Original Article

The Relationship Between Adolescents' Sleep Quality and Academic Expectations Stress

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Abstract

Background: Poor sleep quality and academic expectations stress are common health problems in adolescents.

Objective: The objective of this research was to determine the relationship between adolescents' academic expectations stress and sleep quality.

Methodology: The study was a cross-sectional survey among adolescents aged 10-17 years.

Results: The average age of the adolescents in the study was 14.37±2.19. The participants of this study were middle school (52.3%) and high school students (47.7%). The study was completed with a total of 1161 adolescents. Data were collected through data collection form, Pittsburgh Sleep Quality Index, and Academic Expectations Stress Inventory between March and May 2017. This study found that both sleep quality scores (7.27±3.15) and stress scores related to academic expectations (32.13 ± 7.77) of high school students were significantly higher than that of middle school students, (5.69±3.22;17.06±5.65), p<0.05. The stressful situations of the students regarding academic expectations and the age variable together showed a significant relationship on sleep quality (R^2 = 0.137, $F_{(2, 1158)}$ = 90.532), and it was observed that it caused a 13.7% change in the sleep quality score.

Conclusions: This study showed that adolescents are more likely to experience poor sleep quality and academic expectations stress as they get older.

Keywords: Adolescence; academic achievement; psychological; stress; sleep

Introduction

Most body functions and brain activities occur during sleep (Continente et al. 2017). Sleep is important for health at every stage of life. However, the level of sleep changes in different stages of a person's life. The period when sleep fluctuates the most can be considered the period of adolescence. Unlike infancy and childhood, falling asleep late and waking up late are common in adolescents. Adolescent sleep patterns may be influenced by their biological structure, age, environment, lifestyle, and sociocultural structure. Disturbed sleep patterns bring various health problems after some time. In particular, due to sleep disturbances experienced in early adolescence, the physical development of adolescents may be negatively affected, the strengthening of the structure of muscles and joints may be delayed, the immune system may be negatively affected or obesity with changes in body weight may occur (Stores 2009; Agostini and Centofanti 2021).

Sleep problems in adolescents can also cause medical, emotional and behavioural problems, such as increased life-threatening accidents, depression, anxiety, behavioural problems, suicidal thoughts and attempts, fatigue, pain and poor academic performance, as well as somatic problems (Agostini and Centofanti 2021; Vermeulen et al. 2021).

In addition, sleep problems can have negative consequences for adolescents' academic and

social lives. In adolescents with sleep problems, academic performance decreases due to the weakening of cognitive skills such as learning and memory. Sleep problems affect academic performance because they can cause sleep problems in adolescents who experience academic stress (van Schalkwijk et al. 2015). Academic can lead to poor sleep quality in adolescents.

Background

It is seen that studies that have sought to examine adolescent sleep habits in recent years have generally been conducted with high school students (Koo et al. 2020; Bhurosy and Thiagarajah 2020; Alves et al. 2020; Alfonsi et al. 2020).

However, while both accepted adolescence, middle school and high school students may have different characteristics of this time. Both groups have different academic pressures and responsibilities. In a study conducted with children, adolescents and university students, it was found that high school students had the poorest quality of sleep of all groups. The results of the same study showed that middle school students also had significantly poor sleep quality (Liu et al. 2020).

Another study also found that adolescents' sleep quality worsens as they transition from middle school to high school (Mitchell et al. 2020). For this reason, there is a need for studies that examine the sleep quality of middle and high school students together.

Another case in point is that although many variables that may be associated with poor sleep quality have been studied by researchers to date, there have been few studies on academic stress. Previous studies, have examined sleep habits and depression, eating habits, physical activity, and internet addiction together (Koo et al. 2020; Bhurosy and Thiagarajah 2020; Rosi et al. 2020; Celebioglu et al. 2020).

However, few studies examined sleep habits and stress levels together, and these studies were generally conducted only with high school students. These conditions suggest the need for a study that identifies the relationship between sleep quality and academic stress in middle and high school students.

Determining the impact of the stress adolescents experience in relation to academic expectations on their sleep habits may provide school nurses, teachers, and parents with clues to preventive measures. By drawing attention to the sleep problems that can occur due to academic expectations, can be help plan preventative measures for these problems. It can also contribute to academics researching this topic. The purpose of this study was to examine the relationship between the stress adolescents experience regarding their sleep habits and academic expectations.

Methodology

Study Design, Setting, and Participants: The study was a cross-sectional survey. The population of the study consisted of 1366 students from a public middle school (722) and a high school (644) in the city centre (100%). The study did not use random sampling but aimed to reach the entire population. The study was completed with a total of 1161 students who volunteered to participate in the study (85.0%).

Collection of data: Participants' socio-demographic characteristics Participants' socio-demographic characteristics were collected by the researcher using a data collection form created by reviewing the literature (Continente et al. 2017; Brand et al. 2016; Wang et al. 2016). The form consists of two parts. The first part consists of socio-demographic questions about the child's age, gender, success at school, number of siblings, and parents' education. The second part contains questions about factors thought to influence sleep habits. After the questionnaire was prepared, it was sent to five experts in the field and an assessment of content validity was made based on the responses received (CVI = 95%).

Pittsburgh Sleep Quality Index: Participants' sleep quality was assessed using the Pittsburgh Sleep Quality Index. The Pittsburgh Sleep Quality Index is an index developed by Buysse et al. in 1989. It provides a quantitative measure of sleep quality that helps define good and poor sleep. It contains a total of 24 questions. Each item is scored between 0 and 3. The internal consistency coefficient of the index was determined to be α = 0.80 in the original

study, 0.65 in the validation study, and 0.67 in this study. In the study, a total PSQI score of 5 or higher was considered a poor sleep quality (Buysse et al. 1989).

Academic Expectations Stress Inventory (AESI): Participants' stress levels were assessed using the Academic Expectations Stress Inventory (AESI). The original form of the scale was developed by Ang and Huan (2006) to measure the middle and high school students' stress about academic expectations. The study on the validity and reliability of the AESI scale was conducted by Kellecioğlu and Bilge in 2009. The scale has two sub-dimensions: Family / Teacher Expectations (AESI-EPT) and Self-Expectations (AESI-ES). The scale consists of nine items, with scores ranging from one (never) to five (always). The score for perceived stress is the sum of all item values. The Chronbach alpha reliability coefficient of the scale was determined to be 0.65 in validity study and 0.87 in this study. Stress related to academic expectation is assumed to increase as more points are scored on the scale (Kellecioğlu and Bilge 2009). In the original study of the scale, the average total score 26.54. Students' academic stress was also assessed using this average score.

Pilot application: The pilot application of the study was conducted on a middle school (24 students) and a high school class (30 students) that were, excluded from the study. No changes were made to the questionnaires as there were no ambiguous statements.

Application of data collection tools: The study was conducted between March and May 2017 in the students' classrooms. Upon enrolment, the purpose of the study was explained to the students and the questionnaire form was given to the students who agreed to the study and waited for the form to be answered. The importance of students not interacting with each other while completing the questionnaire was explained, and students were observed while completing the questionnaire.

Statistical Analysis: SPSS data analysis program was used to analyze the data. The study analyzed data from a total of 1161 students. Before analysis, it was checked if there were any incorrect or incomplete data entries. Considering that the missing data were also associated with other variables in the data collection forms, it was decided that there were no negligible missing data, and the analysis of these lost data was performed using the EM test (Expectation-Maximization Algorithm) in the SPSS program (Cum et al. 2018).

Number, mean, standard deviation, t-test and Anova test and Sheffe's test as post hoc tests were used to compare participants' socio-demographic characteristics and their scale scores. Correlation analysis was used to assess the relationship between stress-related sleep quality and academic expectancy, and regression analysis was used to determine other factors related to these variables.

Ethical Permissions: Initially, the required written approvals were obtained from XXX University Human Research Ethics Committee and the institutions where the research was conducted (Report No: 2017/83). The school management was informed about the content and purpose of the study. Consent was then obtained from the adolescents, parents and teachers to participate in the study. The questionnaires were used by informing the students on how to complete the questionnaires during the lessons recommended by the school administration. The research abided by the principles of the Helsinki Declaration.

Results

Students' demographic data, sleep quality and academic expectations stress

According to the independent sample t test analysis, female students' sleep quality scores and stress scores ($\bar{X}$ = 6.70, SD = 3.37; $\bar{X}$ = 31.75, SD = 8.65) were compared to male students ($\bar{x}$ = 6.19, SD = 3.18; $\bar{X}$ = 29.66, SD = 8.79) was statistically significant (t (1159) = 2.664, p <0.01, d = 0.16; t (1159) = 2.664, p <0.01, d = 0.24. Sleep quality scores of students with an existing disease ($\bar{X}$ = 7.30, SD = 3.40) were higher than students without the disease ($\bar{x}$ = 6.30, SD = 3.24), t (1159) = 3.654, p <0.01, d = 0.30. No statistically significant difference was found between students with an existing disease ($\bar{X}$ = 31.75, SD = 8.60) and students without disease ($\bar{x}$ = 30.54, SD = 8.80), t (1159) = 1.640, p> 0.05, d = 0.14). Stress scores regarding sleep quality and academic expectations of students who have their own rooms ($\bar{x}$=6.57, SD=3.35;

X̄=31.12, SD=8.57) were higher than those who do not have their own rooms (X̄=6.09, SD=3.07; X̄=29.66, SD=9.24), t (1159) = 2.225, p<0.05, d=0.15; t (1159) =2.540, p<0.01, d=0.16.

According to the one-way variance test result, it was determined that family type did not affect sleep quality and academic expectations stress, p> 0.05. While the economic level of the family was not effective on academic stress (p> 0.05), it was determined that it was effective on the sleep quality score, F (3,1157) = 4,575, p<0.01, η²=0.011.

According to the post hoc analysis performed with the Sheffie test, the PSQI score of the students who stated normal economic status (X̄ = 6.81, SD = 3.33) was significantly higher than the score of the students with good economic status (X̄ = 6.23, SD = 3.17), p <0.05.

Sleep habits and academic expectations stress between middle and high school adolescents

Among high school students, the rate of experiencing poor sleep quality (68.6%) and academic expectations stress (78.2%) were higher than middle school students (respectively, 47.3%, 63.4). Independent group t-test results related to the comparison of PSQI total score and AESI total scores and sub-dimension scores of adolescents according to their school level are given in Table 2. According to the analysis result, the sleep quality scores of the students attending high school (X̄=7.27, SD=3.15) were significantly higher than the students who continue to middle school (X̄=5.69, SD=3.22), (t (1159) =8.411, p<0.01, d=0.49). Sub-dimensions of subjective sleep quality, sleep latency, sleep duration and daytime function of high school students (X̄=1.38, SD= 0.82; X̄=1.17, SD= 0.89; X̄=0.77, SD= 0.83, X̄=1.33, SD= 0.94) were significantly higher than middle school students' scores (X̄=0.90, SD= 0.76; X̄=1.06, SD= 0.85; X̄=0.34, SD= 0.67, X̄=0.83, SD= 0.83), p<0.01.

No statistically significant difference was found between the groups in the subscales of habitual sleep efficiency, sleep disturbance and use of sleeping pills, p> 0.05. It was determined that the AESI general score averages of the high school students (X̄=32.13, SD= 7.77) were significantly higher than the middle school students (X̄=29.42, SD= 9.43), t (1159) = 5.358, p<0.01, d=0.31. There was no statistically significant difference between the groups in the sub-dimensions of expectations of parents/teachers (AESI-EPT), p> 0.05. In the sub-dimension of expectations of self (AESI-ES), it was observed that the scores of the students attending high school (X̄=14.61, SD=3.89), were significantly higher than the students who attended middle school (x̄= 12.36, SD=4.61), t (1159)=8.993, p<0.01, d=0.53.

Variables associated with the sleep quality of adolescents

The results of multiple linear regression analysis regarding the prediction of sleep quality of adolescents are given in Table 3. Before the model was established in the regression model, the necessary components were checked and shown in table 3. The AESI score showed a significant relationship with the sleep quality together with the age variable, R² =0.137, F (2,1158) = 90.532, p<0.01. The AESI score explains 13.7% of the change in sleep quality scores with age.

Table 1: *Comparison of students' sleep quality and academic stress averages according to some demographic variables*

Demographic variables	Sleep Quality X̄± SD	Test	Academic Stress X̄± SD	Test
Total (n=1161)	6.47±3.30		30.71±8.78	
Male (n= 576)	6.19±3.18	t=2.664*	29.66±8.79	t=4.067*

Female (n=585)	6.70±3.37	df=1159 d=0.16	31.75±8.65	df=1159 d=0.24
Those who do not have a disease (n=996)	6.30±3.24	t=3.654* df=1159 d=0.30	30.54 ±8.80	t=1.640 df=1159 d=0.14
Those with the disease (n=165)	7.30±3.40		31.75±8.60	
The nuclear family (n=932)	6.43±3.26	F=0.935 df=1157 η²=0.002	30.76±8.69	F=1.389 df=1157 η²=0.002
Extended family (n=173)	6.32±3.39		29.96±8.78	
Single parent family (n=56)	7.00±3.24		32.14±10.06	
Bad economic situation (n=18)a	7.33 ±3.22	F=4.575* df=1157 η²=0.011 b >c	29.39±10.52	F=0.355 df=115 η²=0.001
Normal economic situation (n=472) b	6.80±3.33		30.49±8.53	
Good economic situation (n=588)c	6.23±3.17		30.91±8.83	
Very good economic situation (n=83)d	5.72±3.60		30.90±9.42	
Having their room (n=838)	6.57±3.35	t=2.225** df=1159 d=0.15	31.12±8.57	t=2,540** df=1159 d=0.1
Those who do not have their own room (n=323)	6.09±3.07		29.66±9.24	

*p<0.01, **p<0.05, F: One Way Anova, t: Independent Sample t-test, η²: Eta Square, d: Cohen's d, x̄: Mean, SD: Standard Deviation

Table 2: *Comparison of PSQI and AESI to the school level of adolescents*

PSQI	Middle school X̄± SD (n = 607)	High school X̄± SD (n = 554)	*t*-value (Cohen's *d*)
Global PSQI Score	5.69±3.22	7.27±3.15	t=8.411* df=1159 d=0.49
Subjective sleep quality	0.90±0.76	1.38±0.82	t=10.210* df=1159 d=0.60
Sleep latency	1.06±0.85	1.17±0.89	t=2.125* df=1159 d=0.12

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Sleep duration	0.34±0.67	0.77±0.83	t=9.626* df=1159 d=0.57
Habitual sleep efficiency	0.10±0.46	0.10±0.47	t=-0.033 df=1159 d=0.0
Sleep disturbances	1.46±0.70	1.51±0.64	t=1.166 df=1159 d=0.07
Use of sleeping medication	1.0±1.07	1.01±0.96	t=0.119 df=1159 d=0.0
Daytime dysfunction	0.83±0.83	1.33±0.94	t=9.731* df=1159 d=0.56
AESI Total	29.42 ± 9.43	32.13 ± 7.77	t=5.358* df=1159 d=0.31
AESI-EPT	17.06 ± 5.65	17.52 ± 4.98	t=1.482 df=1159 d=0.08
AESI-ES	12.36 ± 4.61	14.61 ± 3.89	t=8.993* df=1159 d=0.53

*$p<0.01$, x̄:Mean, SD:Standard Deviation, t:Independent Sample t test, d: Cohen's d

Table 3: *Multiple regression analysis for predicting sleep quality of adolescents*

Variable	B	SE B	β	t	p	Binary r	Partial r
Constant	-1.788	0.642		-2.784	0.005		
AESI	0.086	0.010	0.229	8.317	0.001	0.24	0.23
Age	0.390	0.041	0.260	9.443	0.001	0.27	0.26

Sleep quality (Dependent variable) Constant
R^2=0.137, F (2,1158) = 90.532, $p<0.01$, DW=1.812, Tolerance=0.984,   VIF=1.016

DW= Durbin-Watson, R^2= R Square, VIF=Variance inflation factors

Figure 1: *Sleep quality and academic expectation stress in middle and high school students*
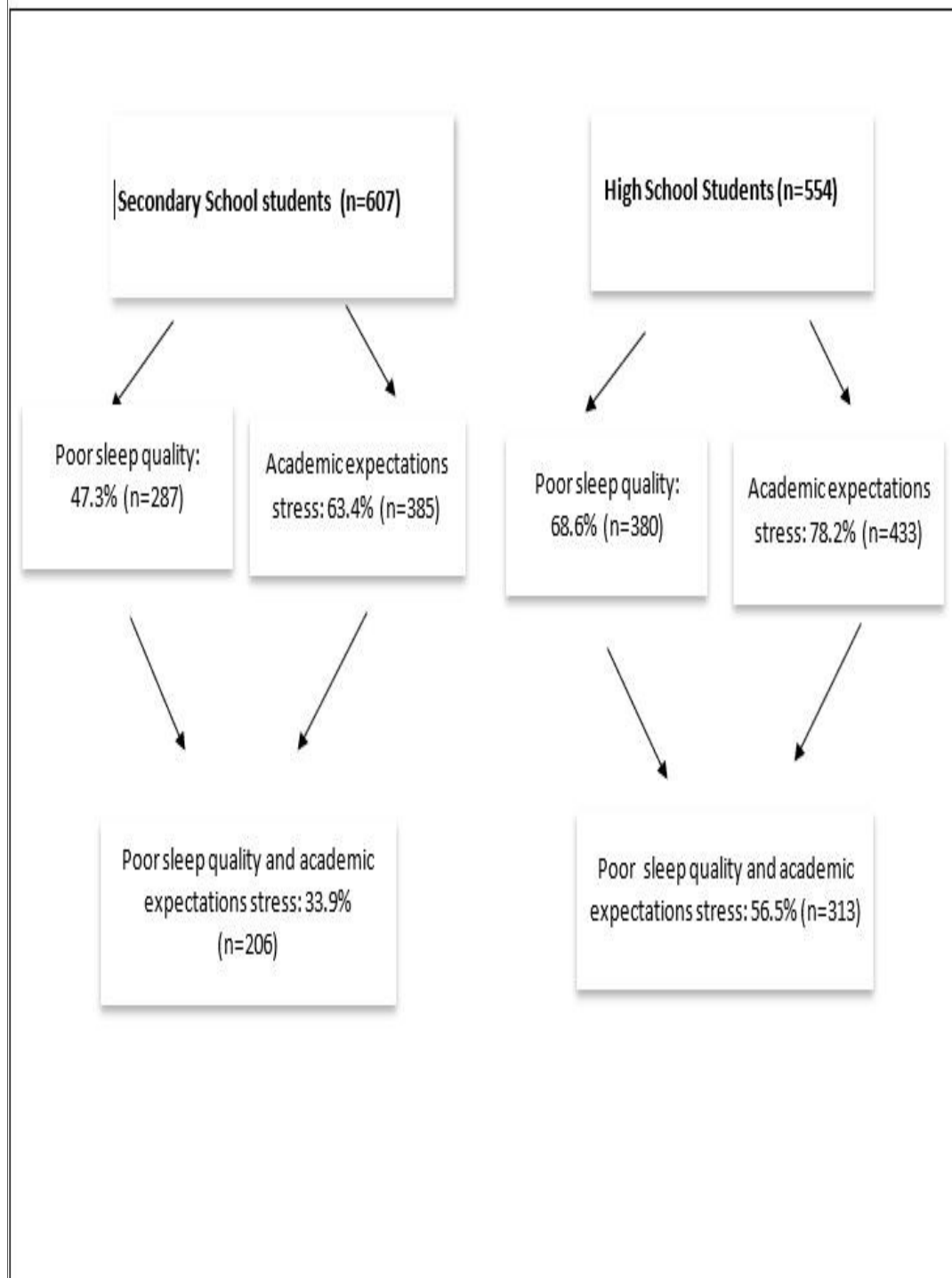
Discussion

This study showed that a relationship exists between the stress adolescents experience related to academic expectations and sleep quality in a sample of middle and high school students. The results of the study showed that adolescents who attend high school, as indicated by the literature information, have poorer sleep quality and experience more stress related to academic expectations than

middle school adolescents. However, age and academic stress were found to be predictive variables of adolescent sleep quality.

Studies show that too many variables affect adolescent sleep quality. A study on sleep quality of high school students shows that school level, grade level, family environment, academic pressure, and number of friends were effective (Liu et al. 2020).

This study shows that, regardless of their education level, being a female having a pre-existing medical condition, having a poor economic situation and having their own room had negative effects on the sleep quality of all adolescents participating in the study. It has also been found that being a woman is a variable that increases academic stress levels.

In a study conducted with adolescents, it was found that women with sleep disorders and younger adolescents had difficulty forming a stress coping response compared to others (Zhang et al. 2020). This could be one of the reasons why female students identified in this study experience more academic stress than male students. Another reason could be that females are naturally more emotional than males and their bodies are more responsive to insomnia (Brand et al. 2016; Mrug et al. 2016).

Surprisingly, however, the adolescents with their rooms also had higher levels of stress related to academic expectations than other adolescents. One can speculate that the reasons for this result are that the adolescent's expectation of academic success is high, the adolescent cannot plan to effectively use the time they spend in their room, and interactions with their family decrease when they are in their room.

Consistent with the literature, the results of this study demonstrate that adolescent sleep quality deteriorates in high school. (Gillen-O'Neel et al. 2013). In a study conducted with Italian middle school students, it was found that 82% of the students had moderate and high sleep quality (Rosi et al. 2020).

The results of this study also show that high school students have a longer time to fall asleep, a shorter time to stay asleep, and more intense daytime dysfunctions compared to middle school students. It is known that these negative sleep habits are a variable that greatly affects the academic status of students. It is known that adolescents with shorter night sleep may experience morning fatigue, daytime sleepiness, cognitive dysfunction, mood disorders, and low motivation (Marcdante and Kliegman, 2019).

However, academic anxiety and worry also lead to sleep disturbances. The aspects of human behaviour that are most affected by fatigue and inadequate sleep are executive functioning, learning, memory, and self-efficacy, which are key functional areas of functioning that are necessary for academic success. It is known that adolescents who do not get enough sleep at night are more successful in terms of cognitive, verbal, motor, visuospatial and creative performance than only one-ninth of adolescents who get enough sleep (Stores 2009). This situation puts students with poor sleep quality at risk for academic stress.

A study of Chinese adolescents found that adolescents slept for shorter periods of time, slept later to study, and woke up earlier while preparing for university entrance exams (Wang et al. 2016). However, such a situation have a negative impact on academic skills the next day and affect adolescents' academic performance in the long term. (Gillen-O'Neel et al. 2013).

In this study, high school adolescents preparing for their university entrance exams believed that it would determine their future in Turkey. For this reason, families, teachers, and high school adolescents focus on being successful in the university entrance exam. This can lead to stress-related to academic performance, less sleep to study, or decreased sleep quality due to stress.

In a previous study conducted with 757 adolescents aged 12 to 18 years, it was found that there was a negative relationship between academic stress and sleep quality (Yan et al. 2018). Another study conducted with 202 adolescents, also showed a negative relationship between academic stress level and sleep quality (van Schalkwijk, 2015).

The results of the present study are consistent with the literature in this regard. There is a complex relationship between academic

stress and sleep quality. While adolescents may have their sleep quality disrupted due to academic stress, less sleep may also cause them to experience more academic stress by affecting the body's cortisol release (Mrug et al. 2016).

In conclusion, it can be said that the incidence of poor sleep quality and stress associated with school expectations among adolescents increases as they transition from middle school to high school. Meanwhile, these two situations are interdependent. Stress and poor sleep quality can lead to many negative health problems. For this reason, it is very important to take measures to prevent poor sleep quality and academic stress during adolescence in order to protect and improve the health of adolescent.

Health educations and screenings to be given to adolescents in this sense may prevent the possible situations in the adolescent period if they are carried out at an earlier age such as middle school first grade or primary education. As well health initiatives should be planned in collaboration with the family, teachers and students, and students should be encouraged to share their problems with their counsellors. School nurses play a significant role in health promotin and prevention practices, health education and counseling, and nursing research planning.

Strengths and Limitations: There are a number of limitations in this study. The first is that the study was carried out using subjective measurement tools. An objective measurement tool to measure sleep problems can provide a more efficient assessment of adolescents' sleep quality.

Finally, the results of the study can be generalized to students in the middle and high school students where the study was conducted. For this reason, for researchers who want to examine the sleep quality and academic stress of adolescents, it may be better to use objective measurement tools and carry out their studies with larger samples.

There are also strengths of the study (Koo et al. 2020; Bhurosy and Thiagarajah 2020; Alves et al. 2020; Alfonsi et al. 2020).

A number of sleep studies have been carried out with high school students. In this study it was possible to compare the variables planned to be examined in both middle and high school students. The power of the study continued to reach 85.0% of the participants. In addition, the use of standard measurement tools (PSQI, AESI), the content validity of the socio-demographic characteristics form of the participants and the pilot application of the study increased the validity of this study.

Data availability statement: The data that support the findings of this study are available on request from the corresponding author, [SÇ]. The data are not publicly available due to [restrictions e.g. their containing information that could compromise the privacy of research participants].

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