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Adolescents with Migraine Experience More Daytime Dysfunction than Other Counterparts: A Descriptive Cross-Sectional Study

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Abstract

Objective: *This study examined circadian rhtyhm factors of adolescents with primary headaches and its relation with perceived quality of life and sleep quality as well.*

Method: *Adolescents aged 14-18 years with primary headaches were examined via International Physical Activity Questionnaire-Short Form (IPAQ-SF), World Health Organization Quality of Life-Short Form (WHOQOL-BREF), Biological Rhythm Interview of Assesment in Neuropsychiatry Scale (BRIAN) and Pittsburg Sleep Quality Index (PSQI). SPSS 17.0 was used for statistical analyses. $p<.05$ was accepted as significant.*

Results: *Of 101 adolescents with primary headaches and 97 healthy counterparts were included. Adolescents with primary headaches had similar circadien pattern of sleep, physical and social activity and eating habits, as well as perceived quality of life and sleep quality compared to the healthy counterparts (for all variables $p>.05$). In terms of specific headaches, there was a significance for having migraine in terms of higher daytime dysfunction, a subscale of PSQI ($F(2) = 4.209$, $p = .016$) and lower environmental quality of life, a subscale of WHOQOL-BREF ($F(2) = 5.034$, $p = .007$.*

Conclusion: *Migraine affects daytime functioning and environment's quality of life perceived. Countermeasures related to improving daytime functions of adolescents with migraine could result in better quality of life perceived.*

Keywords: *migraine, BRIAN, QoL, sleep, adolescent*

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Introduction

Primary headaches are one of the debilitating disorders that affect adolescence's quality of life and their sleep quality. Physical inactivity, smoking, and lifestyle factors are previously reported as preventable risk factors for primary headache in adolescents[1].

Biological rhythm is a homeostatic factor to equilibrium of the body functions including circadian rhythm as the most important one. Disrupted biological rhythm as a contributor factor in primary headaches, on the other hand, are relatively less studied subjects in adolescents.

The aim of this study is to examine should primary headaches are affected by circadian factors.

Material and Methods

Adolescents aged 14-18 years whom they admitted to Ankara Training and Research Hospital Child Neurology department between April 2018 and April 2019 were examined. Adolescents whose headache was fulfilled by one of the primary headaches using with International Headache Society's International Classification of Headache Disorders (ICHD-3, 2013) criteria[2] constituted primary headache group and others who had not any specific neurological disorder as healthy counterparts.

Inclusion criteria for both groups were the following; Normal neurological findings of cranial MRI or computerized tomography, normal EEG results, not having any organic, genetic or syndromic disorder related to the headache, mental retardation, and agreed to join this study. These participants were consultated to the child psychiatry department to evaluate their mental status. Psychiatric diagnoses were carried out according to the DSM-5 (APA, 2013) criteria[3] by the child psychiatrists[2].

Tools Used

Demographic variables were recorded. Body-mass index (BMI) were categorized as <18.5 kg/m^2 as underweight, ≥18.5-<24.9 kg/m^2 normal, ≥25-<29.9 kg/m^2 overweight, and ≥30 kg/m^2 obese based on WHO for 5-19 years. Physical activity were examined via International Physical Activity Questionnaire- Short Form (IPAQ-SF)[4], quality of life (QoL) was assessed with World Health Organization-QoL-Short Form (WHO-QoL-BREF) scale[5], circadian rhythm was assessed by Biological Rhythm Interview of Assesment in Neuropsychiatry Scale (BRIAN)[6,7] and sleep quality was examined with Pittsburg Sleep Quality Index (PSQI).[8,9]

International Physical Activity Questionnaire-Short Form (IPAQ-SF): The questionnaire is based on the calculation of the metabolic equivalent (MET) value which is spent by evaluating the short form of physical activity of at least 10 minutes in terms of frequency, duration (minutes) and severity in the last 7 days. 1 MET = indicates the amount of oxygen used by the person at rest (in sitting state) (3.5 ml/O_2/kg). The form consists of four parts under walking, moderate physical activity and very severe physical activity. The total MET value of the activity of each section is calculated by calculating the values in minutes and days of the efficacy of the activity (3.3 MET for walking, 4 MET for moderate physical activity and 8 MET for severe physical activity). Sum of three items point total MET value and it is categorized as "inactive" if a total weekly MET value is less than 600, 600-3000 MET as "minimally active" and more than 3000 MET as "highly active". Turkish validation of this scale was conducted by Saglam et al in 2010.[4]

World Health Organization Quality of Life-Short Form (WHOQOL-BREF): The health-related quality of life scale was developed by WHO and validated by reliability by Eser et al., in 1999.[5] The scale measures physical, psychological, social and environmental well-being and consists of 26 questions. The scale does not have a total score. Since each field independently expresses the quality of life in its field, the area scores are calculated between 4-20. The higher the score, the better the quality of life.

Biological Rhythm Interview of Assesment in Neuropsychiatry Scale (BRIAN): Developed by Giglio et al (2009), the scale measures daily cyclic rhythm and functionality of patients.[6] The 4-item Likert consists of 21 items and five sub-headings as sleep (5-item), activity (5-item), social (4-item), eating habits (4-item) and dominant biorhytm (3-item). Last three items are not added to the total score. High scores indicate irregularity in biological rhythm. Turkish validity and reliability study of it was carried out by Aydemir et al (2012).[7] Croanbach alpha internal consistency was detected as .798. Croanbach alpha of item-test correlations were found to be from .697 to .781.

Pittsburg Sleep Quality Index (PSQI): A 24-item scale that questions sleep quality and sleep-related disorders during a one-month period was developed by Buysse et al. (1989).[8] These include 7 sub-components: Subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication and daytime dysfunction. Each component is rated at 0-3 points. The total score of the 7 components gives the total score of the scale that ranges

from 0 to 21. If the total score is greater than 5, it indicates "poor sleep quality". The reliability of the Turkish version was performed by Agargun et al. (1996).[9] Croanbach alpha internal consistency was detected as .782. Croanbach alpha of item-test correlations were found to be from .398 to .758.

Ethical approval was obtained from the Local Committee of Ankara Training and Research Hospital (document numbered with 28.03.2018/0040/400). Written consent were obtained from adolescents themselves.

Power analysis (G-Power 3.1, Kiel-Germany, 2017) of this study with 90% power, 5% error rate and effect size of 0.5 with 1:1 distribution revealed that 90 adolescents would be sufficient for each group.

Statistical analysis: SPSS 17.0 (Chicago Inc., 2008) program was used for statistical analyses. Continuous variables were defined as mean, standard deviation, minimum-maximum values and categorical ones as frequency (n) and percentage (%). Normality of the continuous variables was examined via Kolmogorov-Smirnov test. For comparisons of the continuous variables, Student t test or ANOVA were used. Categorical variables were compared using the χ^2 test. Pearson correlation analysis were used for scale scores with other independent variables. $p<.05$ was accepted as significant in dual comparisons and $p<.017$ for triple comparisons.

Results

Of 198 adolescents aged 14-18, mean age was 15.9 years, 78.3% (n = 155) of them were girls and 21.7% (n = 43) were boys. Primary headaches group (n=101) included 73.3% (n = 74) of tension-type headache and 26.7% (n = 27) of migraine. Of 70.2% (n = 139) had normal BMI. Of 10.6% of all (n = 21) were active-smoking and 45.5% (n = 90) of all were reaching their school via walking. Of 34.3% (n = 68) were physically inactive.

Evaluating the effect of having tension-type or migraine type headache on scale scores compared to the healthy group revealed that three groups were similar in terms of demographics including age, BMI scores, smoking status, reaching to school, except gender (for all variables $p>.05$, see Table 1).

Table 1. *Comparisons of variables between tension-type, migraine and healthy groups.*

	Primary Headaches (n = 101)				
	Healthy control	**Tension-type**	**Migraine**	**Statistics**	
	n = 97	**n = 74**	**n = 27**	**F or χ2**	**P value**
Age (years)[a]	15.8 (1.3)	15.8 (1.3)	16.1 (1.0)	.690	.503
Gender, n (%)					
Girls	86 (88.7)	49 (66.2)	20 (74.1)	12.763	.002
Boys	11 (11.3)	25 (33.8)	7 (25.9)		
BMI (kg/m²)[a]	20.9 (3.7)	21.4 (3.5)	22.6 (3.3)	2.233	.110
BMI categories, n (%)					
Underweight	16 (16.5)	17 (23.0)	3 (11.1)		
Normal	73 (75.3)	47 (63.5)	19 (70.4)		
Overweight	4 (4.1)	9 (12.2)	5 (18.5)		
Obese	4 (4.1)	1 (1.4)	0		
Smoking, n (%)					
Not-smoking	86 (88.7)	68 (91.9)	23 (85.2)	1.047	.593
Active smoking	11 (11.3)	6 (8.1)	4 (14.8)		
Reaching school, n (%)					
On motor vehicle	54 (55.7)	37 (50.0)	17 (63.0)	1.438	.487
On foot	43 (44.3)	37 (50.0)	10 (37.0)		
Scales					
IPAQ-SF activity, n (%)					
Inactive	34 (35.1)	24 (32.4)	10 (37.0)		
Minimally active	46 (47.4)	34 (45.9)	12 (44.4)	.571	.966
Highly active	17 (17.5)	16 (21.6)	5 (18.5)		
WHO-QoL-BREF[a]					
Physical health	15.7 (2.8)	16.1 (2.9)	15.2 (3.3)	1.032	.358
Psychological health	15.4 (2.8)	15.9 (3.1)	14.5 (3.9)	2.068	.129
Social relationship	15.9 (4.1)	16.3 (3.7)	16.1 (3.1)	.232	.793
Environment	16.0 (2.7)	16.9 (2.1)	15.1 (3.1)	5.034	.007
BRIAN[a]					
BRIAN-Sleep	12.9 (3.2)	12.3 (3.1)	13.4 (3.1)	1.461	.234
BRIAN-Physical activity	9.2 (3.3)	9.5 (3.5)	9.4 (2.7)	.215	.807
BRIAN-Social activity	8.6 (2.8)	8.1 (2.5)	8.3 (3.2)	.755	.471
BRIAN-Eating pattern	8.2 (2.6)	8.7 (3.3)	9.2 (3.0)	1.141	.322
BRIAN-Total	39.1 (8.9)	38.7 (9.7)	40.4 (9.0)	.345	.708
PSQI[a]					
Sleep quality	1.4 (0.9)	1.1 (0.7)	1.5 (0.7)	3.075	.048
Sleep latency	0.8 (0.7)	0.9 (0.7)	1.0 (1.0)	.402	.669
Sleep duration	0.9 (1.0)	0.8 (1.0)	1.0 (1.0)	.332	.718
Sleep efficiency	0.8 (0.7)	0.8 (0.7)	1.0 (0.6)	.473	.624
Sleep disturbances	1.6 (0.8)	1.6 (0.8)	1.8 (0.8)	.535	.586
Sleep medication	0.1 (0.3)	0.1 (0.5)	0.2 (0.6)	1.202	.303
Daytime dysfunction	1.4 (0.8)	1.1 (0.7)	1.5 (0.7)	4.209	.016
Total PSQI scores	7.2 (3.5)	6.7 (3.8)	8.2 (3.7)	1.650	.195
PSQI categories, n (%)					
Normal (0-5)	32 (33.0)	32 (43.2)	6 (22.2)	4.290	.117
Poor (6-21)	65 (67.0)	42 (56.8)	21 (77.8)		
DSM-5 diagnosis, n (%)					
None	91 (93.8)	59 (79.6)	20 (74.1)	10.434	.005
Yes	6 (6.2)	15 (20.3)	7 (25.9)		

[a]: Mean (standard deviation), BMI: Body mass index, IPAQ-SF: International Physical Activity Questionnaire- Short Form, WHO-QoL-BREF: World Health Organization Quality of Life-Short Form, BRIAN: Biological Rhythm Interview of Assesment in Neuropsychiatry, PSIQ: Pittsburg Sleep Quality Index

In all sample (n = 198), boy gender proportion were significantly higher ($\chi 2$ (2) = 12.763, p = .002) due to the fact that boys with tension-type headache was higher compared to the non-specific headache (33.8% vs. 11.3, $\chi 2$ (1) = 12.722, P<.001).

Three groups also similar with physical activity categories, WHO-QoL-BREF of physical, psychological, and social scores, BRIAN total and sub-scales, all PSQI total and subscales.

Daytime dysfunction were significantly higher in migraine group (F(2) = 4.209, p = .016). Environment and Environment-TR QoL scores were significantly lower in migraine group than that of tension-type headache or non-specific headache group (F(2) = 5.034, P = .007 and F(2) = 5.753, P = .004, respectively, see Table 1).

Psychiatric disorder was found in 6.2% of non-specific headache group, whereas this rate was 20.3% in adolescents with tension-type headache and 25.9% in migraine group ($\chi 2$ (2) = 10.434, p = .005). Comparison of psychiatric disorder among three groups revealed that migraine group had significantly higher rate psychiatric disorder compared to the healthy group (25.9% vs. 6.2%, $\chi 2$ (1) = 8.770, P = .003).

Circadian rhythm examination of the adolescents with headache revealed that biological rhythm scores based on BRIAN scale are significantly and negatively correlated with physical, psychological, social, environmental (both single and combined with national item scores). In addition, circadien rhythm scores was found to be positively correlated with sleep quality index scores (see Table 2).

Table 2. *Biorhythm profiles of adolescents with headache evaluated via BRIAN scale with others.*

	Physical QoL	**Psychological QoL**	**Environmental QoL**	**PSQI-T**
BRIAN-Total	-.335**	-.388**	-.257**	.448**
BRIAN-Sleep	-.270**	-.297**	NS	.346**
BRIAN-Activity	-.293**	-.301**	-.258**	.345**
BRIAN-Social	-.260**	-.311**	-.244**	.386**
BRIAN-Eating pattern	-.174*	-.253**	NS	.266**

QoL: Quality of life, PSQI-T: Pittsburg Sleep Quality Index

Discussion and Conclusion

Primary headaches are one of the debilitating disorders in adolescents in terms of quality of their life and their sleep quality. Physical inactivity and smoking are previously reported risk factors for primary headaches. In our sample, everyone in ten was active smoker and about a third was

physically inactive. These two factors, however, were found to be similar in primary headache group with healthy controls implying that physical inactivity and smoking are not likely to have a direct causative effect on headache.

Sleep quality is another factor effecting headache as previously shown by Bruni et al. (2008) in a total of 1073 non-clinical sample of children and adolescents[10]. Similar with physical inactivity, sleep quality scores obtained by PSQI scale were same in adolescents with primary headaches and healthy counterparts. Besides this, migraine had significantly deteriorated sleep quality compared to the tension type headache subjects or healthy adolescents. Adolescents with migraine also had lower environmental quality of life scores suggesting that there is an important relation between subjects with migraine and their environmental factors as a negative factor effecting adolescents' life daily.

As regards gender, girls are more likely to be with non-specific headache whereas boys are at risk primary headache especially for tension-type. Environment subscale of general quality of life is affected in tension-type headache and daytime dysfunction of sleep quality is significantly higher in migraine.

Last thing to mention is that psychiatric disorders was found in primary headache group in general and migraine group. This result might be explaining the outcome that adolescents with migraine are more affected by sleep quality index and subjective environmental quality of life evaluation.

There is one limitation for this study as this is a cross-sectional sample and because of this, findings could not be generalized. Nonetheless, this study is very first one examining circadian pattern of headache and its effect on whether there is a difference between having a primary headache or not

Conclusion:

In conclusion, circadian disfunctions are correlated with subjective lower quality of life and deteriorated sleep quality in adolescents with both primary headaches and healthy subjects. Other factors besides the primary headaches that have might an effect on these circadian factors as well as perceived quality of life or quality of life general worth examining whether they are likely to be a causative for these factors. Futher studies with larger samples are to be needed.

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