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## The relationship between sleep quality and depressive symptoms in adolescents

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**Background/aim:** While poor sleep quality and sleep problems are signs of depression in adolescents, depressive symptoms among this age group further deteriorate sleep quality. The aim of this study was to explore the relationship between sleep quality and depressive symptoms in adolescents of 14 to 20 years of age.

**Materials and methods:** This study was conducted with a descriptive and cross-sectional research design. The sample group consisted of 313 adolescents in İstanbul, Turkey. The data were collected using a questionnaire form, the Beck Depression Inventory (BDI), and the Pittsburgh Sleep Quality Index (PSQI).

**Results:** The mean BDI score of the adolescents was  $12.99 \pm 8.94$  (range: 0–53) and 4.8% had severe depressive symptoms. The global PSQI score of the adolescents was  $4.69 \pm 2.87$  (range: 0–16) and 63.6% had good sleep quality, whereas the remaining 36.4% had poor sleep quality. There was a moderate positive correlation between BDI and PSQI scores. The factors affecting the quality of sleep of adolescents were mild and moderate-severe depressive symptom level, smoking, and the presence of sleep problems in a family member.

**Conclusion:** This study shows a relationship between sleep quality and depressive symptom levels of adolescents. The findings of the current research will contribute to the development of school wellbeing programs that will be prepared with the aim of improving sleep quality and reducing depressive symptoms.

**Key words:** Adolescent sleep, circadian rhythm, insufficient sleep, depression

### 1. Introduction

The association between sleep quality and psychiatric disorders has been described in previous research (1–4). Previous studies have also confirmed that individuals with sleep disturbances may be at risk for the development of depression (5–7).

There is a very close relationship between major depressive disorder (MDD) and sleep problems. While a significant percentage of people with MDD complain of sleep disturbances, depression symptoms are seen more frequently in people with sleep disturbances. Although sleep disturbances are typical characteristics of MDD, sleep disturbances may appear before MDD episodes. This two-way relationship between sleep disturbances and MDD makes it difficult to establish a cause-and-effect connection between them. Longitudinal studies have defined sleep disorders as a risk factor for new onset or recurrent MDD development, and this relationship has been shown in young adult, middle-aged, and elderly populations (8).

It is very important to meet the basic needs of adolescents for their physical and emotional development during adolescence, which, for much of the world, includes ages 13 to 18 years. One of these needs is sleep, and poor sleep quality can yield important problems in adolescents (9–11).

Sleep needs and sleep cycles of children and adolescents are different from those of adults. Wolfson and Carskadon determined that the sleep needs of adolescents are between 7.5 and 8.5 h per night, with 26.6% of adolescents obtaining <6.5 h per night and only 15% obtaining 8.5 h or more (12). Insufficient sleep is the most common cause of daytime sleepiness in adolescents. An adolescent with insufficient sleep will typically report a late bedtime and early wake-up time on school days, with significant oversleeping on weekends (13).

Insufficient sleep results from the interaction of biological factors (puberty) and extrinsic factors. Intrinsic factors are those resulting from the normal development of adolescents. Adolescents mostly have difficulty sleeping

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due to their circadian rhythm. They do not want to wake up in the early morning hours because, during puberty, the timing of melatonin release has been shown to change, which shifts the adolescent's circadian rhythm. The delayed release of melatonin found in adolescents causes a later onset of sleepiness. This change in the circadian rhythm is in contrast to the extrinsic demands of an early school start time, resulting in an overall decrease in total sleep duration. Extrinsic factors include activities, employment, academic demands, school start times, social interaction, and environmental factors. Activities, including sports and music, can delay bedtime. After going to sleep late because of academic and extracurricular demands, adolescents then have to wake up early for school, resulting in insufficient sleep. The increasing use of mobile phones, text messaging, instant messaging, email, and other electronic communications can promote insufficient sleep in adolescents (13).

In addition to these previously mentioned factors, age, sex, eating habits, alcohol and tobacco use, life style, family factors, drug use, physical and mental disorders, and environmental factors such as noise and bedroom temperature affect sleep duration and sleep quality (14–17). Especially nowadays, excessive time spent on the computer or the intensity of academic studies can deteriorate sleep quality in adolescents, leading to daytime sleepiness (12), which is a consequence of poor nocturnal sleep quality. These have adverse effects on the physical and psychological wellbeing of adolescents (10,12,18,19). Additionally, it is possible to say that this two-way relationship between sleep disorders and depression can be seen in adolescence.

Previous studies on adolescents have mostly reported on determining sleep quality and sleep problems (20,21), with only a few studies focusing on sleep problems and behavioral symptoms in adolescents (20,22). Previous reports suggest that 25%–40% of this age group suffers from sleep-related problems (10,19,22–28).

Some recent studies pointed out the connection between adolescent sleep problems and depressive symptoms. One study in the United States found that adolescents with sleep disturbances have a higher rate of depressive symptoms than adolescents without sleep disturbances (29). However, one study reported not finding a strong association between sleep disturbances and depressive symptoms in adolescents (30). It has also been demonstrated that sleep disturbances and depressive symptoms are closely related, and insufficient sleep may result in depressive symptoms in adolescents (31). Guo et al. found that students with depressive symptoms were approximately 2.5 times more likely to suffer from sleep disorders (28). In another study among adolescents, short sleep durations were associated with suicide, illicit

drug use, and depression as defined by the Center for Epidemiologic Studies Depression scale (32).

Most of these studies only demonstrate the situation in Western and Far Eastern countries. There are no known studies that focus on the relationship between sleep quality and depressive symptoms among adolescents in Turkey. Furthermore, although the relationship between sleep quality and depressive symptoms has been identified in adults, studies investigating relationships between sleep disorders and depressive symptoms in adolescents who have different sleep needs and sleep cycles compared to adults are limited. The present study aimed to contribute to the available literature by providing evidence that demonstrates the sleep problems of adolescents and the relationships between sleep quality and depression in Turkey.

The aim of this study was to explore the relationship between sleep quality and depressive symptoms in adolescents of 14 to 20 years of age. The secondary aim of this study was to determine the sociodemographic factors affecting sleep quality in adolescents.

Hypotheses:

1) There is a relationship between sleep quality and depressive symptoms in adolescents.

2) There is a relationship between sleep quality of adolescents and sociodemographic factors.

The dependent variable of this study was the “level of depressive symptoms” and the independent variable was the “sleep quality level” in adolescents. Additionally, age, sex, alcohol use, tobacco use, illegal substance use, body mass index (BMI), Internet use, and watching television were identified as independent variables in determining the relationship with sleep quality.

## 2. Materials and methods

### 2.1. Design

This study was conducted with a descriptive and correlational design.

### 2.2. Participants

The study population consisted of students attending secondary school in a district of İstanbul, Turkey (N = 21,225). The inclusion criteria were adolescents between the ages of 14 and 20 years, with no hearing or visual problems, and willing to participate in the study. The exclusion criteria were adolescents with any diagnosed medical or psychiatric disorders.

### 2.3. Sample size calculation

The power analysis result was based on a 40% prevalence of sleeping difficulty, a 5% margin of error, and a 95% confidence interval, which found a sample group of 400. Four different schools were capable of representing the sample group and were chosen randomly (private school, public school, vocational school, and science school), and

the unit figure falling into each stratified was calculated (stratum 1: 1950, sample: 210; stratum 2: 850, sample: 92; stratum 3: 656, sample: 71; stratum 4: 243, sample: 27; total: 3699, sample: 400). A total of 313 students provided the study data because the parent-student permissions required to join the study were not obtained and it was not possible to contact some of the students.

#### 2.4. Data collection

Data were collected during school hours on days allowed by the school administration. Questionnaires were distributed to students after they had been briefed about the study. It took an average of 20–25 min to complete the questionnaires.

#### 2.5. Instruments

The data for the study were collected using a questionnaire form, the Beck Depression Inventory (BDI), and the Pittsburgh Sleep Quality Index (PSQI).

The questionnaire form was designed for determining the individual characteristics of adolescents by researchers. The sleep problems and familial sleep problems of the adolescents were subjectively evaluated.

The Turkish version of the BDI was used in the current study. The BDI was designed by Beck et al. in 1961 and the validity and reliability of the scale were assessed in Turkey by Hisli in 1989 (33,34). The Cronbach alpha of the scale was 0.86 in the current study.

The Turkish version of the PSQI was used in the current study. The PSQI was designed by Buysse et al. and the Turkish version of the scale was assessed by Agargun et al. There are seven components in the scale and the sum of those component scores yields one global score of subjective sleep quality (range: 0–21). Sleep quality of those with a total score of  $\leq 5$  is considered as “good” and of those  $> 5$  as “poor” (35,36). The Cronbach alpha of the scale was 0.71 in the current study.

#### 2.6. Ethical considerations

The Directorate of National Education approved the current study. Students and their parents were informed about the study and approval was obtained verbally and in writing before the data collection process.

#### 2.7. Data analysis

The study data were analyzed using SPSS 16.0. Descriptive (percentage, mean, and standard deviation) and comparative statistical methods (chi-square tests), correlation tests, and logistic regressions were used to analyze data.

### 3. Results

The average age of the adolescents was  $16.87 \pm 1.21$  years (range: 14–20 years). Of these, 57.8% were male, 42.2% were female, 58.8% had average academic success, 72.8% had normal BMI levels, 25.2% had sleep problems, 16.0%

had a family member with sleep problems, 63.6% did not exercise, 85.6% drank tea/coffee, 33.5% drank alcohol, 17.3% smoked, 1.6% used illegal substances, 95.2% used the Internet, and 90.4% watched television. Adolescents spent  $2.74 \pm 2.07$  h/day on the Internet and  $2.23 \pm 1.45$  h/day watching television.

The average BDI score among the adolescents was  $12.99 \pm 8.94$  (range: 0–53) and 4.8% of the adolescents had severely depressive symptoms. The global PSQI score was  $4.69 \pm 2.87$  (range: 0–16) and 63.6% had good sleep quality, whereas the remaining 36.4% had poor sleep quality (Table 1).

There were significant differences in the relationships between sleep quality and sex, the presence of sleep problems in the individual, the presence of sleep problems in the family member, smoking, and the use of alcohol (Table 2). There was a moderate positive correlation between the BDI score and the PSQI scores ( $r = 0.51$ ;  $P < 0.01$ ) (Table 3).

According to logistic regression analysis, the factors affecting the quality of sleep are mild and moderate-severe depressive symptom level, smoking, and the presence of sleep problems in the family member (Table 4).

### 4. Discussion

The current study found that 36.4% of adolescents had poor sleep quality. Similar studies found that 25% to 40% of adolescents suffered from sleep disorders (10,19,23–26). One study carried out in Turkey by Temel et al. aimed at evaluating sleep quality in adolescents and the potential factors affecting the quality. This group reported that 43.1% of adolescents suffered from poor sleep quality (37). The coherence between the findings of this study and other similar studies performed in Turkey and abroad, regardless of cultural differences, suggest that poor sleep quality is an important public health problem in Turkey that requires attention.

The results found in the current study suggest that poor sleep quality is more prevalent among females. This finding is similar with other studies (28,38). Some studies have found that girls are better sleepers than boys (39). However, these differences may be due to the sample characteristics.

In the current study, there was no correlation between the age and the PSQI scores. Another study reported that sleep quality deteriorates with age (40). There are a number of different studies that have argued that age is not linked with sleep quality (28,41,42). These results are similar with the current study findings. The age group in the current study was similar. Therefore, there is a need to perform further studies to determine the effects of age on sleep quality.

**Table 1.** The findings of BDI and PSQI of adolescents (n = 313).

		n	%	Mean ± SD	Min-max
BDI				12.99 ± 8.94	0-53
	Normal	189	60.4		
	Mild	59	18.8		
	Moderate	50	16.0		
	Severe	15	4.8		
PSQI	Good sleep	199	63.6		
	Poor sleep	114	36.4		
	Subjective sleep quality			1.22 ± 0.68	0-3
	Sleep latency			0.46 ± 0.69	0-3
	<15 min	200	63.9		
	16-30 min	85	27.2		
	31-60 min	23	7.3		
	≥61 min	5	1.6		
	Sleep duration			0.62 ± 0.83	0-3
	>7 h	181	57.8		
	6-7 h	86	27.5		
	5-6 h	28	8.9		
	<5 h	18	5.8		
	Habitual sleep efficiency			0.62 ± 0.83	0-3
	>85%	211	67.4		
	75%-84%	62	19.8		
	65%-74%	22	7.0		
	65%	18	5.8		
	Sleep disturbances			1.21 ± 0.65	0-3
	Use of sleeping medication			0.13 ± 0.44	0-3
	Daytime dysfunction			0.99 ± 0.92	0-3
	Global PSQI			4.69 ± 2.87	0-16

**Table 2.** The comparison of PSQI with characteristics of adolescents (n = 313).

Individual characteristics		Good sleep		Poor sleep		χ <sup>2</sup>	P
		n	%	n	%		
Sex	Male	125	69.1	56	30.9	5.57	<0.01
	Female	74	56.1	58	43.9		
Have a problem with sleep	Yes	33	41.8	46	58.2	21.69	<0.001
	No	166	70.9	68	29.1		
Have a problem with sleep in the family	Yes	19	38.0	31	62.0	16.81	<0.001
	No	180	68.4	83	31.6		
Alcohol use	Yes	57	54.3	48	45.7	5.89	<0.05
	No	142	68.3	66	31.7		
Cigarette use	Yes	23	42.6	31	57.4	12.41	<0.001
	No	176	68.0	83	32.0		

**Table 3.** The correlation of PSQI with BDI and characteristics of adolescents (n = 313).

	r
Age	0.067
BMI	-0.050
Internet use	0.071
Watching television	-0.065
BDI	0.51*

\*P < 0.01.

**Table 4.** The evaluation with logistic regression of the factors affecting the quality of sleep (n = 313).

	Sig.	Exp (B)	95.0% C.I. of Exp (B)	
			Lower	Upper
BDI mild	0.000***	3.709	1.928	7.135
BDI moderate-severe	0.000***	11.141	5.483	22.637
Smoking	0.020*	2.397	1.149	5.001
Have a problem with sleep in the family	0.049*	2.173	1.003	4.709

\*P < 0.05, \*\*\*P < 0.001.

Substance use is a global problem that is on the increase. A study carried out on elementary and secondary school students in Turkey found the prevalence of smoking to be 16.1%, alcohol use to be 15.4%, and the use of volatile substances and illegal drug use to be 1.7% for elementary school students. Moreover, this same study reported that, for secondary school students, the smoking prevalence was 55.9%, alcohol use was 45.0%, cannabis use was 4.0%, volatile substance use was 5.1%, and heroin/ecstasy use was 2.5% (43). In the current study, the rate of smoking was different than the findings of other studies carried out in Turkey; however, rates of alcohol and illegal substance use were similar. Furthermore, those using substances had poorer sleep quality compared to those who did not use in the current study. According to logistic regression analysis, the substance affecting the quality of sleep is cigarettes. Smoking prevents deep sleep. Therefore, quality of sleep may deteriorate. Also, adolescents use these substances to cope with negative feelings, to experience pleasant feelings, and feel better; however, they soon start to feel the disorders caused by the use of such substances. Deterioration of sleep quality is one of these problems. That is why it is possible to suggest that substance users have poor sleep quality. Considering that poor sleep quality leads to depressive symptoms, the adolescent using substances to overcome depressive symptoms consequently has further deteriorated sleep quality. Thus,

it is important to plan school wellbeing programs in a way that addresses these three issues.

Internet use is also on the rise among the younger population. Internet use in Turkey for the age group from 16 to 24 years is at a level of 68.7% (44). The current study found that 94.6% of adolescents used the Internet and that the average time spent on the Internet was approximately 3 h/day. The current study did not establish a relationship between the time spent on the Internet and sleep quality. However, Internet use is a growing problem and these results suggest a need to perform further studies on the relationship between Internet use and sleep quality.

The other factor affecting the quality of sleep is the presence of sleep problems in a family member. In the literature, there are no studies determining the relationship between sleep quality of adolescents and the presence of sleep problems in the family member. Family is one of the most important factors for the formation of the child's behavior. The adolescent learns sleep behavior from the family and the sleep behavior of the family affects the sleep quality of the adolescents. However, there is a need to perform further studies.

It is known that sleep problems can eventually lead to deterioration in certain systems. For instance, sleep problems can lead to metabolic problems that have clinical reflections in the form of obesity (45). Thus, an early diagnosis of adolescent sleep problems will help to

determine or prevent physical ailments at an earlier stage. The current study calculated the BMI values of adolescents and found that most were within the normal BMI percentile values. No connection was found between BMI and the PSQI. Further studies are needed to determine a relationship between obesity and sleep quality.

There is a very close relationship between depressive symptoms and sleep problems. In the current study, the prevalence of adolescents with severe depressive symptoms was 4.8% and there was a moderate positive relationship between sleep quality and depressive symptoms. Brooks et al. reported that 43.5% of students experienced depression and that 38% had problems associated with sleeping or going to sleep (5). In another study, Moo-Estrella et al. reported that students with depressive symptoms suffered more from daytime sleepiness (46). Guo et al. found that students with depressive symptoms were approximately 2.5 times more prone to sleep disorders (28). Due to the bidirectional relationship between depressive symptoms and sleep disturbances, it is difficult to identify the cause and effect. However, it has been suggested that the combination of insomnia and depression influences the severity and duration of MDD as well as relapse rates, whereas pharmacological and nonpharmacological interventions for insomnia may favorably reduce and possibly prevent MDD (8). Therefore, early identification of adolescents with sleeping problems may prevent a depression in the future.

Several limitations are worth noting when considering our results. The sample was conducted from only four high schools. Additional research involving a much larger and more diverse sample of adolescents is suggested to assess a wider perspective on sleep quality and depressive

symptoms in Turkish adolescents. Because the study was cross-sectional, it was difficult to come to a conclusion as to whether poor sleep quality leads to depressive symptoms or depressive symptoms cause poor sleep quality. Using a self-declaration scale based on subjective measurements could cause bias in selections.

The findings acquired from this study could contribute to the planning of school wellbeing programs in Turkey and abroad. Today's younger generation is largely unaware of the relationships between sleep quality and depressive moods. They are expected to study longer hours while sleeping less. This leads to an increase in experiencing depressive symptoms. Meanwhile, technological developments are increasing adolescents' use of computers and the Internet. This also contributes to deterioration in sleep quality. Health workers have an effective role in both healthcare and education. They could be encouraged to assume a greater role in implementing programs that have been developed to improve sleep quality, reduce depressive symptoms, and prevent substance use and other addictions. We believe that the findings of this study will act as a guide to develop health and wellness programs at schools.

In conclusion, one-third of the adolescents in the current study suffered from poor sleep quality; 39.6% presented with mild, moderate, or severe levels of depressive symptoms; and there was a moderate positive relationship between sleep quality and depressive symptoms. These findings demonstrate the significance of preventative initiatives aimed at improving sleep quality.

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