's physical and cognitive development. Sleep quality is associated with various medical and psychological disorders [6]. A reciprocal relationship exists between sleep problems and primary headaches in children, playing a crucial role in the clinical manifestations of primary headaches [7]. In a research involving 622 children with headaches, sleep problems were reported as the most common complaint, affecting 53.6% of participants [8]. Both headaches and sleep disorders are highly prevalent, suggesting that the relationship between the two disorders may arise from a common etiopathogenesis [9]. Extensive research highlights the significant impact of headaches on children's health-related quality of life. Primary headaches can impair children's overall qual-

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ity of life related to health, potentially causing a decline in their academic performance [10].

Chronotype refers to individual variations in circadian rhythm, determining preferences for morning, evening, or intermediate activity patterns. These evaluations classify individuals into three chronotypes: morningness, eveningness, and intermediate types [11]. Research indicates that chronotype influences pain sensitivity, with morning types experiencing lower pain sensitivity compared to evening types [12]. Individuals diagnosed with migraines are less likely to have a normal chronotype and tend to be more flexible regarding circadian rhythms. In the case of migraines, chronobiological mechanisms are directly tied to the underlying pathology and can influence the clinical manifestation, especially the timing of headaches. Migraine sufferers are less prone to exhibit typical chronotypes and have reduced adaptability to changes in circadian rhythm [13]. Research indicates that migraine attacks are more frequently observed in the morning among individuals with a morning chronotype, whereas those with an evening chronotype are more prone to experiencing migraine episodes during nighttime hours [14]. As a result, evaluating chronotype appears important when evaluating and managing patients with migraines.

Studies on primary headaches related to chronotype are limited in the literature, and expanding the existing data in this field could provide significant contributions to the management of headache treatment in affected individuals. This study aims to compare sleep problems, quality of life, and chronotype preferences in children with primary headaches and healthy controls, while also examining the association between chronotype scores and sleep disturbances.

Materials and Methods

This study is a single-centre, cross-sectional, prospective study involving a case group and healthy controls. The sample consists of children aged 6-18 who presented with headache complaints at the Department of Pediatric Neurology, Etlik City Hospital, between June 2023 and October 2023. Ethical approval for the study was obtained from the Etlik City Hospital Clinical Research Ethics Committee (Number: 2023-124, Date: 17.05.2023). The study was conducted under the Declaration of Helsinki and the Patient Rights Regulation. All patients and their families were provided with detailed information about the study, and written informed consent was obtained.

The inclusion criteria for the case group were as follows: a) age between 6 and 18 years, b) diagnosed with primary headache at the Pediatric Neurology Outpatient Clinics of Etlik City Hospital, c) regular neurological examination, d) written informed consent obtained from parents, and e) complete study data. Exclusion criteria for the case group were: a) presence of additional neurological disease, b) known sleep disorder diagnosis, c) being followed in psychiatry, d) having a psychiatric diagnosis, and e) use of medications that could cause headaches. The control group consisted of participants aged 6-18 without any known chronic illness, attending the paediatrics clinic of the same hospital. Inclusion criteria for the control group were: a) being aged 6-18, b) regular neurological examination, c) providing verbal and written consent to participate in the study, and d) completing all study questionnaires. Exclusion criteria for the control group were: a) having an acute or chronic neurological disease, b) having visited child psychiatry, c) using medication in the past and/or currently, and d) experiencing any sleep problems.

During the study period, a total of 108 children aged 6-18 presented to the Pediatric Neurology Clinic at Etlik City Hospital with complaints of headache. Headache complaints were evaluated according to the ICHD-3 criteria, and 34 children were excluded from the study because they did not have primary headaches. The remaining 74 children with primary headaches were clinically evaluated by a child psychiatrist according to DSM-5 diagnostic criteria. Twenty-one children were excluded from the study due to psychiatric diagnoses (7 with major depressive disorder, 5 with anxiety disorder, 3 with enuresis nocturna, 3 with sleep disorders, 2 with obsessive-compulsive disorder, and 1 with developmental delay). Three cases were excluded for not consenting to participate, resulting in a total of 50 children included as the patient group in the study. For the healthy control group, 62 participants were reached initially; however, 7 were excluded due to previous visits to child psychiatry and the use of psychotropic medication, and 5 were excluded for not consenting to participate. Thus, a total of 50 healthy controls were enrolled in the study. The sample size was calculated post-hoc using the G*Power 3.1 program. Using a significance level of 0.05 and a moderate effect size of 0.6, the power of the study was determined to be 84% based on the total sample size of 100 participants included in our study.

Measurements

Sociodemographic data form

The form was created by the clinician to evaluate the sociodemographic characteristics of the children. It includes multiple-choice questions regarding age (in months and years), gender, educational status, parents' education levels and occupations, monthly income, place of residence, and family structure. The form is completed by the clinician.

Pediatric quality of life inventory (PedsQL)

In this study, the PedsQL was utilized to assess children's quality of life in physical, emotional, social, and school-related domains. The scale was developed by Varni and colleagues (1999) [15]. High scores reflect a better quality of life in that domain. Memik and colleagues (2007) [16] conducted the Turkish validity and reliability study of the scale. Patients aged 13 and above complete it themselves, while for younger age groups, it is completed by their parents.

The sleep disturbance scale for children (SDSC)

Bruni and colleagues (1996) designed the scale to evaluate sleep issues and specific sleep disorders in children/adolescents between the ages of 6 and 16 [17]. The Sleep Disturbance Scale for Children (SDSC) is a 26-item five-point Likert-type scale. The scale measures scores from a minimum value of 26 up to a maximum value of 130. The cut-off score of the scale was found to be 39 points. The scale has a total of 6 subscales: disorders of initiating and maintaining sleep (DIMS), sleep-disordered breathing (SDB), disorders of arousal/nightmares (DA), sleep-wake transition disorders (SWTD), disorders of excessive somnolence (EDS), and hyperhydrosis during sleep. Bilmenoğlu and colleagues conducted the scale's Turkish validity and reliability test in 2019 [18]. The scale is completed by parents.

Childhood chronotype questionnare (CCQ)

The questionnaire was developed by Werner et al. (2009) to determine chronotype in childhood [19]. The questionnaire consists of 27 items in total. Ten items assess morningness and eveningness characteristics in daily rhythms, and the last item gathers information about the chronotype. The validity and reliability study for the Turkish version was carried out by Dursun and his team [20]. Parents complete this questionnare.

Statistical Analysis The data were analyzed using the SPSS.23 software program. The Kolmogorov-Smirnov test was applied first to assess whether the quantitative data followed a normal distribution. For datasets exhibiting normal distribution, the central tendency and variability were described using mean and standard deviation. Conversely, for those not exhibiting normality, median and interquartile range were utilized. Percentages were used for categorical data. We hypothesize that children with primary headaches will exhibit more pronounced sleep problems, lower quality of life, and distinct chronotype preferences compared to healthy controls. Additionally, we hypothesize that chronotype scores will be significantly correlated with the severity of sleep disturbances in children with primary headaches. To compare the patient and control groups, the Student's t-test was applied for data with a normal distribution, while the Mann-Whitney U test was employed for data without a normal distribution. The Chi-square test was applied for the analysis of categorical data; when necessary, Fisher's exact test and Yates' correction were performed. For effect size in the Chi-square test, Phi was used for 2x2 analyses and Cramer's V for others. The Pearson correlation test evaluated the relationship between total CCQ scores and PedsQL and SDSC sub-scores. Following the correlation analysis, linear regression analysis was used to determine the predictors of CCQ scores. The significance level was defined as $p<0.05$.

Results

A total of 100 children, consisting of 50 patients and 50 healthy controls, were enrolled in the study during the research period. The mean age of the patients was 14.2±2.4 years, while the mean age of the healthy controls was 12.9±3.3 years ($p=0.002$). A comparison of the two groups regarding gender revealed no statistically significant difference (Yates' correction, $X^2=0.686$, $p=0.407$). Table 1 presents a summary of the sociodemographic features of both the patient and control groups.

The comparison of the PedsQL subscales and total score, as well as the SDSC subtests is shown in Table 2.

In our study, when chronotypes were evaluated according to the CCQ across the entire sample, it was found that 10 participants were of the morning type (<23 points), 38 participants were of the intermediate type (24-32 points), and 32 participants were of the evening type (>32 points). Table 3 displays the comparison of chronotype characteristics between the patient and control groups.

According to the data obtained through clinical interviews, when comparing the patient and control groups based on pain types, no statistically significant differences were observed between them regarding pain duration (over 5 hours or less), unilateral or bilateral location, pain severity (mild-moderate-severe), and changes with physical activity ($p>0.05$).

When examining the correlation between CCQ total scores and PedsQL physical, psychosocial, and total scores, a mildly negative statistically significant correlation was found between the CCQ score and both the PedsQL psychosocial and total scores ($p=0.001$ for both). Similarly, when examining the relationship between CCQ total scores and SDSC subscales, a mild to moderate negative statistically significant correlation was found between the CCQ total score and SDSC-DIMS, SDSC-DA, and SDSC-DOES ($p<0.05$) (Table 4).

Finally, we conducted a linear regression analysis. In this analysis, our dependent variable was the Children's Chronotype Questionnaire (CCQ) score. Age, gender, SDSC subtests and total score, PedsQL physical and psychosocial subscales, and total score were taken as independent variables. The model was significant ($F(10,78)=3.423$, $p=0.001$). There was no autocorrelation among the data (Durbin-Watson coefficient = 1.578). According to this analysis, the SDSC-sleep sweating subtest emerged as a significant predictor of the CCQ total score. The regression results are shown in Table 5.

Discussion

Our study evaluated the comparison of patients with primary headaches and healthy controls in terms of sleep problems, quality of life, and chronotype preference. In the primary headache group, issues with sleep initiation and maintenance, arousal transitions, excessive daytime sleepiness, and physical and psychosocial quality of life were found to be greater than in healthy controls. No difference was observed in chronotype preference between the patient and control groups; however, sleep sweating was found to be a significant predictor of the chronotype total score.

In our study, the group with primary headaches was found to have more issues with sleep initiation and maintenance, arousal transitions, and excessive daytime sleepiness. Multiple studies have consistently demonstrated a strong association between primary headaches and sleep disturbances [21]. Initial studies on this relationship concentrated on the rise in parasomnias and sleep-disordered breathing in children with primary headaches. However, more recent research has demonstrated that this relationship is also linked to sleep disorders like restless legs syndrome, periodic limb movements during sleep, and narcolepsy [9]. A recent review evaluated the relationship

Table 1. Comparison of patient and healthy control groups in terms of sociodemographic characteristics.

	Patient Group (n=50)	Healthy Control Group (n=50)	Chi-square/ t-Z	P
Age (Mean±SD)	14.2±2.4	12.9±3.3	2.303	0.002
Gender (n-%)				
Female	34 (68%)	29 (58%)	0.686	0.407
Male	16 (32%)	21 (42%)		
Education level of the father (n-%)				
Primary School	7 (14%)	2 (4%)	11.267	0.010
Secondary School	5 (10%)	5 (10%)		
High school	26 (52%)	16 (16%)		
University and Beyond	12 (24%)	27 (54%)		
Education level of the mother (n-%)				
Primary School	13 (26%)	6 (12%)	8.278	0.100
Secondary School	11 (22%)	7 (14%)		
High school	14 (28%)	17 (34%)		
University and Beyond	12 (24%)	20 (40%)		
Father's Occupation (n-%)				
Civil Servant	9 (18%)	21 (42%)	9.613	0.022
Laborer	11 (22%)	3 (6%)		
Self-Employed	22 (44%)	20 (40%)		
Other	8 (16%)	6 (12%)		
Family Structure (n-%)				
Nuclear	38 (76%)	38 (76%)	1.955	0.582
Extended/Large	8 (16%)	6 (12%)		
Divorced-Single Parent	2 (4%)	5 (10%)		
Parental Loss-Single Parent	2(4%)	1(2%)		

Table 2. Comparison of sleep disturbance and quality of life scales between groups.

	Patient	Healthy Control	t-Z	P	Effect Size
PedsQL Physical (adolescent) (Mean±SD)	56.8±22.3	79.6±17.8	4.927	0.01*	1.13
PedsQL Social (adolescent) (Mean±SD)	62.4±17.5	79,9±14.8	4.692	0.01*	1.08
PedsQL Total (adolescent) (Mean±SD)	60.5±17.0	79.8±13.2	5.377	0.01*	1.21
PedsQL Physical (Child) (Mean±SD)	60.4±22.2	78.9±17.9	3.888	0.01*	0.92
PedsQL Social (Child) (Mean±SD)	65.0±17.5	80.1±14.8	3.884	0.01*	0.93
PedsQL Total (Child) (Mean±SD)	63.5±16.2	79.7±13.3	4.513	0.01*	1.09
SDSC – DIMS (Median-IQR)	13 (6)	11 (3)	3.357	0.001	0.36
SDSC – SBD (Median-IQR)	4 (2)	4 (4)	0.713	0.476	
SDSC – DA (Median-IQR)	3.5 (2)	3 (1)	1.420	0.156	
SDSC – SWTD (Median-IQR)	9.5 (5)	7 (4)	3.679	<0.001	0.37
SDSC – DOES (Median-IQR)	10 (7)	8 (6)	2.414	0.016	0.24
SDSC – Sleep hyperhydrosis (Median-IQR)	2 (2)	2 (2)	1.368	0.171	
SDSC – Total (Median-IQR)	45.5 (20.8)	39 (12.8)	3.242	0.001	0.32

PedsQL: The Pediatric Quality of Life Inventory, SDSC: The Sleep Disturbance Scale for Children , DIMS: Disorders of initiating and maintaining sleep, SBD: Sleep breathing disorders, DA: Disorders of arousal/nightmares, SWTD: Sleep wake transition disorders, DOES: Disorders of excessive somnolence, SD: Standard Deviation, IQR: Interquartile Range.

Table 3. Comparison of children with and without headache and total groups according to chronotype form.

	Patient n (%)	Healthy Control n (%)	Total n (%)	Chi Square	P
Morningness	3 (6)	7 (14)	10 (10)	1.828	0.401
Intermediate	20 (40)	18 (36)	38 (38)		
Eveningness	27 (54)	25 (50)	52 (52)		

Table 4. Correlations between chronotype total scores and the subscales of the PedsQL, SDSC.

	CCQ Total Score	PedsQL Physical	PedsQL Social	PedsQL Total
CCQ Total Score		r=-0.049 p=0.649	r=-0.342 p=0.001	r=-0.342 p=0.001
SDSC – DIMS	r=0.360 p<0.001	r=-0.109 p=0.310	r=-0.508 p<0.001	r=-0.374 p<0.001
SDSC – SBD	r=0.025 p=0.802	r=-0.159 p=0.138	r=-0.246 p=0.020	r=-0.231 p=0.029
SDSC – DA	r=0.129 p=0.201	r=-0.146 p=0.174	r=-0.318 p=0.002	r=-0.271 p=0.010
SDSC – SWTD	r=0.293 p=0.003	r=-0.256 p=0.015	r=-0.492 p<0.001	r=-0.432 p<0.001
SDSC – DOES	r=0.400 p<0.001	r=-0.409 p<0.001	r=-0.570 p<0.001	r=-0.400 p<0.001
SDSC – Sleep hyperhydrosis	r=-0.026 p=0.799	r=-0.259 p=0.014	r=-0.307 p=0.003	r=-0.315 p=0.003
SDSC – Total Score	r=-0.049 p=0.649	r=-0.332 p<0.001	r=-0.647 p<0.001	r=-0.567 p<0.001

CCQ: Childhood Chronotype Questionnare, PedsQL: The Pediatric Quality of Life Inventory, SDSC: The Sleep Disturbance Scale for Children, DIMS: Disorders of initiating and maintaining sleep, SBD: Sleep breathing disorders, DA: Disorders of arousal/nightmures, SWTD: Sleep wake transition disorders, DOES: Disorders of excessive somnolence.

Table 5. Variables predicting CCQ score.

Variable	B	SEB	β
SDSC- Sleep hyperhydrosis	-0.880	0.439	-0.233*

R^2= 0.305, F(10,78)=3.423, p=0.001 *p<0.05.

between the most common primary headache, migraine, and sleep symptoms. This review found that children with episodic migraines had shorter sleep durations, as well as higher rates of insomnia, sleep-related bruxism, and restless legs syndrome, according to both self-report scales and objective assessments such as polysomnography and actigraphy [22]. In a study on the relationship between daytime sleepiness and headaches, 69 patients aged 13-17 diagnosed with primary headaches were included, and the cases were assessed using the School Sleep Habits Questionnaire. Daytime sleepiness was found in 23.3% of the group with primary headaches [23]. In a study involving 21,177 adults, those with migraines had 1.42 times more significant daytime sleepiness than those without, and multivariate analyses showed that daytime sleepiness was 2.74 times greater in the headache group than those without headaches [24]. Comprehensive assessment of sleep disorders in children and adolescents with primary headaches is considered crucial for improving diagnostic accuracy and optimizing treatment outcomes [25]. The sleep problems observed in our study among those with primary headaches are consistent with the literature, emphasizing the importance of evaluating sleep issues in children and adolescents diagnosed with headaches.

Our study further revealed that children with primary headaches exhibit significant impairments in both physical and psychosocial dimensions of quality of life. A review of 80 articles that evaluated the quality of life in primary headaches found that the physical and emotional/spiritual dimensions of quality of life were impaired [26]. In a recent study conducted in our country, 61 adolescents with primary headaches and 31 healthy controls were compared regarding quality of life. All quality of life scores were lower in the group with primary headaches [27]. In another study involving 466 primary and secondary school children diagnosed with primary headaches, it was found that students had school absenteeism related to headaches and that their families experienced work loss; approximately two-thirds of them also had difficulty coping with this pain [28]. Moreover, a retrospective study evaluating the sleep problems of children aged 7-17 with primary headaches showed that as sleep disorders increased, there was more significant functional impairment [29]. Our study's findings are consistent with the literature.

The results of our study indicated no significant discrepancy in chronotype preference between children with primary headaches and their healthy counterparts. A literature review shows that studies on chronotype and headaches are mainly focused on the migraine group. In a case-control study, researchers reported that individuals with migraines are more prone to early or late chronotypes than the control group. Moreover, individuals with migraines experienced more headache attacks in relation to their chronotype: those with early chronotypes tended to have more migraines in the morning, while those with late chronotypes experienced more attacks in the evening or at night [13]. Similarly, in a study comparing two groups with migraine and tension-type headaches, it was found that there was a significant relationship between chronotype and headache attack timing preference in participants with migraines but not in those with tension-type headaches.

The study proposed that circadian preference could serve as a modifiable factor for migraine management, highlighting the importance of chronotype assessment in tailoring treatment strategies [14].

Finally, our study found that as chronotype scores increased, sleep problems worsened, and quality of life decreased; additionally, sleep sweating could predict chronotype scores. There is evidence that the relationship between sleep disturbances and chronotype may mediate psychopathologies [10]. Individuals with an evening chronotype, in particular, are more likely to experience sleep-related issues such as hypersomnia and nightmares. Additionally, the risk of psychopathology is higher in those with an evening chronotype [30]. The predictive role of sleep sweating in chronotype scores observed in our study might be linked to the stronger association of higher chronotype scores with evening chronotypes and their increased susceptibility to parasomnias.

Our study has some limitations. First, the assessment tools used in our study are based on self or proxyreport scales. This may pose a risk of systematic bias. Second, the participants' sleep was evaluated based on information obtained from them. Third limitation is the lack of consideration for how cultural or regional differences might influence sleep patterns and chronotype characteristics. The age difference between the control and patient groups represents another limitation. Assessing participants' sleep parameters using more objective tools, such as polysomnography or actigraphy, could have minimized the risk of bias. Fourth, our study's single-center design limits the generalizability of the findings. Multi-center studies could yield more robust and externally valid results. Fifth, prospective studies involving a larger number of patients, categorizing primary headaches into tension-type and migraine, would provide much more robust data on this subject.

Conclusion

Our study found that patients followed up with a diagnosis of primary headache had sleep problems and both physical and psychosocial quality of life negatively affected. Although patients and healthy controls did not significantly differ in terms of chronotype preference, our finding that as chronotype scores increased (evening type), sleep problems increased, and quality of life was negatively impacted highlights the importance of evaluating sleep, quality of life, and chronotype in the approach to these patients. Additionally, our finding of 'sleep sweating' as a predictor of chronotype scores may provide insight into evaluating parasomnias.

Ethical approval

Ethical approval for the study was obtained from the Etlik City Hospital Clinical Research Ethics Committee (Number: 2023-124, Date: 17.05.2023).

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