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# The quality of sleep and daytime sleepiness and their association with quality of school life and school achievement among students

Zahra Ahmadi<sup>1</sup>, Shabnam Omidvar<sup>2</sup>

## Abstract

**BACKGROUND:** Sleep quality is an important factor in adolescents' health; physical as well as psychological. The aim of this study was to determine sleep quality and daytime sleepiness and their effect on the quality of school life (QSL) and achievement.

**MATERIALS AND METHODS:** This cross-sectional study was conducted in high schools. The data collection was done on a random sample of 500 students from 15 to 19 years. The questionnaires included the Pittsburgh Sleep Quality Index (PSQI) to measure sleep quality and the Epworth Sleepiness Scale to measure daytime sleepiness as well as QSL. Data were analyzed by SPSS 25. Linear and logistic regressions were used to obtain adjusted and unadjusted odds ratios as well as predictors.

**RESULTS:** The mean PSQI score was  $6.2 \pm 2.4$ . It was realized that 377 participants (75.4%) were poor sleepers; 6.2% had excessive daytime sleepiness. There was a significant association between age and quality of sleep ( $P < 0.04$ ). No association between gender and quality of sleep or between the quality of sleep and school achievement was found. Linear regression exhibited a significant relationship between the quality of sleep and daytime sleepiness ( $\beta = 0.218$ ;  $t = 4.982$ ,  $P = 0.000$ ). There was a significant, inverse correlation between sleepiness and the total score of QSL ( $P = 0.000$ ). Stepwise linear regression analysis exhibited that daytime sleepiness ( $P = 0.002$ ) and school achievement ( $P = 0.001$ ) were predictors of QSL.

**CONCLUSION:** According to the study results, sleepiness affects school performance and QSL, and on the other hand, daytime sleepiness is under the effect of sleep quality.

## Keywords:

Quality of school life, sleep, sleepiness

## Introduction

The quality of school life (QSL) can be regarded as a crucial part of the quality of life itself.<sup>[1,2]</sup> QSL is defined as the students' sense of satisfaction at any given time period.<sup>[3]</sup> Studies suggest that good QSL is also a major goal of education, along with academic performance.

The QSL can be measured based on six domains (general affect, negative affect,

opportunity, teachers, identity, and status).<sup>[4]</sup> Good quality school life creates a healthy environment in schools, leading to better well-being and psychological health, which in turn causes more opportunities for advancement among students.<sup>[5,6]</sup>

Lifestyle and personal behavior are important factors that can affect individual efficiency. One of the most effective factors that can boost efficiency is reported to be sleep.<sup>[7]</sup>

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<sup>1</sup>Student Research Committee, Babol University of Medical Sciences, Babol, Islamic Republic of Iran, <sup>2</sup>Social Determinants of Health Research Center, Health Research Institute, Babol University of Medical Sciences, Babol, Islamic Republic of Iran

## Address for correspondence:

Dr. Shabnam Omidvar,  
Social Determinants of Health Research Center,  
Health Research Institute,  
Babol University of Medical Sciences, Babol,  
Islamic Republic of Iran.  
E-mail: Shomidvar@yahoo.com

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Sleeping disorders are ever-growing issues concerning all human beings all over the world.<sup>[8]</sup> These disorders are greatly affected by factors such as environment, as well as culture and behavior.<sup>[9]</sup> The prevalence of such disorders has been estimated to range from 10% to 48%.<sup>[10]</sup> Sleep deprivation and sleep disorders have been reported as risk factors for systemic hypertension, obesity, cardiovascular diseases, as well as psychological disorders; hence, it leads to change in life quality.<sup>[8,9]</sup> It has been reported that poor sleeping habits, such as prolonged exposure to television or electronic devices when used before bedtime, can lead to irregular bedtime and insufficient sleeping and in turn, increases risks of daytime sleepiness, aggression, and inattention.<sup>[11]</sup> Sleep quality is an important factor in adolescents' health; physical as well as psychological.<sup>[12,13]</sup> Poor sleep quality is in a close relation with obesity and malnutrition,<sup>[14]</sup> hypertension,<sup>[15]</sup> chronic inflammation,<sup>[16]</sup> drug abuse,<sup>[17]</sup> emotional difficulties, and mental health issues.<sup>[18-21]</sup> It has also been reported that sleep disorders and poor academic performance are highly interconnected.<sup>[22]</sup>

Researchers have suggested that poor sleep quality, late bedtime, interrupted nighttime sleep, and early awakening can cause a significant hindrance to learning capacity, behavioral, and academic performance.<sup>[23-27]</sup> There has been research to relate the QSL with academic achievements, continuing studies, attitude toward school as well as responsibility toward school.<sup>[28,29]</sup> Many factors affect academic achievement and QSL (such as community, family, school environment, etc.). Problems with each factor can cause negative effects on the performance of students.<sup>[30]</sup>

The prevalence of sleep disorders has been reported to range between 10% and 45% among adolescents.<sup>[31]</sup> Experimental studies have proven that adolescents require an average of 9 hours of sleep during 24 hours; however, many studies have reported that almost 45% of adolescents sleep less than 8 hours a day.<sup>[31,32]</sup>

Considering the ever-growing prevalence of sleep disorders among adolescents and the possible impacts on their school life quality, there have not been many researches dedicated to this matter in Iran. The study aimed to determine sleep quality and offer basic information for those aiming to design interventions in order to improve the QSL.

## Methods and Materials

**Study design and settings:** This research was a cross-sectional survey.

**Study participants and sampling:** The data collection was done on a random sample of 500 students from 15 to 19 years.

**Data collection tools and technique:** The data have been collected from high schools randomly in the city of Amol during the academic year 2018–2019. It is worthy to mention that in Iran, schools are separated by gender, then we selected the sample from both genders.

The instruments used for data collection were as follows: socio-demographic questionnaire, the Pittsburgh Sleep Quality Index (PSQI) for the evaluation of sleep quality, and the Epworth Sleepiness Scale (ESS) which is used in order to evaluate daytime sleepiness.<sup>[33,34]</sup> Moreover, QSL questionnaire was used for assessing the QSL. We used a digital scale with a precision of 0.1 kg in order to weigh our participants. Participants' height was measured using a stadiometer with a precision of 0.1 cm. The participants' Body Mass Index (BMI) was calculated using the data.

The PSQI is a standard questionnaire consisting of 19 self-reported questions aiming to evaluate seven domains of sleep disorders including subjective sleep quality, sleep duration, sleep latency, sleep efficiency, daytime dysfunction, use of sleep-inducing medication, and sleep disturbances. The scores range from 0 to 21 and scores higher than 5 indicate poor sleep quality.<sup>[33]</sup> The studies relating to the reliability and the validity of the Persian version of this questionnaire report Cranach's Alpha coefficient to range from 0.77 to 0.82.<sup>[35,36]</sup> It has also been reported that the sensitivity and specificity for the cut-off point 5 were 94% and 72%, and in the case of cut-off point 6, 85% and 84%, respectively.<sup>[36]</sup>

The ESS questionnaire is also a self-reported questionnaire; evaluating the participants' tendency to fall asleep in multiple situations. The scores range from 0 to 3 for each situation, summing up for a total of 0 to 24 points for all 8 situations.<sup>[34]</sup> Scores are divided into two ranges; under 11 and 11 or higher. Above 10 points indicate excessive daytime sleepiness.<sup>[37-40]</sup>

The QSL questionnaire included 39 questions and 7 subscales that assess the QSL. These subscales are as follows: Student's satisfaction with school work, alienation towards school, awareness of teacher's supportiveness, the status of student accorded by others at school, sense of identity, opportunities created by the school for the future of students, and sense of achievement in school. It has been reported that the questionnaire is valid and reliable (Cranach's Alpha = 0.81 and 0.83).<sup>[41,42]</sup> The data were fed into a computer and analyzed using SPSS Version 25, in order to determine a relation between sleep quality and the QSL as well as academic achievement among high school students.

**Inclusion criteria:** Being a student of high schools during the data collection and being volunteered to participate.

**Exclusion criteria:** The participants were excluded if they were under 15 or above 19 years or if they had any diseases affecting sleep or had psychological or physiological disorders that could interfere with sleep and consumed regular medication that might impact sleep.

**Ethical consideration:** Consent forms have been filled out by all participants as well as their parents. They were then given questionnaires to fill out.

The study was approved by the Research Ethical Committee of Babol University of Medical Sciences, Iran (MUBABOL.HRI.REC.1396.33).

## Results

The respondents were 500 individuals, comprising 176 boys (35.2%) and 324 girls (64.8%). The mean age was  $16.8 \pm 0.71$  years [Table 1].

BMI ranged from 14.5 to 60.5 and mean BMI was  $23.6 \pm 4.24$ . The mean PSQI score was  $6.2 \pm 2.4$ . It was realized that 377 participants (75.4%) were poor sleepers. The mean ESS score was  $4.9 \pm 3.2$ . Furthermore, 31 participants (6.2%) had excessive daytime sleepiness with a cut-off point of 11, and the mean score of the QSL was  $130.6 \pm 16.4$ .

There was a significant association between age and quality of sleep ( $P < 0.04$ ). We did not find any association between gender and quality of sleep or between the quality of sleep and academic performance Grade Point Average (GPA). However, linear regression exhibited a significant relationship between the quality of sleep and daytime sleepiness ( $\beta = 0.218$ ,  $t = 4.982$ ,  $P = 0.000$ ). The results showed a significant, inverse correlation between sleepiness and the total score of QSL ( $P = 0.000$ ). The same relation was witnessed to exist between sleepiness and all the subscales of the QSL.

Interestingly, no relation was perceived between sleep quality and BMI, despite the proof of a significant relationship between BMI and excessive sleepiness.

Stepwise linear regression analysis exhibited that daytime sleepiness ( $P = 0.002$ ) and GPA ( $P = 0.001$ ) were the significant predictors of QSL [Table 2].

The logistic regression showed that those with sleepiness are 2.8 times more likely to have lower GPA (OR = 2.83,  $P = 0.019$ , CI = 1.18–6.77).

## Discussion

The results in this study showed 75.4% of the students were poor sleepers. The results exhibited the relationship

**Table 1: Socio-demographic characteristics of the students in the academic year 2018-2019**

Variables	n (%)
Gender	
Male	176 (35.2)
Female	324 (64.8)
Age	
15-16	159 (31.8)
17-18	341 (68.2)
Major	
Experiment	245 (49)
Math's	180 (36)
Humanities	75 (15)
GPA	
Low ( $\leq 15$ )	7 (1.4)
Middle (15.1-17)	90 (18.3)
High (17.1-20)	396 (80.3)
BMI	
$\leq 18.5$	14 (9.9)
18.6-24.9	274 (56.4)
25-29.9	139 (28.6)
$\geq 30$	25 (5.1)
Sleep quality	
Good	123 (24.6)
Poor	377 (75.4)
Sleepiness	
Normal sleepiness	468 (93.8)
Excessive sleepiness	31 (6.2)

between excessive daytime sleepiness and poor school performance. Although there has been no report of direct relationships between memory and different sleep stages,<sup>[43]</sup> many studies have suggested that sleep plays a crucial role in the process of learning and the performance of the memory.<sup>[43,44]</sup> Studies have proven that sleep deprivation has a negative impact on learning and memory.<sup>[44,45]</sup> The integrity of learning and memory processes are especially highlighted during childhood and adolescence, as they are in their developmental stages.<sup>[46,47]</sup> It is suggested that sleep restriction has a negative effect on the academic performance of students from middle school, all the way up to college.<sup>[25,46,48-50]</sup>

It is reported that students with regular sleep patterns score higher GPA; whereas students who incurred lower grades, reported shorter night sleep, which in turn led to a higher level of daytime sleepiness.<sup>[51,52]</sup>

Although the study did not find any direct relationship between sleep quality and school achievement, it found a strong regression between sleepiness and school achievement. The chance of having a lower GPA was 2.8 times more in the students with excessive daytime sleepiness; it can hence be declared in the same line with the other study on Palestinian students, which reported no relationship between academic achievement and sleep

**Table 2: The unadjusted and adjusted coefficients of linear regression analysis for the predictors of QSL**

Variables	Model *				Model **			
	$\beta$	T	P	CI	$\beta$	T	P	CI
Age	-0.34	-0.759	0.448	-2.70,				
Gender	-0.049	-1.111	0.267	1.22				
School performance	0.143	3.168	0.002		0.140	3.236	0.001	-1.155,
Sleepiness	-0.130	-2.873	0.004		-0.143	3.164	0.002	-0.288
Quality of sleep	-0.059	-1.299	0.195					

\*Unadjusted model, \*\*Adjusted model

quality.<sup>[53]</sup> The same was reported in another study on 189 medical students.<sup>[54]</sup> Perez-Chada *et al.*<sup>[55]</sup> reported daytime sleepiness, as an independent predicting variable; and not the quality and or quantity of sleep. These findings are paradoxical; as daytime sleepiness has an impact on academic performance, but the same cannot be reported for sleep quality; even though daytime sleepiness is a function of sleep quality and quantity during the night. This has been exhibited in multiple studies, but there has not been a clear explanation.<sup>[56]</sup>

The results exhibited no significant difference between the poor sleep quality and gender of the students, as both reported troubled sleep. There are studies that mentioned that poor sleep quality is more prevalent among female students. In another study, the prevalence of low sleep quality was reported to be 46.0% in girls and 49.6% in boys. Studies suggest that girls are more prone to daytime sleepiness; however, this was not the case with all investigations, as some researchers suggest that there are no gender differences in this matter.<sup>[57-60]</sup>

It has been suggested that the difference in the age range of the samples could have caused the difference in findings; as girls experience more intense pubertal status.

As adolescents are spending more time doing sedentary activities nowadays, obesity has come to be introduced as an important factor in many studies. The results did not exhibit an association between sleep quality and BMI; while a correlation was found between daytime sleepiness and BMI. In contrary to current investigation, some researchers exhibited that there is an association between obesity and poor sleep quality.<sup>[61]</sup> Short sleep in adolescents is prospectively associated with obesity.<sup>[62]</sup> Sleep disorders are also associated with absenteeism, psychological problems, and negative health impact on adolescents.<sup>[63,64]</sup> Delaruelle *et al.*<sup>[16]</sup> studied the effects of school factors on sleep quality in adolescence. They concluded that better teacher-student support can suggest better sleep quality.

Thien and Razak declared that the quality of academic life is an important academic parameter. This can be reported

at all academic levels.<sup>[3,65,66]</sup> Researchers reported that the QSL is dependent on different variables, such as gender, expectations of school, punctuality, class activities, attitude toward the teachers, and the economical status of the student.<sup>[65]</sup> There have been not many investigations to assess the relationship between sleep quality and the QSL. Considering the fact that sleep quality is a vital aspect of lifestyle, which has constantly been changed throughout the modern era, further investigations could prove to be useful.

### Limitations and Recommendation

This study has some limitations that should be considered. Self-reported questionnaires were used to access the information and therefore, there is the possibility of reverse causality; however, we emphasize that the questionnaires used are well established in the literature.

Large and multicenter studies with longitudinal follow-up and interventions to improve sleep habits among students are highly recommended.

### Conclusion

The present results confirmed the importance of sleeping and quality of sleep regarding academic performance. This study adds to the previous studies that not only the quality of sleep is of importance but also daytime sleepiness; due to poor sleep quality, school performance and QSL are affected.

These results are substantially important for sleep hygiene and as recommendations for adolescents, parents, health and education professionals, and public policies. It is now widely recommended that adolescents must sleep at least 8 hours per night. Public health policies could therefore include sleep-related information, educational, and behavioral promotions in this matter, targeting school-aged children and adolescents as well as their families.

### Declaration of consent

The authors certify that they have obtained all appropriate participant consent forms. In the consent form the

participants has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The participants understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Nil.

### Conflicts of interest

There are no conflicts of interest.

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