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The Relationship Between Sleep Quality, Sleep Duration, Social Jet Lag and Obesity in Adolescents

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What is already known on this topic?

Previous studies have shown a relationship between obesity and sleep quality and sleep duration, but the issue of social jet lag (SJL), which represents shifts in circadian rhythm, and its effects on adolescents are still being investigated.

What this study adds?

This study shows a correlation between SJL and body mass index. Sleep history should be a part of the anamnesis in routine outpatient clinic examinations of overweight and obese adolescents which may aid the clinical management of the condition.

Abstract

Objective: The frequency of obesity and poor sleep quality among adolescents is increasing and causes many chronic problems. The objective was to investigate the correlation between body mass index (BMI), sleep quality, sleep duration and social jet lag (SJL) among adolescents.
Methods: This study was cross-sectional. A cohort of 416 adolescents, ranging in age from 12 to 18 years participated in the study. Adolescents were divided into three groups according to BMI standard deviation score (SDS): adolescents with normal weight, adolescents with overweight and adolescents with obesity. The Pittsburgh Sleep Quality Index (PSQI) questionnaire was used to determine the sleep quality of the adolescents. The calculation of SJL and sleep-corrected SJL was performed.
Results: The mean age of the adolescents was 15.0 ± 2.9 years. There were 222 males (53.4%). SJL and PSQI scores were significantly higher in the adolescents with obesity compared to the adolescents with normal weight and overweight ($p < 0.001$). An analysis of the relationship between the PSQI and BMI SDS revealed a significant positive correlation ($r = 0.667$; $p < 0.001$).
Conclusion: Adolescents with obesity have poorer sleep quality and a longer duration of SJL compared to adolescents with normal-weight. Moreover, increased SJL was linked to an increase in BMI. Maintaining good sleep quality and reducing SJL may help reduce the risk of obesity.
Keywords: Adolescents, sleep quality, social jet lag, obesity

Introduction

Sleep disorders are linked to disabilities, dangerous behavior, depression, morbidity and even mortality. According to research, children who sleep less are more prone to become overweight and obese later in life. Adolescents are at a significant risk of developing sleep disorders, and severe sleep deprivation is related with long-term consequences (1). The relationship between sleep disorders and adolescent obesity is not entirely understood. Trends in sleep problems parallel trends in obesity. Adolescent obesity may result

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in significant health issues. These conditions may include diabetes, hypertension, cardiovascular disease, respiratory illnesses, and musculoskeletal disorders (2). The intricate nature of the correlation between sleep duration and body weight is because both sleep and appetite are regulated by the daily circadian rhythm (3). Biologically, a lack of sleep alters the hormonal processes that control hunger, resulting in decreased levels of leptin and heightened levels of ghrelin. This inevitably leads to an increased consumption of food. Night-eating syndrome may arise due to sleep deprivation (4). During this condition, individuals display a tendency to consume food excessively and without inhibition upon awakening during the night. Overconsumption of calories can heighten the probability of getting obese. Insufficient sleep duration is significantly associated with adverse changes in body mass index (BMI) among infants, children, and adolescents, according to a meta-analysis (5). The quality of sleep is determined by the effectiveness and depth of an individual's sleep during their period of rest. A range of methodologies is employed by researchers in order to assess the quality of sleep. The Pittsburgh Sleep Quality Index (PSQI) is a widely acknowledged and scientifically proven method for assessing the quality of sleep (6). Studies have shown a correlation between obesity and the quality of sleep. Social jet lag (SJL) is defined as the discrepancy between the sleep timing imposed by external/social obligations, such as work or school days, and free days. Sleep deprivation occurs by waking up early on weekdays and going to bed late at night, and attempts are made to compensate for this by waking up late and sleeping too much at the weekend. This causes a discrepancy between biological and social circadian rhythms. SJL refers to a persistent and detrimental pattern of sleep disruption and inconsistent sleep. This sleep pattern can result in metabolic, physiological, and psychological complications (7). Recent findings indicate a correlation between SJL and obesity, suggesting that children who undergo SJL are at a higher risk of developing obesity (8). Nevertheless, the correlation between poor sleeping habits and obesity among adolescents remains poorly comprehended. The aim of this research was to examine the correlation between BMI, sleep quality, SJL status, and sleep duration among adolescents.

Methods

Study Participants and Procedure

This study was cross-sectional. The study protocol was approved by the İstinye University Human Research Ethics Committee (meeting number: 2023-09; protocol number: 23-238, date: 06.11.2023). The study included adolescents between the ages of 12 and 18 years who were admitted to a tertiary hospital without any diagnosis of psychiatric disorder, chronic disease or drug use and who agreed to participate in the study. Both written and verbal consent was obtained from the adolescents included in the study and their parents. The adolescents' age, weight, height, and BMI at the time of admission were recorded and they were asked to fill out a PSQI questionnaire, and their sleep-wake times on school days and weekends were noted.

Measures and Sleep Assesment

During the examinations of patients in the outpatient clinic, their height was measured using a Harpenden stadiometer (Holtain Ltd., Crymych, UK), and their weight was measured using a standard electronic scale (Beurer brand) that can detect changes of as little as 100 grams. BMI was calculated as weight (in kg) over the square of height (in meters) and converted to BMI standard deviation score (BMI SDS) using the Turkish national data. Adolescents were divided into three groups according to BMI: adolescents with normal weight; adolescent with overweight; and adolescent with obesity. The adolescents with obesity group was defined as BMI ≥95th percentile, the adolescents with overweight group was defined as BMI 94.9-85th percentile, and the adolescents with normal weight group was defined as BMI 5-84.9th percentile (9).

The PSQI questionnaire was used to determine the sleep quality in adolescents. The validity and reliability study for Turkish children was conducted by Ağargün et al. (10) PSQI is a 19-question survey with seven components (subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbance, use of sleeping pills, daytime dysfunction). If the total PSQI score is five or less, it indicates good sleep quality. If it is more than five, it indicates poor sleep quality. Moreover, as the PSQI score increases, sleep quality worsens. In addition, to determine the average number of hours the adolescent sleeps the participant was asked exactly when he/she sleeps and at what time he/she wakes up in the morning, and then the duration of sleep was calculated. If the adolescent had a nap during the day, this was added. Both school days and free days were assessed using the same protocol. In order to calculate SJL and sleep-corrected SJL (SJLsc), as previously described (11,12). SJL is found by the absolute value of the difference between the middle hour of sleep on free days (midsleep on free days) and the middle hours of sleep on school days (midsleep of school days). The midpoint of sleep is the time between night sleep start time and morning wake-up time. Half of the weekly mean sleep duration is added to both the sleep start time on free days and the sleep start time on school days, and then the values found are subtracted from each other, and the absolute difference is the SJLsc.

Statistical Analysis

The variables were analyzed using Statistical Package for the Social Sciences, version 25.0 (IBM Corp., Armonk, New York, USA) and Medcalc 14 (Acacialaan 22, B-8400 Ostend, Belgium) software. The assessment of whether the data followed a normal distribution was conducted using the Shapiro-Wilk-Francia test, while Levene's test was used to determine the homogeneity of variance. We compared two groups using Monte Carlo simulation outcomes and quantitative variables. We also used Monte Carlo simulation results in conjunction with the Kruskal-Wallis H test, a non-parametric test, to compare more than two groups of quantitative variables. Post-hoc analysis was subsequently conducted using Dunn's test. We used the Monte Carlo simulation method to examine the Pearson's chi-square test and the Fisher's Freeman Halton test in order to compare categorical variables. The correlation between two quantitative variables was assessed using the Spearman rho test. The research investigated the sensitivity, specificity, positive predictive ratio (positive predictive, positive predictivity), and negative predictive ratio (negative predictive, negative predictivity) in relation to the SJL variables-calculated cut-off values that separated the classifications. Analysis of the receiver operating curve analysis was performed to quantify the PSQI outcome variable and the actual classification. Categorical variables are denoted as n (percent), whereas quantitative variables were represented as median (minimum-maximum). Variables were analyzed with a confidence level of 95% and a $p < 0.05$ was deemed to indicate statistical significance.

Results

The study group included 416 adolescents with a mean age of 15.0 ± 2.9 years, of whom 222 (53.4%) were males. Of the 416 adolescents, 130 (31%) were normal weight, 151 (36%) were overweight and 135 (33%) were obese. Alarge part of (87%) both males and females rated their overall health as good or very good. Only 97 (23.3%) of all adolescents had good sleep quality. The average weekly sleep duration of all adolescents was 6.78±0.67 hours. The difference in total PSQI scores between the groups was significant ($p < 0.001$). The adolescents with obesity had a significantly higher median PSQI total score compared to both the adolescents with normal weight and overweight ($p < 0.001$). In addition, the adolescents with overweight group had a significantly higher median PSQI total score ($p = 0.001$) than the adolescents with normal weight group. There was also a significant difference in SJL between the adolescents with obesity, and the owerweight and normal weight groups ($p < 0.001$). The average duration of sleep per week was considerably shorter in the adolescents with obesity group in comparison to both the normal weight and overweight groups ($p < 0.001$). A significant correlation ($p < 0.001$) was observed between the groups and the daytime dysfunction score. Daytime dysfunction score I was prevalent at a rate of 61.5% in the adolescents with normal weight group, 8.6% in the adolescents with overweight group, and 1.5% in the adolescents with obesity group ($p < 0.001$). Daytime dysfunction, as defined in entry 7 of the PQSI, is a cluster of symptoms arising from poor sleep quality or other conditions, critical for daily activities and operational efficiency, especially high-precision tasks. and as the score increases, daytime dysfunction increases. Furthermore, the daytime dysfunction score 1 was significantly more prevalent in the adolescents with overweight group compared to the adolescents with obesity group ($p = 0.007$). In addition, a significant difference was found in the daytime dysfunction score 2 prevalence rates among the groups: the adolescents with overweight, with obesity and with normal weight (70.9% vs 53.3% vs 23.8%, respectively; $p < 0.001$) (Table 1). The prevalence of daytime dysfunction score 3 was significantly greater in the adolescents with obesity group (45.2%) compared to the overweight group (20.5%) ($p < 0.001$) and the normal weight group (0.8%) ($p < 0.001$). An examination of the connection between PSQI and BMI SDS revealed a moderate positive correlation ($r = 0.667$; $p < 0.001$) (Table 2). The groups did not show any significant differences when analyzed for gender distribution ($p = 0.472$), habitual sleep efficiency score ($p = 0.127$), and sleep medication use score ($p = 0.095$). SJL and SJLsc of > 1 hour was assessed in tems of poor sleep quality (PSQI score > 5) with a sensitivity of 74.6%, specificity of 88.7%, positive predictive value rate of 95.6%, and negative predictive value rate of 51.5%. The predictive power for optimal cut-off > 1 hour was very good ($p < 0.001$) (Table 3).

Discussion

The results of this cross-sectional study suggested that adolescents with obesity have poorer sleep quality, have a longer period of SJL, and have a shorter duration of sleep per week compared to adolescents with normal weight. In addition, there was a connection observed between SJL and a decrease in the quality of sleep. Furthermore, a moderate correlation was found between PSQI score and BMI. Optimizing sleep quality is an important objective for adolescents in general. The decline in sleep quality has been

Table 1. Characteristic features of adolescents and relationship between PSQI, sleep habits and the adolescents' BMI

	Total, n (%) (n = 416)	Normal weight (n = 130)	Overweight (n = 151)	Obese (n = 135)	p
	Med (min/max) or n (%)	Med (min/max) or n (%)	Med (min/max) or n (%)	Med (min/max) or n (%)	
Age (decimal)	15.06 (12.28/17.97)	14.55 (12.28/17.82)	15.05 (12.38/17.82)	15.44 (12.38/17.97)^{A}	**0.006^{k}**
Gender (female)	194 (46.6)	61 (46.9)	65 (43)	68 (50.4)	0.472^{c}
BMI	25.02 (16.49/32.6)	-	-	-	-
BMI SDS	1.18 (-1.16/2.57)	-	-	-	-
PSQI ≤5 (Good Sleep Quality)	97 (23.3)	96 (73.8)	1 (0.7)^{A}	-	**< 0.001^{c}**
PSQI total score	7 (1/14)	4 (1/12)	7 (4/12)^{A}	9 (5/14)$^{A, B}$	**< 0.001^{k}**
Subjective sleep quality score					**< 0.001^{ff}**
0	82 (19.7)	81 (62.3)	1 (0.7)^{B}	-	
1	199 (47.8)	47 (36.2)	102 (67.5)^{A}	50 (37)^{B}	
2	131 (31.5)	1 (0.8)	48 (31.8)^{A}	82 (60.7)$^{A, B}$	
3	4 (1)	1 (0.8)	-	3 (2.2)	
Sleep latency score					**< 0.001^{ff}**
0	8 (1.9)	7 (5.4)	-	1 (0.7)^{A}	
1	145 (34.9)	84 (64.6)	37 (24.5)^{A}	24 (17.8)^{A}	
2	163 (39.2)	32 (24.6)	75 (49.7)^{A}	56 (41.5)^{A}	
3	100 (24)	7 (5.4)	39 (25.8)^{A}	54 (40)$^{A, B}$	
Sleep duration score					**< 0.001^{ff}**
0	115 (27.6)	93 (71.5)	15 (9.9)^{A}	7 (5.2)^{A}	
1	259 (62.3)	37 (28.5)	123 (81.5)^{A}	99 (73.3)^{A}	
2	42 (10.1)	-	13 (8.6)	29 (21.5)^{B}	
Habitual sleep efficiency score					0.127^{ff}
0	407 (97.8)	130 (100)	145 (96)	132 (97.8)	
1	8 (1.9)	-	5 (3.3)	3 (2.2)	
2	1 (0.2)	-	1 (0.7)	-	
Sleep disturbance score					**< 0.001^{ff}**
0	11 (2.6)	11 (8.5)	-	-	
1	386 (92.8)	116 (89.2)	148 (98)^{A}	122 (90.4)^{B}	
2	19 (4.6)	3 (2.3)	3 (2)	13 (9.6)$^{A, B}$	
Sleep medication use score					0.095^{ff}
0	408 (98.1)	130 (100)	147 (97.4)	131 (97)	
1	6 (1.4)	-	2 (1.3)	4 (3)	
2	2 (0.5)	-	2 (1.3)	-	
Daytime dysfunction score					**< 0.001^{c}**
0	18 (4.3)	18 (13.8)	-	-	
1	95 (22.8)	80 (61.5)	13 (8.6)^{A}	2 (1.5)$^{A, B}$	
2	210 (50.5)	31 (23.8)	107 (70.9)^{A}	72 (53.3)$^{A, B}$	
3	93 (22.4)	1 (0.8)	31 (20.5)^{A}	61 (45.2)$^{A, B}$	
Social jet lag	1.25 (0/4)	0.5 (0/2.25)	1.5 (0.5/3)^{A}	2 (0.5/4)$^{A, B}$	**< 0.001^{k}**
Sleep corrected social jet lag	1 (0/4)	0.5 (0/2)	1.5 (0/3)^{A}	1.5 (0/4)^{A}	**< 0.001^{k}**
Midpoint of sleep on school days	3:45 (2:00/4:45)	3:30 (2:00-4:30)	3:45 (2:00-4:45)^{A}	4:00 (2:00-4:45)$^{A, B}$	**< 0.001^{k}**
Midpoint of sleep on free days	5:07 (3:00/7:30)	4:00 (3:00-6:00)	5:15 (3:00-7:00)^{A}	5:30 (4:00-7:30)$^{A, B}$	**< 0.001^{k}**
Average weekly sleep duration	6.45 (4.3/8.45)	7.3 (6.15/8.45)	6.4 (5.25/8)^{A}	6.3 (4.3/7.45)$^{A, B}$	**< 0.001^{k}**

^{k}: Kruskal-Wallis H test (Monte Carlo); post-hoc: Dunn's test, ^{c}: Pearson's chi-square test (Monte Carlo); post-hoc: Benjamin-Hochberg test.
^{ff}: Fisher's Freeman Halton test (Monte Carlo); post-hoc: Benjamin-Hochberg test.
^{A}: Indicates significance compared to the 'normal weight' group. ^{B}: Indicates significance compared to the 'overweight' group.
Med: median, Min: minimum, Max: maximum, BMI: body mass index, SDS: standard deviation score, PSQI: Pittsburgh Sleep Quality Index

Table 2. Correlation analysis between PSQI, sleep habits and BMI, BMI SDS, and age

	BMI		BMI SDS		Age (decimal)		BMI*		BMI SDS*		BMI′		BMI SDS′		BMI″		BMI SDS″	
	r	p	r	p	r	p	r	p	r	p	r	p	r	p	r	p	r	p
PSQI Total score	0.623	**< 0.001**	0.667	**< 0.001**	0.145	**0.003**	0.597	**< 0.001**	0.655	**< 0.001**	0.637	**< 0.001**	0.661	**< 0.001**	0.636	**< 0.001**	0.654	**< 0.001**
Subjective sleep quality score	0.604	**< 0.001**	0.622	**< 0.001**	0.128	**0.009**	0.572	**< 0.001**	0.593	**< 0.001**	0.589	**< 0.001**	0.600	**< 0.001**	0.591	**< 0.001**	0.593	**< 0.001**
Sleep latency score	0.337	**< 0.001**	0.418	**< 0.001**	0.01	0.845	0.399	**< 0.001**	0.409	**< 0.001**	0.362	**< 0.001**	0.404	**< 0.001**	0.387	**< 0.001**	0.406	**< 0.001**
Sleep duration score	0.575	**< 0.001**	0.565	**< 0.001**	0.197	**< 0.001**	0.507	**< 0.001**	0.530	**< 0.001**	0.541	**< 0.001**	0.544	**< 0.001**	0.516	**< 0.001**	0.532	**< 0.001**
Habitual sleep efficiency score	0.025	0.609	0.077	0.117	-0.088	0.073	0.074	0.130	0.085	0.084	0.048	0.332	0.067	0.174	0.092	0.061	0.082	0.097
Sleep disturbance score	0.192	**< 0.001**	0.234	**< 0.001**	0.023	0.633	0.184	**< 0.001**	0.212	**< 0.001**	0.196	**< 0.001**	0.210	**< 0.001**	0.203	**< 0.001**	0.209	**< 0.001**
Sleep medication use score	0.015	0.758	0.062	0.209	-0.02	0.742	0.013	0.794	0.053	0.282	0.019	0.701	0.047	0.343	0.028	0.573	0.050	0.313
Daytime dysfunction score	0.614	**< 0.001**	0.631	**< 0.001**	0.192	**< 0.001**	0.584	**< 0.001**	0.641	**< 0.001**	0.641	**< 0.001**	0.649	**< 0.001**	0.623	**< 0.001**	0.639	**< 0.001**
Social jet lag	0.573	**< 0.001**	0.582	**< 0.001**	0.179	**< 0.001**	0.530	**< 0.001**	0.559	**< 0.001**	0.563	**< 0.001**	0.570	**< 0.001**	0.546	**< 0.001**	0.559	**< 0.001**
Sleep corrected social jet lag	0.522	**< 0.001**	0.541	**< 0.001**	0.152	**0.002**	0.504	**< 0.001**	0.535	**< 0.001**	0.531	**< 0.001**	0.545	**< 0.001**	0.519	**< 0.001**	0.535	**< 0.001**
Midpoint of sleep on school days	0.477	**< 0.001**	0.429	**< 0.001**	0.302	**< 0.001**	0.392	**< 0.001**	0.399	**< 0.001**	0.458	**< 0.001**	0.427	**< 0.001**	0.384	**< 0.001**	0.406	**< 0.001**
Midpoint of sleep on free days	0.687	**< 0.001**	0.674	**< 0.001**	0.296	**< 0.001**	0.637	**< 0.001**	0.670	**< 0.001**	0.686	**< 0.001**	0.678	**< 0.001**	0.648	**< 0.001**	0.672	**< 0.001**
Average weekly sleep duration	-0.57	**< 0.001**	-0.563	**< 0.001**	-0.171	**< 0.001**	-0.538	**< 0.001**	-0.556	**< 0.001**	-0.574	**< 0.001**	-0.570	**< 0.001**	-0.547	**< 0.001**	-0.558	**< 0.001**

Spearman rho correlation test, r: correlation coefficient, *: Partial correlation [controlling for age (decimal)], **′**: Partial correlation (controlling for gender), **″**: Partial correlation [controlling for gender and age (decimal)].
BMI: body mass index, SDS: standard deviation score, PSQI: Pittsburgh Sleep Quality Index

Table 3. ROC analysis according to PSQI

Reference PSQI >5 (Bed Sleep Quality)	Cut-off	Specificity	Sensitivity	-PV	+PV	AUC ± SE	p
All participants							
Social jet lag	>1	88.7	74.6	51.5	95.6	0.886 ± 0.017	**<0.001**
Sleep corrected social jet lag	>1	96.9	51.7	37.9	98.2	0.837 ± 0.021	**<0.001**
Male							
Social jet lag	>1	90.6	77.5	55.8	96.3	0.901 ± 0.021	**<0.001**
Sleep corrected social jet lag	>1	54.7	95.9	80.6	87.1	0.851 ± 0.029	**<0.001**
Female							
Social jet lag	>1	86.4	71.3	46.9	94.7	0.867 ± 0.026	**<0.001**
Sleep corrected social jet lag	>1	97.7	50.7	36.8	98.7	0.821 ± 0.031	**<0.001**
Normal weight							
Social jet lag	>1	88.5	35.3	79.4	52.2	0.627 ± 0.060	**0.034**
Sleep corrected social jet lag	>1	49.0	64.7	79.7	31	0.580 ± 0.058	0.170

Analysis Honley&Mc Nell-Youden index J.
ROC: receiver operating curve, AUC: area under the ROC curve, SE: standard error, +PV: positive predictive value, -PV: negative predictive value, PSQI: Pittsburgh Sleep Quality Index

specifically linked to compromised social function, decreased immunity, obesity, and poor performance in school (13). According to the National Sleep Foundation Sleep in America Poll, 75% of 12th graders reported getting less than eight hours of sleep a night. However, research generally shows that it is important for young people to get at least 8-9 hours of sleep a night (14). The optimal duration of sleep can vary between individuals and may be influenced by the age, and the physical and mental requirements of young individuals. A study examining the correlation between the amount of sleep and body fat levels in adolescents reported that decreased sleep duration was associated with increased body fat in adolescents. Furthermore, a direct correlation was found between decreased sleep duration and increased risk of obesity (15). We found that the adolescents who participated in our study had an average week night sleep duration of 6.63 hours which is below the recommended duration. Studies indicate that insufficient sleep time and poor sleep quality elevate the likelihood of developing obesity (16). In individuals with suboptimal sleep patterns, factors such as disturbances in hormonal control, heightened appetite, reduced energy expenditure, and an elevated propensity for weight gain may be operative. Insufficient sleep can heighten the inclination to consume larger quantities of food due to its impact on the appetite-regulating hormones, leptin and ghrelin. Insufficient sleep can result in reduced metabolic function, insulin resistance, and alterations in body composition (17,18). Studies indicate a correlation between SJL and obesity (19). SJL refers to the difference between weekday and weekend sleep hours. In other words, it is the habit of waking up early and staying awake until late on weekdays, going to sleep later, and sleeping longer on weekends. This change in sleep patterns can disrupt sleep patterns and affect the body's biological clock. Research has shown that individuals who experience more SJL generally have a higher BMI and are more prone to obesity (20). However, researchers have yet to determine the precise mechanism by which SJL affects obesity but it has been shown that SJL negatively affects sleep duration and sleep quality. Decreased sleep duration and quality can lead to disruption of hormonal balance, increased appetite, and an irregular metabolism (8). This increases the risk of obesity. Our investigation found a notable correlation between heightened SJL and elevated BMI, consistent with the existing literature. The quality of sleep can be influenced by different factors. Additional variables, including age, gender, lifestyle, and genetic predisposition can influence the quality of sleep (21). The association between BMI and PSQI score we found remained significant, even after controlling for age and gender variables.

Study Limitations

The participants' sleep-wake times were self-reported or reported by parents. If actigraphy could have been used, we would be able to obtain accurate results for sleep duration and SJL. In addition, food consumption records and physical activity scores were not included in this study. There is a bidirectional relationship between short sleep duration and obesity. We also found that even if the total weekly sleep duration was at normal values, adolescents' exposure to more SJL increased BMI. We believe that this bidirectional relationship will be useful both in outpatient clinic administrations for the prevention of obesity and in sleep studies related to circadian rhythm.

Conclusion

This study demonstrated a relationship between inadequate sleep quality, increased exposure to SJL, and a higher BMI in adolescents. We predict that improving sleep quality during adolescence may have a protective effect in preventing obesity. We recommend that all adolescents, especially those with overweight and obesity, be questioned about their sleep habits during their routine outpatient clinic examinations and that their sleep history be a part of the anamnesis. However, additional study is required to develop suitable guidelines for sleep recommendations for adolescents.

Ethics

Ethics Committee Approval: The study protocol was approved by the İstinye University Human Research Ethics Committee (meeting number: 2023-09; protocol number: 23-238, date: 06.11.2023).

Informed Consent: Written informed consent was obtained from all patients.

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Footnotes

Authorship Contributions

Concept: Funda Yıldız, Melike Zeynep Tuğrul Aksakal, Firdevs Baş, Design: Funda Yıldız, Melike Zeynep Tuğrul Aksakal, Firdevs Baş, Data Collection or Processing: Funda Yıldız, Melike Zeynep Tuğrul Aksakal, Analysis or Interpretation: Funda Yıldız, Raif Yıldız, Firdevs Baş, Literature Search: Funda Yıldız, Melike Zeynep Tuğrul Aksakal, Raif Yıldız, Firdevs Baş, Writing: Funda Yıldız, Melike Zeynep Tuğrul Aksakal, Raif Yıldız, Firdevs Baş.

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