Sleep problems of adolescents: A detailed survey

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Abstract

We investigated the sleep problems and sleep habits of adolescents at three public primary schools and two high schools. Our study included 428 Turkish school children (244 girls and 184 boys). We used a questionnaire to determine the time they went to sleep at night; waking time in the morning; incidence of nightmares, snoring, daytime sleepiness, and intrafamilial physical trauma; concentration difficulty in class; and school success. The students were divided into age-related groups (group 1 = 11 to 13 years of age; group 2 = 14 to 15 years; group 3 = 16 to 18 years). The time they went to sleep was mostly between 10 and 11 p.m. in groups 1 and 2, and 11 to 12 p.m. in group 3. Difficulty in falling asleep was reported by 16.8 to 19.6% of the students in the three groups. Difficulty in waking up in the morning was reported by 12.7% of group 1, 16.0% of group 2, and 16.8% of group 3. Snoring was present in 12.1% of females and 22.0% of males. The occurrence of one nightmare in the preceding 3 months was reported by 11.3% of the students; 17.9% of the students reported having nightmares several times. Daytime sleepiness was present in 65.1%, and concentration difficulty was present in 56.8% of the students. We conclude that difficulty in falling asleep, snoring, and daytime sleepiness may be seen in adolescents who are in both primary and high schools. Watching inappropriate programs and movies on television and intrafamilial physical trauma may cause nightmares and sleeping problems in these adolescents. Students and families should be educated about the importance of sleep in academic performance. Countries' public health policies should address sleep problems and related educational activities.

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Introduction

Sleep disorders are common, affecting about one-third of all people,[1] and they can cause depression, impaired performance at school or work, and reduced quality of life and relationships. Despite our substantial knowledge about sleep problems, health professionals are still insufficiently trained in preventing, assessing, and treating sleep disorders.

Adolescence may bring with it particular sleep problems, such as delayed sleep phase syndrome, a disorder in which a person's sleep is delayed by 2 or more hours beyond the socially acceptable or conventional bedtime, which is common in teenagers. General practitioners, visiting healthcare workers, and school nurses can help by being better informed about the identification and treatment of sleep disorders and by being ready to refer complex problems to specialist centers.[1]

Adolescents require at least 8.5 hours of sleep a day.[2] Carskadon et al followed 40 students from grade 9 to 10 and studied the effect of an earlier school start time (from 8:25 a.m. to 7:20 a.m.) on sleep patterns.[3] The earlier start was associated with significant sleep deprivation and daytime sleepiness; students went to bed later and slept less. Significant physiologic findings that were identified in the students in grade 10 were (1) later onset of melatonin secretion, (2) shortened sleep latency, and (3) a marked increase in the incidence of REM (rapid eye movement) sleep.

REM sleep provides a restorative function for both the brain and body. During this step, the subjects dream and there are rapid eye movements, but other muscle contractions are inhibited and the rest of the body becomes immobile and relaxed. It also supports optimal daytime performance, both mentally and physically.

Most adolescents do not obtain the recommended amount of sleep, resulting in significant daytime sleepiness. For most adolescents, insufficient sleep results from the interaction between intrinsic factors, such as puberty, and extrinsic factors, such as school start times. Insufficient sleep and daytime sleepiness impact

all areas of adolescent functioning, including academic, psychological, and behavioral, which underscores the importance of evaluating sleepy adolescents.[4]

Wolfson and Carskadon reviewed the relationship between sleep patterns, sleep quality, and school performance of adolescents attending middle school, high school, and/or college.[5] According to their review, most studies examining sleep-related issues in adolescents relied on self-reporting. Specifically, those studies have looked at (1) sleep/wake patterns and usual grades, (2) school start time in relation to sleep habits and quality and academic performance, and (3) sleep patterns and classroom performance (e.g., examination grades).[5] The findings strongly indicated that the self-reported shortened total sleep time, erratic sleep/wake schedules, late bedtimes and rising times, and poor sleep quality are negatively associated with academic performance for adolescents from middle school through the college years.

In a study by Brand et al, sleep patterns of parents and their adolescent children showed similarities.[6] Moreover, a mother's poor sleep quality has a direct impact on parenting style, which in turn affects adolescents' psychological functioning and sleep. Knowing this relationship might help with family counseling and treatment of adults' and adolescents' sleep complaints.

While polysomnography is required for the diagnosis of certain sleep disorders, causes of sleepiness are generally best identified with a detailed sleep history and daily sleep diary. The management of sleep problems in adolescents involves treating any underlying sleep disorders, increasing total sleep time, and improving other environmental factors that impact sleep. Recognition and management of insufficient sleep and sleepiness are important for the health and functioning of adolescents.[4]

Allergic diseases have a significant impact on the quality of life. Wasilewska et al compared sleep parameters of allergic and nonallergic children.[7] They concluded that (1) allergic diseases were accompanied by different sleep disorders, including dyssomnias and parasomnias (e.g., bedtime resistance, disrupted sleep, or sleep-disordered breathing); and (2) physicians should pay particular attention to sleep quality in children with allergic diseases irrespective of which body system is affected (i.e., the skin [atopic dermatitis], the respiratory tract [bronchial asthma], or the alimentary system [food allergy]).

Evidence is growing that shows that sleep problems in adolescents are significant impediments to learning, cognition, and memory. Sleep problems negatively affect behaviors, attainment of social competence, and quality of life and are more prevalent than realized by education and health professionals.[8]

The present study was designed to investigate the sleep problems and sleep habits of school children aged 11 to 18 years. The relationship between snoring, daytime fatigue, and concentration difficulty in class and sleep habits, intrafamilial physical trauma, and school success were also investigated.

Materials and methods

This cross-sectional study was carried out by the Ear Nose Throat (ENT) and Pediatrics Departments of Kırıkkale University Faculty of Medicine. All steps of the study were planned and continued according to the principles outlined in the Declaration of Helsinki.[9]

Subjects. There is an ongoing project in Kırıkkale to increase adolescents' consciousness of body changes in puberty and of adolescent risk behaviors. It is being conducted by the Departments of Pediatrics and ENT at Kırıkkale University School of Medicine, in cooperation with Kırıkkale Turkish Educational Foundation (EGİTİMSEN). This study was carried out at three public primary schools and two high schools. All students who attended training seminars and agreed to fill out the forms were enrolled in the study. Participants were assured that their responses would be confidential and anonymous and that they had the right to refuse to participate in the study, which 8 students did.

A total of 428 Turkish school children (244 girls, 184 boys) were asked to voluntarily answer a set of questions in their classrooms at the beginning of the training program. The study was carried out in students of primary and high schools in Kırıkkale. There were 250 students (105 male, 145 female) in primary school and 178 (79 male, 99 female) students in high school. They provided written informed consent to participate the study, and to give permission for the use of their data. The participants' mean age was 13.02 ± 0.89 in primary School and 15.77 ± 1.70 in high school. All students with a chronic disease that would affect sleep were excluded from the study.

Questionnaire. A questionnaire consisting of 28 questions related to sociodemographic characteristics of the students and sleep problems were developed by the authors (figure 1). Topics related to sleep problems, concentration difficulties, and school success in adolescents were included in the survey. Topics addressed in the questionnaire encompassed participants' complaints and sleep habits.

Statistical analysis. Statistical Package for the Social

Date: **Place questionnaire was completed:**

1. Date of birth (year):

2. Sex:

3. At what era of life do you put yourself?
a. Childhood
b. Adolescence
c. Youth
d. Adulthood

4. Do you work?
a. No
b. Yes, _____ days/week
c. Yes, _____ days/month

5. Do you have a sister/brother? If yes how many? _____

6. Mother's age _____ Father's age _____

7. Number of people living in the household _____

8. What is the marital status of your parents?
a. Married, living together
b. Married, living separate
c. Divorced, living separate
d. Divorced, living together
e. Divorced mother remarried
f. Divorced father remarried
g. Divorced mother and father remarried
h. Mother has died
i. Father has died
j. Both mother and father have died

9. What is the education of your mother?
a. Nonreader, nonwriter
b. Primary school (finished only first 5 years)
c. Primary school (finished 8 years)
d. High school
e. University

10. What is the education of your father?
a. Nonreader, nonwriter
b. Primary school (finished only first 5 years)
c. Primary school (finished 8 years)
d. High school
e. University

11. Did you have to repeat a year in school?
a. Yes, _____ times
b. No

12. Do you have a pet at home?
a. Yes
b. No
c. I have one that I feed outside

13. Have you ever smoked?
a. No
b. Tried once, never smoked again
c. Tried and still smoke rarely
d. Yes, I am a smoker

14. Have you ever drunk alcohol?
a. No
b. Tried once, never drank again
c. Tried and still drink rarely
d. Yes, I drink regularly

15. How many hours/day do you watch TV?
a. Never watch TV
b. Less than 2 hours
c. 2 to 5 hours
d. More than 5 hours
e. It is turned on all day

16. Do you have a private room at home?
a. Yes, I have a room only for me
b. Yes, I share a room with my sister/brother
c. Yes, I share a room with my grandmother/-father
d. I sleep in a room after everybody sleeps
e. No, everyone sleeps in the same room

17. When do you usually wake up?
a. 6 to 7 a.m.
b. 7 to 8 a.m.
c. 8 to 9 a.m.
d. 9 to 10 a.m.
e. After 10 a.m.

Figure 1. This questionnaire was used to determine the sleep characteristics of adolescents in Kırıkkale.

18. At what time do you usually go to bed?
a. 8 to 9 p.m.
b. 9 to 10 p.m.
c. 10 to 11 p.m.
d. 11 to 12 p.m.
e. After midnight

19. What are your habits before sleeping? (You can mark more than one.)
a. Watch TV
b. Listen to music
c. Read books
d. Chat on the computer
e. Play games on the computer
f. Converse with the whole family
g. Other _____

20. Do you have a sleep problem?
a. No
b. Yes, I have difficulty falling sleep
c. Yes, I wake up continuously without a reason
d. Yes, I wake up with great difficulty in the morning

21. Have you awakened with a nightmare in the past 3 months?
a. No
b. Yes, once
c. Yes, several times
d. Continuously

22. Have you ever faced violence?
a. No, never
b. Yes, from my family ☐ verbal ☐ physical
c. Yes, from my friends ☐ verbal ☐ physical
d. Yes, from my teachers ☐ verbal ☐ physical
e. Yes, in the mosque ☐ verbal ☐ physical
f. Yes, in the street ☐ verbal ☐ physical
g. Yes, in a social environment (café, pub, etc.) ☐ verbal ☐ physical

23. Which of the characteristics describes you? (You can check more than one.)
a. Very calm
b. Usually calm
c. Usually hyperactive
d. Lazy
e. Usually angry
f. Very angry

24. Have you been struck on the head and/or ear? If yes, when?
a. No, never
b. Yes, 1 to 2 months ago
c. Yes, this year
d. Yes, 1 to 2 years ago
e. Yes, but so long ago I do not remember

25. Has there been any explosion near you?
a. No
b. Yes, 1 to 2 months ago
c. Yes, this year
d. Yes, 1 to 2 years ago
e. Yes, but so long ago I do not remember

26. Do you sleep with an open mouth or snore while sleeping?
a. Yes
b. No

27. Do you have weakness, sleepiness, or tiredness during the day?
a. Yes
b. No

28. Do you have a concentration problem during lessons in school?
a. Yes
b. No

Thank you for answering

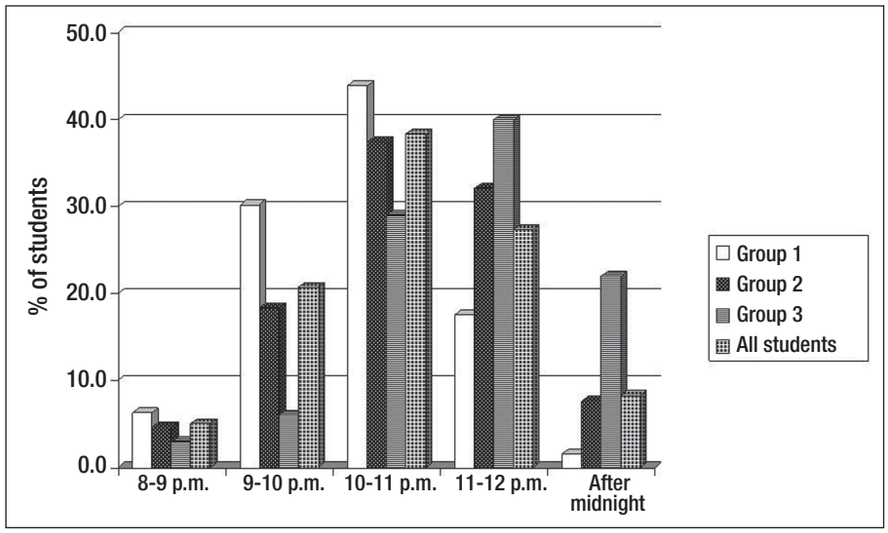

Figure 2. This graph shows the bedtimes of the students.

Sciences, version 8.0 (SPSS, Inc.; Chicago) was used for statistical evaluation. The chi-square test was used for statistical analysis; a p value of <0.05 was considered statistically significant.

Results

The mean age of the 428 students was 14.16 ± 1.87 years (minimum 11, maximum 18 years). Of these, 62.6% considered themselves adolescent, 28.5% as youths, and 7.1% as children; 1.8% did not answer this question. A total of 18.1% had no health insurance, and 2.1% were working outside school hours. The mean ages of the participants' mothers and fathers were 38.35 ± 5.17 and 42.83 ± 5.39 years, respectively. Most of the students (91.2%) were living with both parents, 22.4% had a pet at home, and most students shared their room with a sister or brother (and only 25.9% had a private room).

When asked to assess their school success, 19.2% considered it very good, 72.4% felt it was good, and 8.3% classified it as poor. A few (13.2%) stated that they had to repeat a class at least once.

Children spent most of their leisure time in front of a television and/or computer; 36.7% were watching TV 2 to 5 hours a day. Of the students surveyed, 84.5% never tried smoking and 91.9% never tried drinking alcohol.

Students were divided into three age-related groups (groups 1 to 3). Group 1 included 191 students aged 11 to 13 years; group 2, 132 students aged 14 to 15 years; and group 3, 105 students aged 16 to 18 years. The differences among groups in parameters of falling asleep, waking up continuously without a reason during the night, and difficulty waking up in the morning were analyzed by the chi-square test. The differences were not significant (χ^2 = 10.974; p = 0.203):

- Difficulty in falling asleep was reported by 19.6% of group 1, 17.6% of group 2, and 16.8% of group 3.
- Waking up continuously without a reason during the night was reported by 2.6% of group 1, 6.1% of group 2, and 9.9% of group 3.
- Difficulty waking up in the morning was reported by 12.7% of group 1, 16.0% of group 2, and 16.8% of group 3.

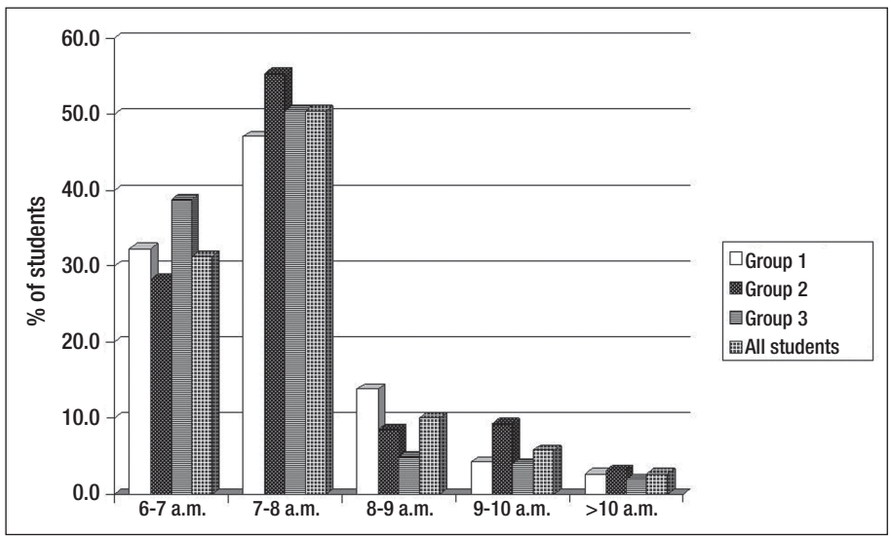

Figure 3. This graph shows the morning waking times of the students.

Bedtimes for groups 1 to 3 are shown in figure 2. The difference was found to be significant among groups (χ^2 = 74.147; p = 0.000). Waking time in the morning is shown in figure 3. The difference was

Table 1. Differences among the three age-related student groups in snoring, daytime sleepiness, difficulty concentrating in class, and exposure to explosion (group 1, ages 11-13 yr; group 2, ages 14-15 yr; group 3, ages 16-18 yr)*

	Group 1 (n = 191)		Group 2 (n = 132)		Group 3 (n = 105)			
	Present	Absent	Present	Absent	Present	Absent	Chi-square test†	
Problems							χ^2	***p* Value**
Snoring, n (%)	37 (19.7)	151 (80.3)	21 (16.9)	103 (83.1)	12 (11.1)	96 (88.9)	3.636	0.162
Sleepiness	124 (66.0)	64 (34.0)	82 (67.2)	40 (32.8)	66 (56.9)	50 (43.1)	0.664	0.718
Difficulty concentrating	109 (58.0)	79 (42.0)	83 (66.9)	41 (33.1)	46 (42.6)	62 (57.4)	**14.169**	**0.001**
Exposure to explosion	22 (26.5)	61 (73.5)	17 (34.7)	32 (65.3)	3 (8.8)	31 (91.2)	**16.657**	**0.034**

**Not all students answered all questions. For each question, only the completed answers were analyzed statistically. Therefore, there are missing values.*
† χ^2 values of >3.84 and p *values of <0.05 are statistically significant (denoted by boldface).*

found to be significant among groups ($\chi^2 = 15.573$; $p = 0.049$). Table 1 shows the differences among groups 1 to 3 in snoring, sleepiness, concentration difficulty in class, and exposure to an explosion.

The differences in concentration difficulty and exposure to explosion among the groups were found to be statistically significant. The fact that concentration difficulty in class was highest in group 2 could be attributable to the student's inherent problems of adolescents aged 14 and 15 years.

School success was reported in group 1 as 25.4% very good, 68.3% good, and 6.3% poor; in group 2, 24.4% very good, 69.5% good, and 6.1% poor; in group 3, 2.9% very good, 83.8% good, and 13.3% poor.

The difference between ages, sexes, mothers' and fathers' education, and intrafamilial physical trauma; and the students' snoring, sleepiness, and concentration difficulty in class were analyzed by the chi-square test (table 2). The differences were found significant between:

- age and concentration difficulty in class;
- gender, and snoring and sleepiness;
- mother's education, and daytime sleepiness and concentration difficulty in class (daytime sleepiness was present 65.1% of all students in our study; of 28 students with literate mothers, 85.7% had daytime sleepiness, and of 227 students whose mothers had primary-school education, 68.7% had daytime sleepiness. Concentration difficulty was present 56.8% of all students in our study and in 58.6% of students with illiterate mothers; 61.8% of students with mothers who graduated from primary school had concentration difficulty in class); and

Table 2. Statistical correlations* among snoring, daytime sleepiness, and difficulty concentrating in class among students according to their age, sex, mothers' and fathers' education levels, and intrafamilial physical trauma.

	Snoring		Sleepiness		Difficulty concentrating	
	χ^2	***p* Value**	χ^2	***p* Value**	χ^2	***p* Value**
Age	3.636	0.162	0.664	0.718	**14.169**	**0.001**
Sex	**7.409**	**0.006**	**12.071**	**0.001**	0.800	0.371
Mother's education	2.320	0.677	**12.859**	**0.012**	**6.239**	**0.012**
Father's education	0.168	0.682	0.611	0.434	2.436	0.115
Intrafamilial physical trauma	**13.381**	**0.004**	**8.080**	**0.004**	**7.433**	**0.006**

** χ^2 values of >3.84 and* p *values of <0.05 are statistically significant (denoted by boldface).*

Table 3. Statistical correlations* among snoring, daytime sleepiness, and difficulty concentrating in class with students' sleep habits

	Sleep problems		Bedtime at night		Morning waking time	
	χ^2	*p* Value	χ^2	*p* Value	χ^2	*p* Value
Snoring	3.069	0.080	2.817	0.093	1.907	0.167
Sleepiness	**8.522**	**0.004**	1.161	0.281	0.280	0.597
Difficulty concentrating	**5.279**	**0.000**	**8.842**	**0.003**	0.222	0.637

** χ^2 values of >3.84 and* p *values of <0.05 are statistically significant (denoted by boldface).*

• Intrafamilial physical trauma and snoring, sleepiness, and concentration difficulty in class (of the 43 students who had experienced intrafamilial physical trauma, snoring was present in 27.9%, sleepiness in 77.3%, and concentration difficulty in 56.8%).

The differences between sexes, snoring, sleepiness, and concentration difficulty in class; and sleep habits and school success are shown in table 3. The differences were found to be significant between:

• snoring and waking with a nightmare;
• sleepiness, sleep problems, waking with a nightmare, and school success; and
• concentration difficulty and sleep problems, sleeping time in the night, waking with a nightmare, and school success.

Discussion

Sleep in adolescence may vary according to stress and environmental factors. In particular, parents' behavior may affect their children's psychological functioning and sleep. However, no data have been gathered with respect to parents and their adolescent children's concurrent sleep patterns.[6] Inadequate sleep time may be contributing to adolescent health problems, such as increased stress and obesity. Findings indicate a need for sleep hygiene education for adolescents and their parents. A long-term solution to chronic sleep deprivation among high school students could include delaying high school start times.[10]

Gibson et al conducted a cross-sectional survey of 2,201 high school students in Ontario, Canada.[8] They used the Epworth Sleepiness Scale (ESS) to measure sleepiness. Morning sleepiness was common; most students (58 to 68%) reported that they were "really sleepy" between 8 and 10 a.m. Excessive daytime sleepiness was common, with 40.9% of students reporting an ESS score greater than 10. Five factors—sex, hours of week-night sleep, consistent bedtime pattern, up late to study, and drinking caffeinated beverages after 6 p.m.—were statistically significantly associated with an ESS >10. Morning sleepiness was common, as the largest proportion of students reported being very sleepy between 8 and 10 a.m.

Taras and Potts-Datema investigated the association between sleep and academic outcomes in school-aged children.[11] Sleep, school performance, and cognitive and achievement tests were applied. A high prevalence of suboptimal amounts of sleep and poor sleep quality were reported among school-aged children. This research demonstrates that suboptimal sleep affects how well students can learn and how it may adversely affect school performance.

High school students are reported to be excessively sleepy, resulting in decreased academic performance, increased psychosocial problems, and increased risk of morbidity and mortality from accidents. Early school start times have been noted to contribute to this problem. This article attempts to confirm the relationship between early school start times and decreased sleep and increased sleepiness. It was found that students at the early-start school reported reduced sleep time and more sleepiness than their counterparts at the later-starting school. Further studies in larger groups are recommended in view of the potential significant impact of sleep deprivation in this age group.[12]

In our study, the difference in bedtime was significant between groups 1 to 3. In group 1, bedtime was 10 to 11 p.m. in 43.9% and 9 to 10 p.m. in 30.2% of the students; in group 2, it was 10 to 11 p.m. in 37.4% and 11 to 12 p.m. in 32.1% of the students; in group 3, it was 11 to 12 p.m. in 40.0% and 10 to 11 p.m. in 29.0% of the students.

In all groups, morning waking time was reported most often as at 7 to 8 a.m.: in 47.1% of the students in group 1, 55.4% of the students in group 2, and 50.5% of the students in group 3. Students reported that late-night social or other activities make it physiologically impossible to get to sleep, leading to insufficient sleep

Waking w/ nightmare		School success	
χ^2	*p* Value	χ^2	*p* Value
8.509	**0.004**	3.190	0.203
4.904	**0.027**	**11.785**	**0.003**
8.392	**0.004**	**10.914**	**0.004**

and sleep debt which, if unrecognized or incorrectly diagnosed and left untreated, may cause daytime sleepiness and under-functioning.[1] Therefore, students' night activities are very important factors in sleep patterns and sufficient sleep duration.

Noland et al investigated adolescents' sleep behaviors and perceptions of sleep.[10] Three hundred eighty-four ninth- to twelfth-grade students (57%) completed a self-administered valid and reliable questionnaire on sleep behaviors and perceptions of sleep. Most respondents (91.9%) obtained inadequate sleep (≥9 hours) on most school nights of the week, with 10% reporting <6 hours of sleep each week-night. The majority indicated that not getting enough sleep had the following effects on them: being more tired during the day (93.7%), having difficulty paying attention (83.6%), lower grades (60.8%), increase in stress (59.0%), and having difficulty getting along with others (57.7%). Some students reported engaging in harmful behaviors to help them sleep: taking sleeping pills (6.0%), smoking a cigarette to relax (5.7%), and drinking alcohol in the evening (2.9%). Students who received fewer hours of sleep were significantly more likely to report being stressed ($p = 0.02$) and were more likely to be overweight ($p = 0.04$).

The amount of sleep adolescents get affects the way they perform, feel, think, learn, and remember. Significant physiological and social changes have profound effects on adolescents' sleeping patterns. Lack of sleep increases the possibility of increased daytime sleepiness, which may result in a tragic automobile or work accident.

Other consequences of sleep deprivation include poor school performance, heightened risk of drug and alcohol use, increased irritability, and aggressive behavior, all of which can interfere with relationships with classmates, parents, and teachers.[13]

Sleep duration affects the health of children and adolescents. Shorter sleep durations have been associated with poorer academic performance, unintentional injuries, and obesity in adolescents.[10]

If adolescents understand and learn to improve their sleep patterns while they are young, they may have improved sleep habits in adulthood. Teaching adolescents about the importance of sleep is an essential task for school nurses.[13]

In our study, we concluded that waking up with a nightmare caused sleep problems and sleepiness, ultimately affecting school success negatively. Sleeping time in the night, waking with a nightmare, and sleep problems increased concentration difficulty of the students and reduced school success. Therefore, adolescents' sleep habits should be managed by their families. Daily sleep duration and sleeping time at night are very important for adolescents' rest and school success.

Difficulty in falling asleep, snoring, and daytime sleepiness may be seen in adolescents at both primary and high school ages. Watching inappropriate programs and films on TV and movies, and intrafamilial physical trauma, may cause adolescents to experience nightmares and sleeping problems. Countries' public health policies should address sleep problems and related educational activities.

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