Original Article

Factors Affecting Daytime Sleepiness in Adolescents

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Abstract

Background: Sleep has many physiological and psychological benefits for human especially adolescents. Adequate and good quality sleep is a particular requirement for the physical and developmental functions of children in the growth and development period. However, many adolescents have sleep problems as a result of being in this period of development.
Objective: This study aimed to examine daytime sleepiness in adolescents and factors that affect it.
Methods: This study used a descriptive, correlational, and cross-sectional design. The sample consisted of 334 adolescents at two schools, which were selected from among the high schools affiliated with the Ismir Provincial National Education Directorate using a simple random sampling method. The data were selected using a sociodemographic data form and Pediatric Daytime Sleepiness Scale. Percentage calculations, mean, correlation, and regression analyses were used for data analysis.
Results: The Daytime Sleepiness Scale mean score of the participants was found to be 25.59±5.73. A low-level, statistically significant relationship was found between economic status, academic achievement, being satisfied with body image, sleeping and waking time, smoking, reading books before sleep, and daytime sleepiness (p<.05). The variables explained 23.4% of the daytime sleepiness.
Conclusions: This study found that factors such as economic status, academic achievement, being satisfied with body image, sleeping and waking time, smoking, and reading books before sleep affected daytime sleepiness in adolescents.

Keywords: Daytime sleepiness; adolescents; factors.

Introduction

Sleep is defined as a process that has many physiological and psychological benefits including helping the body regain energy, cell renewal, strengthening the immune system, central nervous system development, increasing memory and learning capacities with the development of cognitive abilities (Aysan, Karakose, Zaybak, & İsmailoglu, 2014; Ertugrul & Rezaki, 2004; Sahin & Ascioglu, 2013;

Vallido, Peters, O'Brien, & Jackson, 2009). Regarded as an important part of a healthy life, sleep is a periodical unconsciousness state that can be ended with stimulants, such as noise and light (Ertugrul & Rezaki, 2004; Karadag, 2007). Adequate and good quality sleep is a particular requirement for the physical and developmental functions of children in the growth and development period (Karadag, 2007; Roberts & Steele, 2009). The sleep duration required by children, who have different growth and development characteristics in different periods, to complete this period healthily is also different. This duration drops from twelve to nine hours in adolescents who are experiencing their most complicated period – physiologically, psychologically, and socially (Blunden, Hoban, & Chervin, 2006; Fallone, Owens, & Deane, 2002; Pagel & Kwiatkowski, 2010). However, many adolescents have sleep problems as a result of being in this period of development. The most commonly encountered sleep problem is daytime sleepiness, which is caused by inadequate and poor quality sleep (Aysan et al., 2014; Watson, 2015).

Daytime sleepiness is a condition based on a desire for sleep at inappropriate times, which is followed by cognitive and behavioral problems, as a result of the impairment of sleep quality or inadequate sleep and sleep hygiene (Grove, Burns, & Gray, 2012; Tan, Healey, Gray, & Galland, 2012). Daytime sleepiness increases in early adolescence (Campbell, Burright, Kraus, Grimm, & Feinberg, 2017). A great majority of studies on sleepiness among adolescents in Turkey have focused on sleep hygiene and sleep quality in adolescents (Bulbul, Kurt, Ünlu, & Kirl, 2010; Sahin, Ozturk, Oyekcin & Uludag, 2014). Children who have adequate and good quality sleep develop in a healthier way and the sleep quality of children can be improved by determining their daytime sleepiness. Therefore, this study aimed to examine daytime sleepiness in adolescents and factors that affect it.

Method

Study Design and Participants

This study used a descriptive, correlational, and comparative cross-sectional research design to determine daytime sleepiness and factors that affect it. The study was conducted between January and April 2016 with 334 adolescents studying in 9th, 10th, 11th, and 12th grades at two high schools, which were selected from among the high schools affiliated with the Ismir Provincial National Education Directorate, using a simple random sampling method.

Based on the regression analysis in a study conducted by Bektas et al. (2016), Type I error and Type II error were regarded as 0.05 and 0.20 (80% power), respectively, and the required sample size calculated for the study was found to be 151 high school students. A total of 1151 students were receiving education at three high schools, which were selected from among the high schools affiliated with the Ismir Provincial National Education Directorate using a simple random sampling method. It was initially planned to include all of the students at two high schools (n=1151) in the sample, using an improbable sampling method, in order to clearly reveal the factors which affect daytime sleepiness. Finally, however, the study was conducted with students who agreed to participate in the study and completed the questionnaire items (n=334). In the present study, 29.1% of the original planned sample of 1151 students was reached.

Data Collection Tools

Sociodemographic Data Collection Form

The Sociodemographic Data Collection Form consisted of 37 questions about the sociodemographic characteristics and sleep habits of adolescents who participated in this study. Sociodemographic characteristics included "age, sex, grade, socioeconomic level, and academic achievement", while the characteristics related to sleep habit included "night sleep and daytime waking times, sleep habits, smoking, and room properties."

Pediatric Daytime Sleepiness Scale

The Pediatric Daytime Sleepiness Scale was developed by Drake et al. (2003). It is a special scale used to assess daytime sleepiness in children and adolescents aged between 12 and 18 and consists of eight items which define the behaviors related to sleep. The total Cronbach's alpha coefficient of the original scale was found to be .80. For its internal validity, the method of dividing into two halves was used. The Cronbach's alpha coefficient of the first and second dimensions of the scale was found to be .80 and .81, respectively. The validity and reliability study of the scale's Turkish version was carried out by Bektas et al. (2016). The Cronbach's alpha coefficient of Turkish version

of the scale was found to be .79. Its Kaiser-Meyer-Olkin (KMO) value was found to be .78; while its item-total correlation varied between .53 and .73. A 5-point Likert-type scale was used in this scale. The lowest possible score obtained is "0", while the highest score is "32." As the score obtained from the scale increases, the level of daytime sleepiness increases. Three items were calculated by reverse scoring.

Data Analysis

Number, percentage, and mean were used for the analysis of demographic data; while multiple regression analysis was used to make predictions about daytime sleepiness via independent variables. Variance Inflation Factor (VIF) and tolerance value were used to decide which independent variable would be included in the regression analysis. The variables whose VIF value was lower than 10 and whose tolerance value was higher than 0.2 were included in the regression analysis. The significance level was regarded as 0.05.

Ethical Considerations

Ethical approval was received from the Non-Invasive Clinical Studies Ethics Committee of Dokuz Eylul University (2410-GOA protocol and numbered 2016/06-31). Institutional permissions (12018877-604.01.02-E.2060779) were obtained from the Ismir Provincial National Education Directorate with which the schools where the study was conducted are affiliated. Students who participated in the study and their parents gave written and verbal consent.

Results

Sample Characteristics

A total of 334 students participated in the study. The mean age of participants was 15.72±0.62. More than half of the students (53%) were in ninth grade and 38% had a sibling. Of the participants' mothers and fathers, 31.5% and 34.7% respectively, were secondary school graduates. The monthly income of 42% of participants' families was higher than 2,000 Turkish lira. The majority of the students (63.2%) considered themselves moderately academically successful; 56.3% were satisfied with their body image; 36.2% were using a computer for half an hour a day; 14.7% were using a computer for three hours; 5.1% were using cellphones for half an hour a day, and 66.2% were using cellphones for three hours a day. More than one third (40.1%) of the students stopped watching TV 10 minutes before sleep, but this rose to two-thirds (66.2%) when it came to using a cellphone. The students went to sleep at 23.00 and woke at 06.30 on weekdays, while they went to sleep at 24.00 and woke at 10.30 at weekends.

Daytime Sleepiness Characteristics and Affecting Factors

The students' mean Pediatric Daytime Sleepiness Scale score was found to be 25.59±5.73.

Table 1. The correlation between independent variables and Pediatric Daytime Sleepiness Scale score

	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*
1. Daytime sleepiness total score	1,000										
2. Economic status	**.148****	1.000									
3. Academic achievement	**.242****	.006	1.000								
4. How many minutes before sleeping do you stop using your cellphone?	**-.171****	-.089	.010	1,000							
5. What do you think about your body image?	**-.193****	-.035	.082	-.042	1.000						
6. Do you ever go to sleep late because of using your cellphone?	**.263****	.042	.019	025	-.050	1.000					
7. Do you ever sleep holding your cellphone in your hand?	**.225****	-.017	-.025	-.037	-.023	.044	1.000				
8. Do you smoke?	**.17****	-.077	.042	.013	-.082	-.017	.010	1.000			
9. Do you have the habit of reading books before sleeping?	**-.157****	.006	.014	-.035	.037	.007	.001	-.077	1.000		
10. Do you use any sleeping pills?	**.142***	-.086	.050	-.113*	-.076	-.001	.106	.024	-.071	1.000	
11. Do you go to sleep at the same time each night?	**-.206****	.007	.069	-.024	-.025	-.043	.030	-.051	-.016	.071	1,000

*p<.05   ****p<.01**

Table 2. The prediction level of independent variables on daytime sleepiness

	Model				
	B	**SH**	**Beta**	**t**	**p**
Constant	23.084	3.105		7.434	.000
Economic status of family	.973	.348	.141	2.794	.006
Academic achievement	1.481	.488	.159	3.034	.003
Using cellphone before sleep	-.667	.297	-.115	-2.248	.025
Being satisfied with his/her body image	-.1.011	.362	-.146	-2.791	.006
Smoking	-2.331	.886	-.138	-2.630	.009
Reading books before sleep	1.684	.614	.138	2.742	.006
Using sleeping pills to sleep	-3.112	1.242	-.127	-2.505	.013
Going to sleep at the same time each night	1.496	.638	.121	2.345	.020
Sleeping time on weekdays	.152	.084	.094	1.820	.070
Waking time at weekend	-.348	.171	-.105	-2.036	.043
R	.484				
R²	.234				
F	9.334				
p	.000				

The correlation between the independent variables and the daytime sleepiness of adolescents was shown in Table 1. A low-level positive correlation was found between daytime sleepiness and economic status (r = 0.148), academic achievement (r = 0.242), going to sleep late because of cellphone use (r = 0.263), falling asleep while holding a cellphone in his/her hand (r = 0.225), smoking (r = 0.217), and using sleeping pills to sleep (r = 0.142); whereas a low-level negative correlation was found between daytime sleepiness and using cellphones before sleep (r = -0.171), being satisfied with his/her body image (r = -0.193), reading books before sleep (r = -0.157), and going to sleep at the same time each night (r = -0.206).

A regression model was developed by considering the variables which had significant correlation with daytime sleepiness. The prediction levels on daytime sleepiness of economic status, academic achievement, using a cellphone before sleep, being satisfied with his/her own body image, smoking, reading books before sleep, using sleeping pills to sleep, going to sleep at the same time each night, sleeping time on weekdays, and waking time at weekend, were given in the model.

These 10 factors affected daytime sleepiness at the level of 23.4%. These variables were found to affect daytime sleepiness in order of academic achievement (β=0.159), being satisfied with his/her body image (β=0.146), economic status (β=0.141), smoking (β=-0.138) and reading books before sleep (β=0.138), using sleeping pills to sleep (β=-0.127), going to sleep at the same time each night (β=0.121), using a cellphone before sleep (β=-0.115), waking time at weekend (β=-0.105), and sleeping time on weekdays (β=0.094) (p<.05).

Discussion

Inadequate sleep causes cognitive and behavioral disorders in adolescents who are in a rapid change and development period. Therefore, determining factors that cause adolescents to get inadequate sleep is important for the physical and cognitive health of adolescents (Becker, Adams, Orr, & Quilter, 2008). Sleepiness has significant adverse effects on learning and quality of life (Calhoun et al., 2012; Gustafsson et al., 2016). The prevalence of parent or teacher-reported excessive daytime sleepiness was estimated at 15% in a community-based sample of school-aged children (Calhoun et al., 2011).

The Pediatric Daytime Sleepiness Scale mean score obtained in this study was found to be higher than those obtained in the studies conducted by Rhie, Lee and Chae (2011) and Perez-Chada et al. (2007). As the score obtained from the Pediatric Daytime Sleepiness Scale increases, the level of daytime sleepiness is regarded as increasing (Bektas et al., 2016). The fact that the mean score was found to be higher than those obtained in studies conducted in other countries might result from reasons such as schools starting at early hours of the morning and finishing late, the long time allocated for homework, and spending time in heavy traffic to reach school and fatigue caused by the former.

More than half of the students who participated in this study used cellphones for more than three hours a day and stopped using cellphones and watching television right before sleeping. A study conducted by Choi et al. (2009) reported that excessive Internet use increased daytime sleepiness, while another study conducted by Kocoglu, Kesgin and Kulakcı (2010) found that using a computer for more than two hours a day not only increased daytime sleepiness, but also decreased sleep quality. A study conducted by Thomee, Harenstam and Hagberg (2011) found that excessive cellphone use caused sleep disorders. Another study conducted by Cain and Gradisar (2010) found that adolescents who had electronic devices in their room, such as a television, computer, game console, and telephone, used these devices for a longer time in a day and spent longer time with these device before sleeping, and that they had more sleep problems. A study conducted by Munezewa et al. (2011) also found that using a cellphone in bed causes sleep disorders. It is thought that the high levels of using cellphones for more than three

hours a day and of using cellphones immediately before sleeping found in this study, decreased the duration of quality sleep, and therefore increased the pediatric daytime sleepiness. The fact that the level of daytime sleepiness was high is regarded as an indicator that the daily sleep requirements are not being met.

It is important to have quality sleep at adequate levels, which is an important part of a healthy life. A study by Edwards (2012) stated that sleeping late and waking at early hours led to a decrease in sleep duration. It was also found in this study that sleeping late and waking at early hours caused an increase in daytime sleepiness. A study conducted by Aysan et al. (2014) found lower sleep quality in students with a short sleep duration. Edwards (2012) also found that early school starting times increased daytime sleepiness in students. Chan et al. (2017) stated that a modest delay (15 min) in school start time can increase adolescent sleep with corresponding improvement in mood and behaviors. Adolescents' attention is also affected negatively by sleep restriction (Agostini, Carskadon, Dorrian, Coussens, & Short, 2017). Waking up early to go to school and frequently going to bed late because of cellphone use, television, or studying are regarded as factors in the decrease in sleep duration. It is thought that as the sleep duration decreases, the daytime sleepiness increases.

As seen in Table 2, a significant correlation was found between daytime sleepiness and economic status, academic achievement, using a cellphone before sleep, being satisfied with his/her body image, going to sleep late because of cellphone use, falling asleep while holding a cellphone, smoking, reading books before sleep, using sleeping pills to sleep, and going to sleep at the same time each night (p<0.05). A model was developed taking these variables into consideration.

In this model, academic achievement was found to be the factor that affected daytime sleepiness at the highest level. Factors such as being satisfied with his/her body image, economic status, smoking, reading books before sleep, using sleeping pills to sleep, waking at the same time each morning, using a cellphone before sleep, waking time at weekend, and sleeping time on weekdays were found to affect daytime sleepiness at close levels to each other and to explain 23.4% of daytime sleepiness (Table 2).

Studies in the literature found that having inadequate sleep decreases academic achievement, and studying or doing homework at night causes students to sleep late at night (Gomes, Tavares, & Azevedo, 2011; Senol, Soyuer, Peksen Akca, & Argun, 2012). A study conducted by Becker et al. (2008) found that being academically unsuccessful causes students to sleep less. However, this study found that as the academic achievement increased, daytime sleepiness also increased. It is thought that this difference may result from the fact that successful students study late into the night, and that studying or doing homework at night causes students to sleep late and shorten their sleep duration. Li et al. (2013) found that insufficient sleep and daytime sleepiness positively associated with the impairment of school performance and academic achievement.

This study also found that as the level of smoking increased, daytime sleepiness decreased. A study conducted by Altintas et al. (2006) found that smoking delays falling asleep, while another study by Cohrs et al. (2012) found that smoking reduces sleep quality. As distinct from the literature, this study found that smoking decreased daytime sleepiness, and this result may result from the stimulating effects of nicotine in cigarettes causing a decrease in sleepiness.

This study found a positive correlation between economic status and daytime sleepiness. It is observed that as the level of economic status increases, daytime sleepiness also increases. A study by Senol et al. (2012) suggested that sleep quality decreases as the economic level decreases. Another study conducted by Kocoglu et al. (2010) suggested that a perceived poor economic status is a risk factor for daytime sleepiness. Umlauf et al. (2014) also found that poor economic status causes sleep problems. Unlike the literature, this study found a positive correlation between economic status and daytime sleepiness and this may result from the fact that children whose economic status is high have more technological devices, such as cellphones, Internet, computers, and can access these devices easily, have more than one device, and consequently spend more time with these devices.

This study also found a negative correlation between being satisfied with body image and daytime sleepiness. As the level of satisfaction with body image increased, the daytime sleepiness decreased. Eliacık et al. (2016) found that adolescents with obesity were significantly more likely to have higher daytime sleepiness. A study by Thommee et al. (2011) suggested that stress causes sleep problems, and dissatisfaction with body image is a source of stress for adolescents. Adolescence is regarded as a period of physiological, psychological, and cognitive change and it is thought that psychological issues, such as dissatisfaction with body image, that are experienced in adolescence, decrease coping abilities and sleep quality, and increase daytime sleepiness because they make it difficult to fall asleep.

This study found that using a cellphone before sleep increased daytime sleepiness. Studies conducted by Choi et al. (2009), Cain and Gradisar (2010), and Thommee et al. (2011) found that using a cellphone before sleep at night delays falling asleep and shortens sleep duration. The results of this study were compatible with literature. It is thought that using a cellphone causes students to sleep late, and sleeping late leads to daytime sleepiness.

Acquiring sleep habits has considerable importance in setting a sleep pattern (Kocoglu et al., 2010; Rhie et al., 2011). This study found that sleeping at the same time each night and reading books before sleep increased daytime sleepiness. According to the literature, sleeping at the same time and reading books before sleep make it easier to fall asleep (Aysan et al., 2014; Kocoglu et al., 2010; Rhie et al., 2011). However, the difference with the result in this study may be attributed to the fact that adolescents sleep later immersing themselves in books, which shortens their sleep duration, and that they experience sleep deprivation and daytime fatigue. A study conducted by Edwards (2012) found that waking one hour later causes individuals to be more energetic. Another study conducted by Kocoglu et al. (2010) found that sleeping late increases daytime sleepiness.

Conclusion

This study found that the daytime sleepiness mean score of adolescents was high. Economic status, academic achievement, using a cellphone before sleep, being satisfied with his/her body image, going to sleep late because of using a cellphone, falling asleep while holding a cellphone, smoking, reading books before sleep, using sleeping pills to sleep, and going to sleep at

the same time each night, were found to affect daytime sleepiness. The fact that the level of daytime sleepiness was found to be high is regarded as an indicator that students do not have adequate good quality sleep. In accordance with these findings, it is recommended that awareness should be raised among adolescents of the importance of adequate sleep and that inadequate sleep causes many physiological, psychological, and academic problems. Education programs should be developed to increase the level of adolescents' knowledge that will enable them to have quality sleep, support children and adolescents in using good sleep hygiene principles and further studies with larger samples in different adolescent groups should be planned.

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