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Original Article

Sleep Disturbances and Internet Overuse in Pediatric Migraine: A Neuropsychiatric Approach

Pediatrik Migrenlerde Uyku Bozuklukları ve Aşırı İnternet Kullanımı: Nöropsikiyatrik Bir Yaklaşım

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ABSTRACT

Objective: The aim of this study was to evaluate sleep quality and internet use behaviours in children with pediatric migraine, focusing on their associations with anxiety, internet gaming disorder (IGD), and daytime functional impairment.

Method: The study included 38 pediatric patients aged 10-18 years with migraine and 35 age-matched controls without migraine or psychiatric complaints. Migraine characteristics were systematically assessed, and sociodemographic data were collected. Comorbid psychiatric symptoms were evaluated using the Kiddie Schedule for Affective Disorders and Schizophrenia-Present and Lifetime Version. All participants completed the Pittsburgh Sleep Quality Index (PSQI), the IGD Scale-Short-Form (IGDS9-SF), and the Screen for Child Anxiety Related Disorders (SCARED).

Results: The migraine patients comprised 65.8% females and 34.2% males. Of these, 26 reported a positive family history of migraine, 12 were diagnosed with migraine with aura, and 26 without aura. The SCARED and IGDS9-SF scores were significantly higher in the migraine group than in the control group (p=0.001, p=0.011). Total PSQI scores indicated poorer sleep quality in migraine patients (p=0.001). Sleep latency (p=0.579) and duration (p=0.882) did not differ between the groups but subscale analyses revealed significant impairments in subjective sleep quality (p=0.001), daytime dysfunction (p=0.018), sleep disturbances (p=0.001), and habitual sleep efficiency (p=0.001) in the migraine patients.

Conclusion: Pediatric migraine is associated with heightened anxiety, problematic gaming, and impaired sleep quality, contributing to daytime dysfunction. These results underscore the importance of a multidisciplinary approach addressing both migraine symptoms and co-existing psychological factors.

Keywords: Migraine, child and adolescent psychiatry, internet addiction, sleep quality

ÖZ

Amaç: Bu çalışmanın amacı, pediatrik migren tanılı çocuklarda uyku kalitesi ve internet kullanım davranışlarını değerlendirmek ve bu değişkenlerin anksiyete, internet oyun bozukluğu ve gündüz işlevselliği ile ilişkilerini incelemektir.

Yöntem: Çalışmaya, 10-18 yaş aralığında migren tanısı almış 38 çocuk ile migren veya psikiyatrik yakınması bulunmayan, yaş ve cinsiyet açısından eşleştirilmiş 35 sağlıklı kontrol grubu dahil edilmiştir. Migren özellikleri ve sosyodemografik veriler sistematik olarak kaydedilmiştir. Eşlik eden psikiyatrik belirtiler Çocuklar için Duygudurum Bozuklukları ve Şizofreni Tarama Çizelgesi-Şimdiki ve Yaşam Boyu Versiyonu ile değerlendirilmiştir. Katılımcılara Pittsburgh Uyku Kalitesi İndeksi (PUKİ), İnternet Oyun Bozukluğu Ölçeği-Kısa Form (İOOBÖ9-KF) ve Çocuklarda Anksiyeteye İlişkin Bozuklukları Tarama Ölçeği (ÇATÖ) uygulanmıştır.

Bulgular: Migren grubunun %65,8'i kız olup 26'sında ailede migren öyküsü mevcuttu. On iki olguda auralı, 26 olguda aurasız migren saptanmıştır. Migren grubunda ÇATÖ puanları kontrol grubuna göre anlamlı düzeyde yüksek bulunmuştur (p=0,001). İOOBÖ9-KF puanları da migren grubunda daha yüksektir (p=0,011). Toplam PUKİ puanları, migrenli çocuklarda daha düşük uyku kalitesine işaret etmiştir (p=0,001). Uyku latensi (p=0,579) ve süresi (p=0,882) açısından fark saptanmamıştır. Ancak öznel uyku kalitesi (p=0,001), gündüz işlev bozukluğu (p=0,018), uyku bozuklukları (p=0,001) ve alışılmış uyku etkinliği (p=0,001) alt ölçeklerinde anlamlı bozulma belirlenmiştir.

Sonuç: Pediatrik migren, artmış anksiyete düzeyi, problemli oyun oynama davranışı ve bozulmuş uyku kalitesi ile ilişkilidir. Bu bulgular, migrenin yönetiminde psikolojik eş tanıların dikkate alındığı multidisipliner yaklaşımların gerekliliğini vurgulamaktadır.

Anahtar kelimeler: Migren, çocuk ve ergen psikiyatrisi, internet oyun bozukluğu, uyku kalitesi

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INTRODUCTION

Migraine is a common neurological disorder during childhood and adolescence that significantly impacts quality of life. Its etiology is thought to result from the interaction of genetic, environmental, and lifestyle factors[1]. The prevalence of migraine in childhood is approximately 10%, increasing to as high as 15% during adolescence[2,3]. Pediatric migraine is not limited to physical symptoms but also adversely affects cognitive, social, and emotional development. Studies have reported higher levels of depression and anxiety in children with migraine, together with increased school absenteeism, social withdrawal, and a marked decline in quality of life[4].

Recently, the increasing use of digital media has introduced new risk factors for migraine. Prolonged screen exposure has been associated with increased frequency and severity of migraine attacks, particularly when digital media is used during night-time hours[5]. Internet and gaming addiction may trigger migraine through mechanisms such as sleep disturbances, physical inactivity, and increased psychosocial stress[6]. Furthermore, Internet use has been reported to be associated with psychiatric symptoms. In a study examining adolescents diagnosed with migraine, those who used the Internet for more than two hours per week exhibited impairments in mood and social functioning[7].

Migraine is also bidirectionally associated with sleep disorders and psychiatric conditions. While poor sleep quality can increase the frequency of migraine attacks, headaches themselves may disrupt sleep patterns[8,9]. Sleep problems can lead to daytime sleepiness, impaired attention, and functional decline[10]. Previous studies have demonstrated a reduction in rapid eye movement (REM) sleep and disruption of sleep continuity in adult migraine patients[11]. It has also been reported that individuals with migraine experience increased daytime sleepiness, which negatively impacts daily functioning[12].

Psychiatric comorbidities such as anxiety, depression, attention deficit hyperactivity disorder (ADHD), and somatization are common in children and adolescents with migraine, complicating both diagnosis and treatment processes[13,14]. Migraine is considered not merely a headache disorder, but a multidisciplinary condition influenced by psychiatric, behavioral, and environmental factors[15]. In this context, the aim of this study was to assess the relationships between internet use, sleep quality, and psychiatric symptoms in children and adolescents diagnosed with migraine.

MATERIALS and METHODS

Participants and Study Design

The study included 38 children aged 10 to 18 years who were diagnosed with migraine, together with their parents, who presented at the Pediatric Neurology Clinic over a period of 2 months. The migraine diagnosis was made according to the criteria outlined in the third edition of the International Classification of Headache Disorders[16]. The study participants were categorized into two groups based on migraine subtype: those with aura and those without aura. Various factors, including the location, frequency, duration of headaches, and accompanying migraine symptoms were evaluated in detail and categorized. Parents were interviewed to offer opinions about the familial and emotional aspects related to managing their child's condition. A standardized pain scale was administered to all patients to evaluate headache severity, which was subsequently classified into three categories of mild, moderate, and severe[17].

All the study participants were referred to the child psychiatry clinic, with their parents, and were personally interviewed by the researcher. To identify comorbid psychiatric disorders and enhance diagnostic reliability, assessments were conducted using the Kiddie Schedule for Affective Disorders and Schizophrenia for School-Age Children-Present and Lifetime Version (K-SADS-PL). All the participants were also asked to complete the Pittsburgh Sleep Quality Index (PSQI) to evaluate sleep quality, the Internet Gaming Disorder Scale-Short Form (IGDS9-SF) to assess problematic online gaming behaviours, and the Screen for Child Anxiety Related Emotional Disorders (SCARED) to measure anxiety levels.

A control group was formed of 35 children and their parents who did not present with any neurological or psychiatric complaints. The study exclusion criteria were defined as a dignosis of any chronic neurological disorder other than migraine, a clinical diagnosis of intellectual disability or autism spectrum disorder, and unwillingness to participate in the study.

Approval for this study was granted by the Non-Interventional Research Ethics Committee of the University of Health Sciences Turkey, İzmir Tepecik Education and Research Hospital (approval number: 2025/05-16, dated: 12.06.2025). Written and verbal informed consent was obtained from the participating children and their parents.

Instruments

Sociodemographic Data Form

This form was developed by the researcher based on a review of the literature and was completed by the researcher using information obtained from the parents. It includes sociodemographic and clinical characteristics related to the participant and their family. Specifically, the form collects data on the participant's age, sex, presence of perinatal complications, family history of migraine diagnosis, diagnosis, headache location, duration and frequency, whether the pain is unilateral or bilateral, presence of accompanying photophobia or phonophobia, presence of accompanying nausea or vomiting, headache severity, whether the headache is exacerbated by physical activity, presence of aura, and if present, the duration and type of aura. It also records whether the participant uses analgesic medications during attacks or prophylactically.

K-SADS-PL

This form is used to evaluate lifetime comorbid psychopathologies in children. If diagnostic symptoms are identified during the initial interview, an additional evaluation checklist is administered. The presence and severity of positive findings are determined based on the clinician's, family's, and participant's input. The standardization of the form has been conducted for Turkish children[18,19].

PSQI

The scale was developed by Buysse et al.[20] to assess sleep quality. The PSQI comprises seven components: sleep latency, sleep duration, subjective sleep quality, habitual sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction. The total score ranges from 0 to 21 points, with 0-4 points indicating good sleep quality, and 5-12 points, poor sleep quality. The Turkish validity and reliability study of the scale was conducted by Yücel Ağargün et al.[21].

IGDS9-SF

This scale was developed by Pontes and Griffiths[22], based on nine core criteria that define IGD. These criteria can be summarized as follows: preoccupation with gaming, withdrawal symptoms, development of tolerance, unsuccessful attempts to control gaming behaviour, loss of interest in previous enjoyable activities, continued excessive gaming despite negative psychosocial consequences, deceiving family members or therapists regarding the amount of time spent gaming, using gaming to escape negative mood states, and jeopardizing or losing a significant relationship, job, educational, or career opportunity due to gaming. The Turkish validity and reliability study of the scale has been conducted[23].

SCARED

This scale was developed by Birmaher et al.[24] to screen for childhood anxiety disorders, and the Turkish validity and reliability study was conducted by Karaceylan Çakmakçı et al.[25]. The scale consists of a total of 41 items, with scores of ≥25 points considered indicative of potential anxiety disorders.

Statistical Analysis

Data were analyzed using SPSS software. The Shapiro-Wilk test was used to assess the normality of data distribution. Variables with normal distribution were presented as mean ± standard deviation values, and variables not showing normal distribution as median and interquartile range values. Categorical variables were compared using the chi-square test or Fisher's exact test. Continuous variables were analyzed using the Independent Samples t-test or Mann-Whitney U test for two-group comparisons. Post-hoc tests were applied when significant differences were detected. A value of $p<0.05$ was considered statistically significant.

RESULTS

Evaluations were made of a total of 73 children, comprising 38 patients in the migraine group and 35 individuals in the control group. The mean age of the children was 13.6±2.5 year in the migraine group and 12.7±0.6 years in the control group, with no significant difference in age at presentation between the groups. Of the patients diagnosed with migraine, 65.8% (n=25) were female and 34.2% (n=13) were male; in the control group, 40% (n=14) were female and 60% (n=21) were male. A statistically significant difference in sex distribution was observed between the groups (p=0.027). A family history of migraine was reported in 68.4% (n=26) of the case group and in 14.3% (n=5) of the control group, with this difference also reaching statistical significance (p=0.001) (Table 1).

When clinical subtypes of migraine were evaluated, 12 patients were diagnosed with migraine with aura, and 26 patients with migraine without aura. According to the classification based on headache localization, pain was reported in the frontal region in 20 patients, parietal region in 3 patients, occipital region in 5 patients, and

temporal region in 10 patients. Regarding lateralization, 11 patients experienced unilateral headaches, whereas 27 patients had bilateral headaches. Photophobia was observed in 29 patients, and phonophobia in 25 patients. Nausea was reported in 23 patients, and vomiting in 5 patients. When headache severity was assessed using a pain scale, 20 patients described their pain as severe, and 18 as moderate. Headaches triggered by physical activity were reported by 23 patients. Among those diagnosed with migraine with aura, 8 patients experienced visual aura symptoms, 2 somatosensory, and 2 auditory aura symptoms. According to the headache frequency classification, 4 patients reported headaches at least once a month, 19 at least once a week, 6 experienced headaches on average three days per week, and 9 reported daily headaches.

Table 1. Demographic and clinical characteristics of the cases

	Migraine group (n=38)	Control group (n=35)	p-value
Age (years)	13.6±2.5	12.7±0.6	0.057
Gender			
Female	25 (65.8%)	14 (40%)	0.027
Male	13 (34.2%)	21 (60%)	
Family history of migraine			0.001
Yes	26 (68.4%)	5 (14.3%)	
No	12 (31.6%)	30 (85.7%)	
Psychiatric diagnosis			<0.001
Yes	26 (68.4%)	8 (22.9%)	
No	12 (31.6%)	27 (77.1%)	
Anxiety disorder			0.001
Yes	25 (65.8%)	7 (20%)	
No	13 (34.2%)	28 (80%)	
Depressive disorder			0.201
Yes	5 (13.2%)	1 (2.9%)	
No	33 (86.8%)	34 (97.1%)	
OCD			
Yes	3 (7.9%)	0 (0%)	0.241
No	35 (92.1%)	35 (100%)	
ADHD			
Yes	6 (15.8%)	5 (14.3%)	0.858
No	32 (84.2%)	30 (85.7%)	

OCD: Obsessive-compulsive disorder, ADHD: Attention deficit hyperactivity disorder

A significant difference was observed between the groups in respect of psychiatric diagnoses (p<0.001). Anxiety disorder was present in 65.8% (n=25) of the migraine group, compared to 20% (n=7) in the control group, with this difference reaching statistical significance (p=0.001). Of the patients with migraine, 13.2% (n=5) had comorbid depressive disorder, 7.9% (n=3) had obsessive-compulsive disorder, and 15.8% (n=6) had ADHD. In the control group, depressive disorder was present in 2.9% (n=1), and ADHD in 14.3% (n=5). No significant differences were found between the groups for these diagnoses (Table 1).

In the assessment of anxiety symptoms, the total score of the SCARED, was statistically significantly higher in the migraine group at 29.5±13.6 compared to 11.7±4.7 in the control group (p=0.001). The total score of the IGDS9-SF was 15.6±5.7 in the migraine group and 12.7±3.3 in the control group, showing a statistically significant difference (p=0.011). The total PSQI score was 6.7±3.7 in the migraine group and 3.7±2.1 in the control group, with a significant difference between groups (p=0.001). No significant differences were found between the groups in the PSQI sub-scores for sleep latency (0.8±0.86 vs. 0.9±0.7; p=0.579), sleep duration (0.7±0.9 vs. 0.7±0.6; p=0.882), and use of sleep medication (0.4±0.8 vs. 0.3±0.5; p=0.721). The sleep quality sub-score was significantly higher in the migraine group (1.3±0.9) compared to the control group (0.3±0.6) (p=0.001). The sub-scores for daytime dysfunction (1.0±1.1 vs. 0.5±0.6; p=0.018), sleep disturbances (1.4±1.0 vs. 0.6±0.7; p=0.001), and habitual sleep efficiency (1.4±0.8 vs. 0.4±0.6; p=0.001) were significantly higher in the migraine group than in the control group (Table 2).

DISCUSSION

The aim of this study was to comprehensively evaluate comorbid psychiatric symptoms, anxiety levels, sleep quality, and the tendency toward IGD in children and adolescents diagnosed with migraine. The findings indicated that migraine is not merely a neurological disorder but also constitutes a complex clinical condition that significantly affects psychosocial functioning.

Although migraine is defined as a neurovascular disorder, it has also long been investigated within a psychosocial framework. The current study finding of a higher prevalence of a family history of migraine compared to the control group supports genetic studies in the field that explore etiological factors[26]. However, in recent

Table 2. Scale scores			
	Migraine group (n= 38) Median (min-max)	**Control group (n=35) Median (min-max)**	**p-value**
SCARED total score	29.5±13.6	11.7±4.7	0.001
IGDS9-SF total score	156±5.7	12.7±3.3	0.011
PSQI total score	6.7±3.7	3.7±2.1	0.001
Sleep latency	0.8±0.86	0.9±0.7	0.579
Sleep duration	0.7±0.9	0.7±0.6	0.882
Sleep quality	1.3±0.9	0.3±0.6	0.001
Use of sleep medication	0.4±0.8	0.3±0.5	0.721
Daytime dysfunction	1±1.1	0.5±0.6	0.018
Sleep disturbances habitual	1.4±1	0.6±0.7	0.001
Sleep efficiency	1.4±0.8	0.4±0.6	0.001

SCARED: Screen for Child Anxiety Related Emotional Disorders, IGDS9-SF: Internet Gaming Disorder Scale-Short Form, PSQI: Pittsburgh Sleep Quality Index

years, psychiatric factors have also been highlighted as both predisposing and perpetuating contributors. It is known that anxiety disorders are observed in 20-50% of children diagnosed with migraine[27]. Consistent with the literature, the current study observed a predominance of female sex among children with migraine, and anxiety rates were significantly higher compared to the control subjects. Notably, although a substantial proportion of the control group also exhibited anxiety or depressive symptoms (7 of 35 with an anxiety disorder, 1 with depression), the rates in the migraine group remained significantly elevated. This suggests that while psychiatric symptoms can occur in the general pediatric population, migraine may act as an independent risk factor for increased anxiety, potentially due to the unpredictable, chronic, and recurrent nature of attacks. The observed sex difference is most likely influenced by hormonal changes in addition to genetic and psychosocial factors[28]. The finding of increased anxiety symptoms in the migraine group is consistent with previous studies, which have stated that the unpredictable, chronic, and recurrent nature of migraine may elevate anxiety levels in children or have suggested that anxiety, by increasing the frequency of migraine attacks, acts as both a trigger and a secondary comorbid condition[29].

However, in the current study, no significant differences were observed in terms of comorbid depression and ADHD diagnoses. Although some studies have reported a strong association between migraine and these disorders[13], this relationship appears to vary particularly across clinical settings and age groups. Factors such as the sample size, the age range of participants, or the assessment methods employed in the current study may have limited the early detection of these disorders. Furthermore, considering the role of psychosocial factors in the etiology of migraine, it can be hypothesized that anxiety emerges earlier and more prominently in children with migraine, whereas disorders such as depression and ADHD may develop later or follow different clinical courses. The higher prevalence of internalizing disorders in females, compared to externalizing disorders such as ADHD[30], also supports the consideration of sex distribution when examining migraine and associated psychiatric comorbidities.

A review of the literature revealed that although there are a limited number of studies examining digital addiction and problematic gaming behaviors in the context of long-term pain and coping strategies, some important insights have been reported regarding this relationship. In particular, due to the psychosocial impact of chronic illnesses, children are at increased risk of developing comorbid psychiatric conditions such as social isolation and anxiety, which in turn may trigger problematic gaming behaviours through digital platforms[31]. Moreover, increased screen time and psychosocial difficulties can also act as triggers for headaches[32]. This situation may adversely affect the quality of life in individuals with migraine. In the current study, problematic online gaming behaviours were observed to be more prevalent in the children with migraine compared to the control group. While increased dopaminergic sensitivity is known to play a role in the pathophysiology of migraine[33], there is also evidence in the literature suggesting that excessive activation of the

mesolimbic dopamine pathway contributes to addictive behaviours in IGD[34]. Although the data regarding the association between these two conditions are noteworthy, no studies to date have directly investigated this relationship. Further neuroimaging studies are needed in this field.

There is evidence suggesting that in children with migraine, total sleep duration may be normal or even prolonged in some cases, although sleep quality is often poor and fragmented[35]. Studies have proposed that this phenomenon may be related to increased trigeminal autonomic activity, dysfunction in melatonin rhythmicity, and imbalances within neurotransmitter systems involved in central pain modulation[36]. Another study reported that a reduction in REM sleep in patients diagnosed with migraine negatively affects sleep quality[37]. In addition, psychiatric comorbidities in the groups should be considered as potential factors affecting sleep quality. Even if the overall sleep duration appears normal, the restorative and recuperative effects of sleep are diminished, thereby exacerbating daytime functional impairment. Daytime dysfunction negatively affects social, cognitive, and academic functioning, ultimately reducing quality of life[35]. While the findings of the current study are consistent with the literature, they also indicate that sleep duration and sleep quality may be considered independent variables in the etiopathogenesis and clinical manifestations of migraine, and that this interaction may be bidirectional.

Study Limitations

There were some limitations to this study, which must be considered, primarily the cross-sectional design, the collection of data through self-report questionnaires, and the potential influence of individual differences and environmental factors on variables such as problematic internet use and sleep quality. In addition, the sample size and the fact that data were collected from a single centre restrict the generalizability of the study results. Further research with larger samples is warranted.

CONCLUSION

Migraine in children and adolescents is a complex, multifactorial disorder, arising from the interaction of genetic predisposition, environmental triggers, lifestyle deficiencies, and psychosocial stressors. A multidisciplinary evaluation of diagnosed children is crucial for the prevention of both behavioral problems and deteriorations in quality of life, and ito be able to influence the overall prognosis of the disorder.

Ethics

Ethics Committee Approval: Approval for this study was granted by the Non-Interventional Research Ethics Committee of the University of Health Sciences Turkey, İzmir Tepecik Education and Research Hospital (approval number: 2025/05-16, dated: 12.06.2025).

Informed Consent: Written and verbal informed consent was obtained from the participating children and their parents.

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Footnotes

Author Contributions

Surgical and Medical Practices: B.Y.T., D.Ö.K., Y.G., Concept: B.Y.T., D.Ö.K., Y.G., Design: B.Y.T., D.Ö.K., Y.G., Data Collection or Processing: B.Y.T., D.Ö.K., Y.G., Analysis or Interpretation: B.Y.T., Y.G., Literature Search: B.Y.T., Y.G., Writing: B.Y.T., D.Ö.K., Y.G.

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