

Investigation of Emotional Eating, Sleep Quality and Obesity According to Chronotype Characteristics in Adolescents: Cross-Sectional Research

Adölesanlarda Kronotip Özelliklerine Göre Duygusal Yeme, Uyku Kalitesi ve Obezitenin İncelenmesi: Kesitsel Bir Araştırma

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ABSTRACT Objective: It is believed that biological, psychological, and social changes in adolescents can significantly influence health habits, including nutrition and sleep. This study aimed to examine the relationships between chronotype characteristics, emotional eating behaviours, sleep quality, and obesity among adolescents. **Material and Methods:** This cross-sectional study was conducted at a private physiotherapy clinic in Türkiye. After obtaining consent from the participants and their parents, a socio-demographic questionnaire, the Morningness-Eveningness Questionnaire, Emotional Eating Scale for Children and Adolescents, Pittsburgh Sleep Quality Index (PSQI), and anthropometric measurements were administered. **Results:** The data obtained from one hundred adolescents were evaluated and it was found that 85% of the adolescents had poor sleep quality. It was found that adolescents with evening chronotype exhibited more emotional eating behaviours compared to morning and middle chronotypes ($p=0.041$). Depression-related eating behaviour and restlessness-related eating behaviour were significantly higher in adolescents with evening chronotype ($p=0.046$, $p=0.002$, respectively). A weak negative correlation was found between participants' chronotype score and restless eating behaviour ($r=-0.238$, $p=0.017$). Chronotype score and PSQI were significantly higher in females ($p=0.026$). Emotional eating behaviours and poor sleep quality were not associated with obesity risk ($p>0.05$). **Conclusion:** This study highlights the importance of considering chronotype characteristics in health interventions. Developing individualized preventive strategies and interventions, particularly for adolescents with an evening-type chronotype, may improve health outcomes.

Keywords: Adolescent; eating; chronobiology discipline; sleep quality; obesity

ÖZET Amaç: Adölesanlarda yaşanan biyolojik, psikolojik ve sosyal değişimlerin beslenme ve uyku gibi sağlık alışkanlıklarını önemli ölçüde etkileyebileceği düşünülmektedir. Bu çalışmanın amacı, adölesanlarda kronotip özelliklerinin duygusal yeme davranışları, uyku kalitesi ve obezite ile ilişkisini incelemektir. **Gereç ve Yöntemler:** Çalışma, Türkiye'de özel bir fizyoterapi kliniğinde kesitsel olarak yürütülmüştür. Katılımcılardan ve ebeveynlerinden onay alındıktan sonra sosyodemografik anket, Sabahçılık-Akşamcılık Ölçeği, Çocuklar ve Ergenler İçin Duygusal Yeme Ölçeği, Pittsburgh Uyku Kalitesi İndeksi [Pittsburgh Sleep Quality Index (PSQI)] ve antropometrik ölçümler yapılmıştır. **Bulgular:** Yüz adölesandan elde edilen veriler değerlendirilmiş ve adölesanların %85'inin uyku kalitesinin düşük olduğu bulunmuştur. Akşam kronotipine sahip ergenlerin, sabah ve orta kronotiplere kıyasla daha fazla duygusal yeme davranışı sergilediği bulunmuştur ($p=0,041$). Depresyonla ilişkili yeme davranışı ve huzursuzlukla ilişkili yeme davranışı akşam kronotipindeki ergenlerde anlamlı derecede yüksek bulunmuştur (sırasıyla $p=0,046$, $p=0,002$). Katılımcıların kronotip puanı ile huzursuz yeme davranışı arasında zayıf bir negatif korelasyon bulunmuştur ($r=-0,238$, $p=0,017$). Kronotip skoru ve PSQI kadınlarda anlamlı olarak daha yüksek bulunmuştur ($p=0,026$). Duygusal yeme davranışları ve kötü uyku kalitesi obezite riski ile ilişkili bulunmamıştır ($p>0,05$). **Sonuç:** Bu çalışma, sağlık müdahalelerinde kronotip özelliklerinin dikkate alınması gerektiğini vurgulamaktadır. Böylece, özellikle akşam tipi kronotipe sahip adölesanlar için bireyselleştirilmiş önleyici stratejilerin ve müdahalelerin geliştirilmesi sağlık sonuçlarını iyileştirebilir.

Anahtar Kelimeler: Adölesan; yeme; kronobioloji; uyku kalitesi; obezite

TO CITE THIS ARTICLE:

Toğuç H. Investigation of emotional eating, sleep quality and obesity according to chronotype characteristics in adolescents: Cross-sectional research. Türkiye Klinikleri J Pediatr. 2024;33(3):81-8.

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Peer review under responsibility of Türkiye Klinikleri Journal of Pediatrics.

Received: 24 Jun 2024

Received in revised form: 18 Oct 2024

Accepted: 04 Nov 2024

Available online: 18 Dec 2024

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Adolescence is the stage in which transition from childhood to adulthood and intense biological, psychological and social changes are experienced. This stage usually covers the age range of 10-19 years and health habits in this period may significantly affect the general health status in adulthood.¹ Changes in the sleep-wake cycle observed especially in adolescents are related with sleep problems frequently encountered in this period.²

Chronotype is a biological system that defines the tendency of individuals to fall asleep and wake up through circadian rhythms.³ Individuals are generally classified as morning, intermediate or evening type according to their chronotype characteristics that affect their daily activities and social interactions.⁴ While the morning chronotype prefers to go to bed early and get up early, the evening chronotype prefers to be active late and wake up late in the morning, the intermediate chronotype can adapt to any time of the day.^{3,4} Studies conducted in adolescents reveal that chronotype may show more variability in this age group due to hormonal changes and increased social pressures.⁵ In addition, with increasing academic and social demands, sleep duration of adolescents is generally decreasing, which is critical for their mental, emotional and physical health.⁶

Emotional eating in adolescents is an eating behaviour that occurs as an attempt to cope with stressful or negative emotional states.⁷ This behaviour usually occurs to provide temporary emotional relief and may lead to unhealthy eating habits.⁷ Previous studies have examined how chronotype characteristics and sleep quality may be related to emotional eating behaviours and obesity in adolescents. Findings showed that morning-type chronotypes had healthier eating habits and lower obesity risk than evening-type chronotypes.⁶ In addition, insufficient sleep duration and poor sleep quality have been associated with high emotional eating behaviour and increased obesity risk in adolescents.⁸

This article aims to examine in detail the effects of chronotype characteristics on emotional eating behaviours, sleep quality and obesity in adolescents.

MATERIAL AND METHODS

This cross-sectional study was approved by the İnönü University Non-Interventional Clinical Research Ethics Committee in accordance with the Declaration of Helsinki (date: May 14, 2024, no: 2024/5848). The study was conducted in a private physiotherapy clinic in Türkiye and participants were selected from healthy individuals attending this clinic. The inclusion criteria stated that participants should not have any neurological disease or severe psychiatric disorder. However, to increase the generalisability of our findings to a wider population, we included individuals who reported mild psychiatric disorders, such as mild depression and anxiety disorders. All participants and their parents were informed in detail about the study aims, procedures and conditions of voluntary participation and their written informed consent was obtained. Specifying these details reinforces the clarity of the participant selection criteria and the scope of the study.

SAMPLE OF THE STUDY

The sample comprised 100 healthy adolescents aged 14-18 years who met the inclusion criteria and applied to the relevant institution between January and March 2024. The sample size was determined using the "Sample Size Calculator" programme, aiming for a minimum of 88 participants with a 5% margin of error, and ultimately reaching 100 participants by the study's conclusion. The age range was selected to align with high school students, as this period represents mid to late adolescence, a stage associated with significant psychological and physiological changes. Early adolescence (ages 10-13) was excluded to focus on a more developmentally consistent group and to minimize potential variability due to the rapid physical and cognitive changes that occur in younger adolescents.

DATA COLLECTION TOOLS

The data collection form included five sections: sociodemographic information, the Morningness-Eveningness Questionnaire (MEQ), the Emotional Eating Scale for Children and Adolescents (EES-C), Pittsburgh Sleep Quality Index (PSQI), and anthropometric measurements.

The MEQ was developed by Horne and Ostberg and its Turkish version’s reliability was tested by Pündük et al.⁹ It comprises 19 Likert-type questions, categorizing adolescents into three groups based on scores: low scores indicative of an evening chronotype (<32), intermediate scores indicative of a neutral chronotype (32-58), and high scores indicative of a morning chronotype (>58).¹⁰

EES-C, developed by Tanofsky-Kraff et al., was adapted and validated in Turkish by Bektaş et al.¹¹ This scale consists of 25 questions and assesses emotional eating based on depressive symptoms (EES-C-DEP), anxiety-anger-disappointment (EES-C-AAF), and restlessness (EES-C-UNS).¹²

The PSQI was adapted for the Turkish population by Ağargün et al. It consists of 24 questions divided into 7 sub-sections, with a total score above 5 indicating poor sleep quality.¹³

Anthropometric measurements included height measured in the Frankfort plane from the top of the head using a non-flexible tape measure, and weight measured with a scale. Body mass index (BMI) was

calculated using the formula: body weight (kg)/height² (m²).¹⁴

RESEARCH DESIGN AND STATISTICAL ANALYSIS

The study, conducted from April to May 2024, initially included 113 participants, of whom 13 withdrew, leaving a final sample of 100 participants. Data were analysed using IBM SPSS software (version 22.0, USA). Numerical data were presented as mean, standard deviation, and percentage. Normal distribution was confirmed via visual inspection of histograms and the Kolmogorov-Smirnov test. Categorical variables were assessed using the Pearson chi-square test. Group differences were evaluated using one-way analysis of variance for parametric data and the Kruskal-Wallis test for nonparametric data. Bonferroni correction was applied for multiple comparisons, and statistical significance was set at p<0.05.

RESULTS

In this study, the data obtained from 100 adolescents were analysed and their chronotype-based demographic characteristics are summarised in Table 1. The aver-

TABLE 1: Participants' demographic characteristics by chronotype.

		Chronotype				p value
		Morningness X̄±SD	Intermediate X̄±SD	Eveningness X̄±SD	Total X̄±SD	
Age		15.00±1.08	15.42±1.43	15.67±1.29	15.38±1.35	0.346
		n	n	n	n	
Gender	Male	2	24	7	33	0.067
	Female	16	43	8	67	
Father's education	Illiterate	0	2	0	2	0.660
	Primary education	11	36	5	52	
	High school	6	24	8	38	
	University and above	1	5	2	8	
Mother's education	Illiterate	0	8	1	9	0.545
	Primary education	14	49	13	76	
	High school	2	7	1	10	
	University and above	2	3	0	5	
Income status	Income more than expenditure	3	12	2	17	0.737
	Income and expenditure equal	10	27	8	45	
	Income less than expenditure	5	28	5	38	
Smoking	Yes	2	12	0	14	0.181
	None	16	55	15	86	
Alcohol	Yes	2	2	0	4	0.204
	None	16	65	15	96	

SD: Standard deviation.

age of participants was 15.38±1.35 years, and no significant associations were found between age, gender, parental education levels, income status, smoking, or alcohol use based on chronotype characteristics (p>0.05).

Table 2 shows the distribution of sleep quality, eating behaviours and anthropometric characteristics according to chronotype. It was observed that 15% of the participants had good sleep quality and 85% had poor sleep quality. Significant relationships were found between the chronotype characteristics of the participants and emotional eating behaviours (p=0.041), especially EES-C-DEP (p=0.046) and EES-C-UNS (p=0.002).

Table 3 displays correlations between participants' chronotype, sleep quality, eating behaviours,

and anthropometric characteristics. A weak negative correlation was found between participants' chronotype and EES-C-UNS, a component of emotional eating behaviour (r=-0.238, p=0.017).

Table 4 illustrates the distribution of chronotype, sleep quality, BMI, and emotional eating based on participants' gender. Chronotype scores were significantly lower in males, indicating a more nocturnal preference (p=0.045). Additionally, PSQI scores were significantly higher in females, indicating poorer sleep quality compared to males (p=0.026).

Adolescents with evening chronotype showed significant emotional eating behaviour compared to adolescents with morning and intermediate chronotype (p=0.041). Moreover, eating behaviour associ-

TABLE 2: Distribution of sleep, eating behaviour, and anthropometric characteristics by chronotype.

		Chronotype				p value
		Morningness	Intermediate	Eveningness	Total	
		n	n	n	n	
PSQI	Bad	1	10	4	15	0.239
	Good	17	57	11	85	
		$\bar{X}\pm SD$	$\bar{X}\pm SD$	$\bar{X}\pm SD$	$\bar{X}\pm SD$	
Chronotype-score		60.94±2.86	49.67±2.93	39.93±1.71	50.24±6.68	
PSQI-Score		8.22±1.73	7.48±1.92	7.47±2.72	7.61±2.02	0.370
EES-C		39.22±14.34	47.51±17.51	54.33±17.55	47.04±17.39	0.041
EES-C-DEP		12.28±5.26	13.69±5.22	16.93±6.57	13.92±5.56	0.046
EES-C-UNS		9.22±3.83	10.54±3.75	14.00±4.41	10.82±4.09	0.002
EES-C-AAF		17.72±6.93	23.30±10.14	23.40±7.50	22.31±9.45	0.074
Height		162.33±7.75	165.28±9.00	169.67±9.25	165.41±9.00	0.063
Weight		53.03±8.65	57.42±13.13	58.80±8.82	56.84±11.93	0.304
BMI		20.10±2.81	20.87±3.68	20.45±2.77	20.67±3.41	0.675

PSQI: Pittsburgh Sleep Quality Index; EES-C: Emotional Eating Scale for Children Score; EES-C-DEP: Depressive symptoms; EES-C-UNS: Feeling unsettled; EES-C-AAF: Anxiety, anger, and frustration; BMI: Body mass index; SD: Standard deviation.

TABLE 3: The relationship between chronotype, sleep, emotional eating, and anthropometric characteristics.

	Chronotype		PSQI		BMI		EES-C		EES-C-DEP		EES-C-UNS		EES-C-AAF	
	r	p	r	p	r	p	r	p	r	p	r	p	r	p
Chronotype	1		0.112	0.266	-0.062	0.537	-0.187	0.063	-0.195	0.052	-0.238	0.017	-0.125	0.214
PSQI	0.112	0.266	1		0.123	0.221	0.025	0.802	0.003	0.980	0.007	0.943	0.043	0.672
BMI	-0.062	0.537	0.123	0.221	1		-0.070	0.486	-0.123	0.223	-0.054	0.590	-0.034	0.737
EES-C	0.187	0.063	0.025	0.802	-0.070	0.486	1		0.908**	0.000	0.855**	0.000	0.939**	0.000
EES-C-DEP	-0.195	0.052	0.003	0.980	-0.123	0.223	0.908**	0.000	1		0.792**	0.000	0.742**	0.000
EES-C-UNS	-0.238*	0.017	0.007	0.943	-0.054	0.590	0.855**	0.000	0.792**	0.000	1		0.677**	0.000
EES-C-AAF	-0.125	0.214	0.043	0.672	-0.034	0.737	0.939**	0.000	0.742**	0.000	0.677**	0.000	1	

PSQI: Pittsburgh Sleep Quality Index; EES-C: Emotional Eating Scale for Children Score; EES-C-DEP: Depressive symptoms; EES-C-UNS: Feeling unsettled; EES-C-AAF: Anxiety, anger, and frustration; BMI: Body mass index. *: p<0.05; **: p<0.01

TABLE 4: Distribution of chronotype, sleep quality, BMI, and emotional eating among participants by gender.

	Female (n=67) X̄±SD	Male (n=33) X̄±SD	p value
Age	15.27±1.32	15.61±1.41	0.243
Chronotype	51.18±6.89	48.33±5.89	0.045
PSQI	7.93±1.95	6.97±2.05	0.026
EES-C	46.28±16.96	48.58±18.42	0.538
EES-C-DEP	13.52±5.03	14.73±6.52	0.311
EES-C-UNS	10.54±3.90	11.39±4.45	0.327
EES-C-AAF	22.24±9.66	22.45±9.16	0.915
BMI	20.49±3.25	21.02±3.73	0.468

PSQI: Pittsburgh Sleep Quality Index; EES-C: Emotional Eating Scale for Children Score; EES-C-DEP: Depressive symptoms; EES-C-UNS: Feeling unsettled; EES-C-AAF: Anxiety, anger, and frustration; BMI: Body mass index; SD: Standard deviation.

ated with EES-C-DEP and eating behaviour associated with EES-C-UNS were higher in adolescents with evening chronotype compared to adolescents with intermediate chronotype and morning chronotype (p=0.046; p=0.002, respectively). Apart from this, no significant relationship was found between BMI levels according to chronotype (p>0.05) (Figure 1).

DISCUSSION

Regarding sleep quality, the study found that 15% of participants had good sleep quality, while 85% experienced poor sleep quality. This finding highlights the high prevalence of poor sleep quality among adolescents, as evidenced by Cavalcanti et al., where 53% of 1,296 high school students experienced low sleep quality.¹⁵ These results are consistent with findings by Taylor et al., who highlighted the high prevalence and adverse health effects of poor sleep quality in adolescents.¹⁶ Owens et al. also noted that sleep duration and quality significantly affect adolescents' self-regulation abilities.¹⁷ Furthermore, research from Australia emphasized that declining sleep quality in adolescents may contribute to obesity.¹⁸

Adolescence is characterised by rapid mood changes and these changes can significantly affect sleep patterns, chronotype and eating habits. Esin and Ayyıldız found that individuals with evening chronotype exhibited higher emotional eating behaviours and had lower sleep quality.^{18,19} Esin and Ayyıldız, in a study conducted on university students, found that individuals with evening-type sleep patterns showed

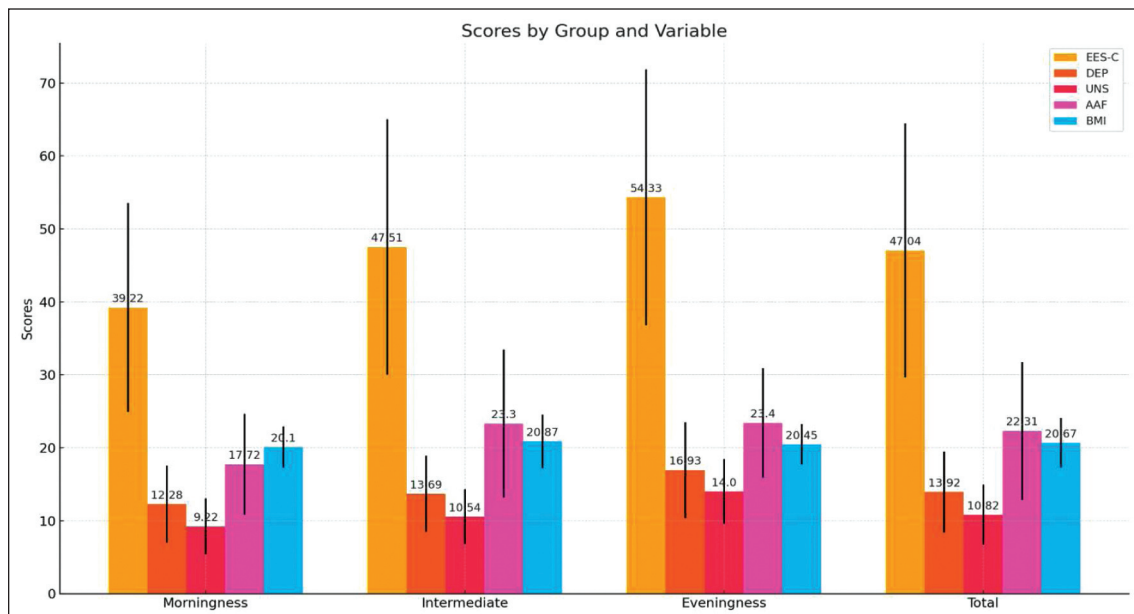


FIGURE 1: Relationship of chronotypes with EES-C, EES-C-DEP, EES-C-UNS, EES-C-AAF and BMI.

PSQI: Pittsburgh Sleep Quality Index; EES-C: Emotional Eating Scale for Children Score; EES-C-DEP: Depressive symptoms; EES-C-UNS: Feeling unsettled; EES-C-AAF: Anxiety, anger, and frustration; BMI: Body mass index.

more emotional eating behaviours compared to those with morning-type sleep patterns.²⁰ In addition, Fischer et al. found that individuals with evening-type sleep patterns had more irregular eating habits and this may increase the risk of obesity.²¹ Nakade et al. examined the relationship between sleep duration type and eating behaviours and found that individuals with evening-type sleep patterns consumed more snacks and had irregular eating habits.²² The findings of these studies show that adolescents with evening-type sleep patterns exhibit more emotional eating behaviours than those with morning and intermediate-type sleep patterns and emotional eating behaviours decrease as the sleep type score increases. These results are consistent with the literature and may help us better understand the effects of mood changes on sleep and eating behaviours in adolescents.

While investigating chronotype and emotional eating behaviour in adolescents, this study also explored the sub-dimensions of the scale, specifically EES-C-DEP and EES-C-UNS, revealing higher scores among adolescents with an evening chronotype. This finding aligns with Kontinen et al.'s research, which observed lower levels of depression and emotional eating behaviours in morning chronotypes among adults aged 25-74 years.²³ Lucassen et al. suggest that unhealthy eating behaviours observed in individuals with the evening chronotype are associated with increased levels of the stress hormones plasma adrenocorticotropic hormone, urinary epinephrine and norepinephrine.²⁴ Overall, the study's results are consistent with existing literature on this topic.

In this study, no significant association was found between BMI levels and chronotype, consistent with the findings of Adan et al., who similarly reported that chronotype did not directly influence BMI.³ Nevertheless, considering its relationship with emotional eating and psychological factors, chronotype may exert an indirect effect on BMI. Kontinen et al. also suggested that while chronotype itself does not directly impact BMI, it may be associated with depressive symptoms and emotional eating behaviours.^{23,24}

Although research on the effects of chronotype characteristics on eating behaviours and sleep quality

is limited in the literature, existing studies generally indicate that individuals with an evening chronotype experience poorer sleep quality and exhibit more emotional eating behaviours. However, there is a notable gap in studies specifically investigating these relationships among adolescents.^{21,22}

Studies on the effects of gender differences on sleep quality and chronotype in adolescents have yielded diverse results. Lopez-Soto et al. conducted a systematic review concluding that males exhibit a higher susceptibility to sleep disorders than females.²⁵ Fatima et al. reported higher prevalence of poor sleep quality among women compared to men in a study on young adults.²⁶ This current study aligns with Fatima et al., reinforcing that women tend to experience poorer sleep quality than men. Regarding chronotype, literature presents varying findings on gender differences.²⁶ Lehnkering and Siegmund discovered that men are significantly more likely to be evening chronotypes, while women lean towards morning chronotypes.²⁷ Conversely, Santhi et al. identified a higher prevalence of evening chronotype among women, consistent with our study's findings.²⁸ These studies underscore the complexity of gender's impact on sleep quality and chronotype. The discrepancies in findings highlight the need for more extensive and detailed investigations into this subject matter.

LIMITATIONS AND FUTURE RESEARCH

This study has several limitations. Firstly, the homogeneity of the sample within a specific age group may limit its generalizability. While those with mild and moderate psychiatric disorders were included in the study, those with severe disorders were excluded, which limits the applicability of the results to a wider population. Additionally, the cross-sectional design poses challenges in establishing causal relationships. Future research with larger and more diverse sample groups, as well as longitudinal designs, could offer a more comprehensive understanding of how chronotype characteristics influence eating behaviours and sleep patterns.

CONCLUSION

This study contributes to the literature by elucidating the effects of chronotype characteristics on emotional

eating behaviours and sleep quality. The observation of increased emotional eating behaviours and increased vulnerability to psychological factors among adolescents with an evening chronotype underlines the need for tailored interventions and preventive strategies that take into account individual chronotype characteristics.

Source of Finance

During this study, no financial or spiritual support was received neither from any pharmaceutical company that has a direct connection with the research subject, nor from a company that pro-

vides or produces medical instruments and materials which may negatively affect the evaluation process of this study.

Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

This study is entirely author's own work and no other author contribution.

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