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Research Article

**IMPACT OF SLEEP HABITS ON ACADEMIC ACHIEVEMENT
AMONG FOURTH-YEAR MEDICAL STUDENTS AT TAIBAH
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Abstract:

Background: Medical education is marked by stressful events, in which sleep-wake habit of the students might play a role in their academic performance.

Objectives: The study aimed to identify the sleep-wake habit of 4th year medical students at Taibah College of Medicine, examine the association between sleep habit variables and the academic performance of the studied students in term of their grade point average (GPA) and Comparison of sleep-wake pattern between male and female students

Methods: A cross-sectional study was conducted at Taibah College of medicine, Madinah, Saudi Arabia. The study included all 4th year medical students registered during the study year 2016/17. A self-administered questionnaire was completed and returned back by 126 students. The questionnaire included socio-demographic, lifestyle factors, study related and academic performance data in terms of Grade Point Averages (GPA), and sleep-wake habit variables.

Results: The response rate was 75.4% (126/167). The studied students were more females (54 %) , single (87.3%), BMI < 25 kg/m² (81.8%), and caffeine intake of > 2 cups per day (39.9%). The students, however, were less in smoking habit (5.6%), and intake of soda cans and chocolate bars. The mean GPA of the studied students was 3.6 ± 1.2. With the exception of weekdays rise time, napping and quality of sleep, other studied sleep-wake variables showed no statistically significant differences between male and female students. Excellent and very good academic performance was significantly higher among female students reported to wake up between 6:00 and 7:00 am (84.8%) and to sleep less than 6 hours (57.6%) during weekdays. Similar findings were detected among male students, although not significant. Increasing excellent performance was significantly associated with weekday rise time at 6-7:00 am, particularly among females (OR= 3.10; 95% CI= 1.01-10.3). Poor sleep quality, however, was significantly associated with decreasing excellent performance with an OR of 0.75 (95% CI= 0.30-0.99).

Conclusions: The study revealed a great role of sleep-wake pattern of the studied 4th year medical students and their academic performance. More studies are needed at the whole faculty and even University level.

Key words: Academic performance, Sleep disorders, Sleep quality, Medical students, Saudi Arabia

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INTRODUCTION:

Academic performance of medical students is known to be affected by many lifestyle factors. Among these factors, sleep pattern is critical issue determining better cognitive functions, memory consolidation and learning(1-3) Sleep disorders are very common problems among medical students due to the stressful lifestyle, higher studying load and increased academic demands (4-6). Several studies have reported an impact of sleep disorders on the university students' academic performance and grade point average (GPA), particularly medical students. Pagel and Kwiatkowski (7) and Veldi et al. (8) have concluded in their studies that insomnia significantly reduces academic performance and GPA of medical students. On the other hand, however, a cross-sectional study reported that medical students reported sleeping 6 hours and more to have significantly higher academic performance (9).

In Saudi Arabia, a cross sectional study conducted in Tabouk has reported that sleeping 6 to 9 hours per day to be associated high academic performance (10). Another cross sectional study (11), conducted at College of Medicine, King Saud University, found that inadequate sleep time during weekdays and weekends and increased napping to reduce the academic performance (11), with the excellent performance was common among students reported earlier bedtimes and higher sleep duration during weekdays. Obtaining sufficient sleep time and none smoking were the only independent predictors of excellent performance in that study (11). Since its establishment in the beginning of this millennium, the relationship between Taibah college medical students' academic performance and their sleeping habit has briefly examined in only one study as a part of the studied lifestyle factors (12). That study reported that more hours of studying, not smoking, not drinking energy drinks and sleeping more than 6 hours were the most important factors affecting the students' academic performance and GPA. Therefore, the present cross-sectional study was conducted to assess, in more details, the relationship between sleep-wake patterns and GPA among Taibah college medical students, Madinah City, Saudi Arabia.

METHODS:

A cross-sectional study was conducted at college of Medicine, Taibah University, Madinah, Saudi Arabia. The study has only recruited the 4th year registered students from male and female side, during the study year 2016/17.

The data were collected using prepared questionnaire. The questionnaire was designed by the research team

and prepared by literature . The study questionnaire included socio-demographic data (age, sex, marital status), studying hours data, and lifestyle data (smoking, soda cans drinks, caffeine intake, chocolate intake and body mass index),. As a measure of overweight and obesity, body mass index (BMI) was calculated as the reference weight in kilograms divided by height in meters squared (kg/m²). Based on World Health Organization (WHO) standards, obesity was defined for both sexes as a BMI of 30 kg/ m² or more, and overweight was defined as BMI between 25 and less than 30 kg/ m² (14) and data about studying hours. The sleep-wake pattern in the questionnaire included variables about sleep quality, sleep latency, sleep duration, napping, bed time and rise time during weekdays and weekends. The questionnaires were self - administered to all registered 4th year students. Of them 126 of 167 students (75.4%) were filled and return back the study questionnaire. The dependent variable in the current study was the academic performance of the studied students. The academic performance was measured as students' self-reported grade point average (GPA) in the previous study year. According to Saudi classification grading system (15), the GPA was classified into 5 categories as follow: Excellent (4.51/5-5/5), very good (3.51/5- 4.50/5), good (2.51/5-3.5/5), pass (1.01/5-2.5/5), and fail (< 1.01/5). The distribution of the studied students according to this classification was 5.6% (excellent), 11.1% (very good), 29.4% (good), 27.8% (pass), and 26.2% fail. Because of small sample size and to perform dichotomous logistic regression analysis, these categories were merged as excellent and very good performance (54%) and good and below performance (46%). The collected data were entered and analyzed using statistical package for social science (SPSS) version 23.0. Data was presented as frequency number and percent, mean and standard deviation as appropriate. Chi square and Fischer exact tests were used to compare the differences between the groups included in the study. P value \leq 0.05 was considered as an indicator of statistically significant difference. Univariate logistic regression analysis was also performed to examine the association between GPA and the studied sleep-wake pattern variables where the excellent and very good group was considered as the study group and good and below group as the control group. The participation of students was voluntary, and the confidentiality and privacy of the collected data were ensured where the data were manipulated and analyzed anonymously. Finally, approval was taken from the ethics committee at Taibah College of Medicine.

RESULTS:

The present study analyzed data from 126 4th year medical students at Taibah College of medicine, Madinah, Saudi Arabia, with a response rate of 75.4% (126/167), with no significant difference between male and female students' response rate. Table 1 presents the characteristics of the studied students. Female students were slightly more than male students (68 vs. 58 students) with the majority of them were single 87.3%. The mean BMI of the studied students was 22.9 ± 3.8 kg/m² with 81.8% of them were of BMI < 25 kg/m². About two-fifth of the students (39.7%) reported to drink ≥ 3 cups of caffeine per day, while intake of more than two cans of soda and two bars of chocolate were reported by 9.5% and 15.9% of the students, respectively. The prevalence of smoking among the studied students was 5.6% and it was very low among female students (2.9%), and high among male students (8.6%). The percent of students reported to study > 6 hours per day was 4%. The mean grade point average (GPA) was 3.6 ± 1.2 , with 54% very good performance and 46% with good and below performance.

Table 2 shows the comparison of sleep-wake habit between the studied male and female students. With the exception of weekdays rise time, napping and sleep quality, there were no statistically significant differences between the studied male and female students regarding other studied sleep-wake habit variables. Wake up during the weekdays was earlier than 6:00 am found in 29.3% of the studied males compared to 23.5% among females ($p = 0.02$). Napping for more than two hours was reported by 70.6% of the studied female students compared to 46.5% among the studied males with p value of 0.04. Good quality of sleep was reported by 69% of the studied males and 50% of the studied female students with statistically significant difference ($p = 0.03$).

Table 3 presents the distribution academic performance by the studied sleep-wake variables among the studied Female students. The higher percent of excellent and very good academic performance were found among female students reported to wake up between 6:00 and 7:00 am (84.8%) and to sleep less than 6 hours (57.6%) during weekdays, with statistically significant differences. Other studied sleep-wake variables showed no statistically significant differences regarding the academic performance of female students. However, excellent and very good academic performance was

more among female students reported weekday bed time > 12:00 am (48.4%), and napping of more than 2 hours (69.8%), and good sleep quality (57.6%).

Table 4 shows the distribution of academic performance by sleep-wake variables among the studied male students. No statistically significant differences were observed between academic performance and sleep habit of the studied male students. However, the higher percent of male students with excellent and very good academic performance were reported to wake up between 6:00 and 7:00 am (51.4%), weekdays bed time > 12:00 am (48.5%) and total sleep at night of less than 6 hours (51.4%), napping of more than two hours (57.2%), and good quality sleep (65.7%) during weekdays .

Table 5 presents the association of excellent and very good academic performance with the studied sleep-wake variables of the studied 4th year medical students. Weekday bed time was associated with excellent and very good performance among both male and female students. The odds ratio (OR) was 2 (95% CI= 0.60-7.12) among female and 1.6 (95% CI= 0.22-11.8) among male students, although not significant. Sleep latency of more than two hours was associated with insignificant less excellent performance, particularly among male students (OR= 0.55; 95% CI= 0.15-2.32). A significant association between excellent academic performance and weekday rise time of 6-7:00 am was detected among total students (OR= 2; 95% CI= 1.05-4.90) and among only female students (OR= 3.10; 95% CI= 1.01-10.3). Sleeping hours at night of more than 6 hours during weekday was associated with less excellent and very good performance in both male and female students, and it was significant among females reported to sleep 6-8 hours with an OR of 0.15 (95% CI= 0.05-0.49). Also, poor sleep quality was associated with less excellent academic performance, particularly among female students with an OR of 0.50 (95% CI= 0.21-0.98).

DISCUSSION:

The present study analyzed data from the 4th year medical students at Taibah College of medicine to identify their sleep-wake habit and to examine the association of these variables with the students' academic performance. With some exception, the study results revealed a similar sleep-wake pattern among the studied male and female students. These results may reflect the norm in Saudi culture and tradition that the student remains under the care and

supervision of the family until after graduation. These results of no difference in sleep-wake pattern between medical students were also reported in a recent cross sectional Saudi study (16), included 320 clinical years medical students, where similar patterns of total hours of sleep, sleep latency, weeknight bedtime, weekend bedtime was detected in that study. The studies reported a major difference in the sleep pattern between male and female medical students were restricted to the relationships between sleep symptoms and emotional symptoms. Of these studies, two studies were reported were a significant difference between worry, and depression (17,18).

The study findings revealed that excellent and very good academic performance was significantly higher among female students reported to wake up between 6:00 and 7:00 am (84.8%) and to sleep less than 6 hours (57.6%) during weekdays. Similar findings were detected among male students, although not significant. Sleeping less than 6 hours during weekday may be attributed to factors such as early class start times may play a major role in short sleep durations during weekdays and a resulting need to make up for sleep debt in the weekend. In our study, most of the studied students were reported weekend rise at late time between 7:00 am and 12:00 pm (58.7%) and even after 12:00 pm (27.8%). Lima *et al.* (19) have demonstrated that medical students who start classes late are more likely to acquire longer hours of sleep during the weekdays and weekend, compared with students who start class early. Moreover, the above mentioned findings were also observed not only among college students but also among adolescents in high school students (20). In addition, some studies have suggested that the time of sleep and time of wake up may be more important than sleep length or quality. In the Hong Kong study including a cohort of medical students, significant correlations were detected between the usual bedtimes/rise times and the examination results; and also between clinical skills assessment and self-rated sleep quality (21). However, these results should be interpreted cautiously as that this could be influenced by other environmental factors such as the timing of classes and examinations, which were not well described in studies to date.

The results of univariate logistic regression analysis in the present study were revealed a positive association between excellent and very good academic performance and the studied sleep-wake variables. Of these variables, weekday bed time was associated with excellent and very good performance among all studied students, and it was slightly higher among female students, although not significant.

Similar finding was also reported in a study at Munich University, Germany, where the timing of sleep-wake behavior was a more important predictor of medical school performance than sleep quality or sleep length (22).

In the present study, sleep latency of more than two hours was associated with insignificant decrease in excellent performance, particularly among male students (OR= 0.55; 95% CI= 0.15-2.32). The previously mentioned Saudi study (16), has reported that poorer academic performance more frequently reported symptoms of insomnia defined as an inability to fall asleep within 30 minutes. In that study, the authors have concluded that decreasing grades from excellent to very good, and then to good or below, the students had a 60% increase in the odds of reporting an inability to fall asleep within 30 minutes of going to bed. Another Brazilian study showed a correlation between sleep onset, sleep regularity, and sleep length with academic performance of medical students (23). These findings, however, appeared not consistent with the findings of a recent large study conducted by Taylor *et al.* (24), where no significant association between chronic insomnia and academic performance was detected.

Sleeping hours at night of more than 6 hours during weekday was associated with decrease in the excellent and very good performance in studied male and female students in the present study. This observed association was significant among female students reported to sleep 6-8 hours with an OR of 0.15 (95% CI= 0.05-0.49). In a similar cross-sectional study conducted on medical students of Tabouk University, Saudi Arabia (10), however, more sleep hours was found to be associated with better academic performance. where, sleeping from 6 to 9 hours per day was found to be associated high academic performance (10). In some studies, however, that measured sleep quantity versus sleep quality showed that average sleep quality was better related to health, balance, and feelings of tension, depression, anger, fatigue, and confusion than average sleep quantity (25). In accordance with these findings, the present study has revealed that poor sleep quality to be associated with significant less decrease in excellent and very good academic performance, particularly among female students with an OR of 0.50 (95% CI= 0.21-0.98). Similarly, another study in Munich University, Germany, found that low academic performance to be correlated with low sleep quality and high stress prior to the exams (26). Also, more studies have confirmed the influencing role of sleep quality on academic performance (27,28). A recent Sudanese study,

conducted among 165 male and female medical students, has also reported a significant difference between the excellent and average groups and the overall sleep quality. In that study, good sleep quality was associated with an excellent academic performance (29).

Many factors are known to alter sleep habits including caffeine, soda, chocolate intake and smoking, and the use of sleep medications (30,31). In the present study, were lower prevalence of intake of more than two cups of caffeine, two cans of soda and two bars of chocolate and smoking among the studied students, with no statistically significant differences between male and female students regarding these sleeping affecting factors (data not shown).

The strengths of the present study include being the 2nd study conducted at Taibah College of medicine to study the effect of sleep-wake habit of medical students on their academic performance as a single entity not as a part of huge studied lifestyle variables. Because of the used anonymous questionnaire, an accurate filling of the questionnaire would be suspected decreasing the potential risk of information bias. Compared with other similar regional studies, the relative high response rate in this study would consolidate the obtained results. In addition, unlike other similar Saudi studies, this study has compared the sleep pattern between male and female students and, it has examined the effect of sleep-wake habit on academic performance by using the logistic regression analysis, and thus, the study has quantified the measured effects in both male and female students.

The main limitation of this study was its small sample size. Invalid prepared questionnaire also consider as limitation in this study. In conclusion, the study findings have revealed the role of sleep-wake pattern of medical students on their academic performance particularly their weekday bed time and rise up as well as the sleep latency time, total hours of night sleep and sleep quality. More studies, including the whole college study years, or even the whole university colleges, are needed to confirm these findings and overcome the limitations of the present study.

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REFERENCES:

- 1.Fenn KM, Hambrick DZ: Individual differences in working memory capacity predict sleep-dependent memory consolidation. *J Exp Psychol. General* 2011.
- 2.Chen D, Lew R, Hershman W, Orlander J. A cross-sectional measurement of medical student empathy. *J Gen Intern Med.* 2007;22:1432-1438.
- 3.Sateia MJ. Update on sleep and psychiatric disorders. *Chest.* 2009;135:1370-1379.
- 4.Petrides KV, Chamorro-Premuzic T, Frederickson N, Furnham A. Explaining individual differences in scholastic behaviour and achievement. *Br J Educ Psychol.* 2005;75:239-255.
- 5.Oswald FL, Schmitt N, Kim BH, Ramsay LJ, Gillespie MA. Developing a Biodata measure and situational judgement inventory as predictors of college student performance. *J Appl Psychol.* 2004;89:187-207.
- 6.Giri P, Baviskar M, Phalke D. Study of sleep habits and sleep problems among medical students of Pravara Institute of Medical Sciences Loni, Western Maharashtra, India. *Ann Med Health Sci Res.* 2013;3:51-54.
- 7.Pagel J. F., Kwiatkowski C. F. Sleep complaints affecting school performance at different educational levels. *Frontiers in Neurology.* 2010;1, article 125.
- 8.Veldi M., Aluoja A., Vasar V. Sleep quality and more common sleep-related problems in medical students. *Sleep Medicine.* 2005;6(3):269-275.
- 9.Siraj HH, Salam A, Roslan R, Hasan NA, Jin TH, Othman MN. Sleep pattern and academic performance of undergraduate medical students at universiti Kebangsaan Malaysia *Journal of Applied Pharmaceutical Science* 4 (12); 2014: 052-055
- 10.Mohamed O. Alyoussef AA, Mirghani H, Ahmed M, Elbadwai A. Impact of Lifestyle on Academic Performance of Medical Students at University of Tabuk. *Indian Journal of applied research* 2015; 5(7): 131-133.
- 11.Bahammam AS, Alaseem AM, Alzakri AA, Almeneessier AS, Sharif MM. The relationship between sleep and wake habits and academic performance in medical students: a cross-sectional study. *BMC Med Educ.* 2012;12:61.
- 12.Alhosaini AA, Sultan SA, Alzughaihi NK, Alhathloul AH, Zahid AG, Khoja MA, Alghabban AM, Alshantqiti AA, Kulaib AM, Allogmani AM. Lifestyle factors and academic performance among medical students at Taibah University, Madinah, Saudi Arabia. *Journal of Global Research in Education and Social Science* 2016; 7(1):66.72.
- 13.Buysse DJ, Reynolds CF 3rd, Monk TH, Berman

- SR, Kupfer DJ. The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. *Psychiatry Res* 1989; 28: 193-213.
14. <https://www.classbase.com/Countries/Saudi-Arabia/Grading-System>
15. World Health Organization. Obesity: preventing and managing the global epidemic. Report of a WHO consultation. *World Health Organ Tech Rep Ser* 2000;894:i-xii, 1-254. 2000.
16. Alsaggaf M, Wali SO, Merdad MA, Merdad LA. Sleep quantity, quality, and insomnia symptoms of medical students during clinical years: Relationship with stress and academic performance. *Saudi Med J* 2016;37(2):173-182
17. Tafoya SA, Jurado MM, Yépez NJ, Fouilloux M, Lara MC. Sleep difficulties and psychological symptoms in medicine students in Mexico. *Medicina (B Aires)* 2013;73:247-251.
18. Eller T, Aluoja A, Vasar V, Veldi M. Symptoms of anxiety and depression in Estonian medical students with sleep problems. *Depress Anxiety*. 2006;23:250-256.
19. Lima PF, Medeiros AL, Araujo JF. Sleep-wake pattern of medical students: early versus late class starting time. *Braz J Med Biol Res* 2002; 35: 1373-1377.
20. Hershner SD, Chervin RD. Causes and consequences of sleepiness among college students. *Nat Sci Sleep* 2014; 6: 73-84.
21. Yeung WF, Chung KF, Cy Chan T. Sleep-wake habits, excessive daytime sleepiness and academic performance among medical students in Hong Kong. *Biol Rhythm Res*. 2008;39:369-377.
22. Genzel L, Ahrberg K, Roselli C, et al. Sleep timing is more important than sleep length or quality for medical school performance. *Chronobiol Int*. 2013;30:766-771.
23. Medeiros AL, Mendes DB, Lima PF, Araujo JF. The relationships between sleep-wake cycle and academic performance in medical students. *Biol Rhythm Res*. 2001;32:263-270.
24. Taylor DJ, Bramoweth AD, Grieser EA, Tatum JI, Roane BM. Epidemiology of insomnia in college students: relationship with mental health, quality of life, and substance use difficulties. *Behav Ther* 2013; 44: 339-348.
25. Pilcher JJ, Ginter DR, Sadowsky B. Sleep quality versus sleep quantity: relationships between sleep and measures of health, well-being and sleepiness in college students. *J Psychosom Res*. 1997;42(6):583-596.
26. Ahrberg K, Dresler M, Niedermaier S, Steiger A, Genzel L. The interaction between sleep quality and academic performance. *J Psychiatr Res*. 2012;46:1618-1622.
27. Gomes AA, Tavares J, de Azevedo MH. Sleep and academic performance in undergraduates: a multi-measure, multi-predictor approach. *Chronobiol Int*. 2011;28:786-801.
28. Feng G, Chen J, Yang X. Study on the status and quality of sleep-related influencing factors in medical college students. *Zhonghua Liu Xing Bing Xue Za Zhi*. 2005;26:328-331.
29. Mirghani HO, Mohammed OS, Almutadha YM, Ahmed MS. Good sleep quality is associated with better academic performance among Sudanese medical students. *BMC Research Notes*. 2015;8:706.
30. Plicher JJ, Walter AS. How sleep deprivation affect psychological variables related to college students cognitive performance. *J Am Coll Heal*. 1997;46:121-126.
31. Pagel JF. Excessive daytime sleepiness. *AM Fam Physician*. 2009;97:391-396.

Table 1. Characteristics of studied students

Characteristics*	N= 126
Student sex	
Female	68 (54.0)
Male	58 (46.0)
Marital status	
Single	110 (87.3)
Married	15 (11.9)
Divorced and widow	1 (0.8)
Body mass index (kg/m²); mean ± SD	22.9 ± 3.8
Body mass index (kg/m²)	
< 25	103 (81.8)
25-30	17 (13.4)
≥ 30	6 (4.8)
Caffeine intake per day	
1-2 cup	55 (43.7)
3-4 cups	21 (16.6)
≥ 5 cups	50 (39.7)
Soda cans intake per day	
1 can	90 (71.4)
2 cans	24 (19.1)
≥ 3 cans	12 (9.5)
Chocolate bars intake per day	
No	76 (60.3)
1-2 bars	30 (23.8)
≥ 3 bars	20 (15.9)
Smoking status	
Yes	7 (5.6)
No	119 (94.4)
Studying hours per day	
< 4	71 (56.4)
4-6	50 (39.6)
> 6	5 (4.0)
Academic performance (GPA)**	
Excellent	33 (26.2)
Very good	35 (27.8)
Good and below	58 (46.0)
Academic performance (GPA); mean ± SD	3.6 ± 1.2

*Data are presented by mean ± SD or by n (%)

**GAP (Grade point Average): (Excellent (GPA 4/5-5/5), very good (GPA=3.5/5-3.9/5), and good or below (GPA <3.5/5).

Table 2. Sleep-wake habit among the studied students by their sex

Sleep habit factors	Total N = 126 n (%)	Females N = 68 n (%)	Males N = 58 n (%)	P value
Weekday bed-time < 9:00 pm 9:00 - 12:00 > 12:00 am[6]	12 (9.5) 58 (46.0) 55 (44.5)	7 (10.3) 29 (42.7) 32 (47.0)	5 (8.6) 29 (50.0) 24 (41.4)	0.70
Sleep latency time Few minutes 1-2 hours > 2 hours[7]	32 (25.4) 48 (38.1) 46 (36.5)	16 (23.5) 24 (35.3) 28 (41.2)	16 (27.5) 24 (41.4) 18 (31.1)	0.50
Weekday rise time < 6:00 am 6-7:00 am > 7:00 am	33 (26.2) 77 (61.1) 16 (12.7)	16 (23.5) 48 (70.6) 4 (5.9)	17 (29.3) 29 (50.0) 12 (20.7)	0.02*
Total sleep hour at night < 6 hours 6-8 hours > 8 hours	51 (40.5) 52 (41.3) 23 (18.2)	27 (39.7) 27 (39.7) 14 (20.6)	24 (41.4) 25 (43.1) 9 (15.5)	0.75
Weekend bed-time < 9:00 pm 9:00 pm - 12:00 am > 12:00 am[8]	1 (0.8) 14 (11.1) 111 (88.1)	1 (1.5) 8 (11.8) 59 (86.7)	0 (0.0) 6 (10.3) 52 (89.7)	0.63
Weekend rise time 7:00 am and earlier 7:00 am - 12:00 pm > 12:00 pm	17 (13.5) 74 (58.7) 35 (27.8)	8 (11.7) 44 (64.7) 16 (23.5)	9 (15.5) 30 (51.7) 19 (32.8)	0.34
Napping No 1-2 hours > 2 hours	35 (27.8) 16 (12.7) 75 (59.5)	14 (20.6) 6 (8.8) 48 (70.6)	21 (36.2) 10 (17.3) 27 (46.5)	0.04*
Good sleep quality Yes No	74 (58.7) 52 (41.3)	34 (50.0) 34 (50.0)	40 (69.0) 18 (31.0)	0.03*

*Significant

Table 3. Sleep-wake habit and academic performance among the studied female students

	Academic performance		P value
	Excellent and very good (n= 33)	Good and below (n= 35)	
Weekday bed-time < 9:00 pm 9:00 - 12:00 > 12:00 am	2 (6.1) 15 (45.5) 16 (48.4)	5 (14.3) 14 (40.0) 16 (45.7)	0.53
Sleep latency time < one hour 1-2 hours > 2 hours	7 (21.2) 14 (42.4) 12 (36.4)	9 (25.7) 10 (28.6) 16 (45.7)	0.49
Weekday rise time < 6:00 am 6-7:00 am > 7:00 am	5 (15.2) 28 (84.8) 0 (0.0)	11 (31.4) 20 (57.1) 4 (11.4)	0.02**
Sleep hour at night < 6 hours 6-8 hours > 8 hours	19 (57.6) 7 (21.1) 7 (21.1)	8 (22.9) 20 (57.1) 7 (20.0)	0.004* *
Weekend bed-time < 9:00 pm 9:00 pm - 12:00 am > 12:00 am	0 (0.0) 4 (12.1) 29 (87.9)	1 (2.9) 4 (11.4) 30 (85.7)	0.61
Weekend rise time 7:00 am and earlier 7:00 am - 12:00 pm > 12:00 pm	4 (12.1) 24 (72.7) 5 (15.2)	4 (11.4) 20 (57.2) 11 (31.4)	0.28
Napping No 1-2 hours > 2 hours	7 (21.1) 3 (9.1) 23 (69.8)	7 (20.0) 3 (8.6) 25 (71.4)	0.98
Good sleep quality Yes No	19 (57.6) 14 (42.4)	15 (42.8) 20 (57.2)	0.23

*GAP (Grade point Average): (Excellent (GPA 4/5-5/5) and very good (GPA=3.5/5-3.9/5), and good or below (GPA <3.5/5).

**Significant

Table 4. Sleep-wake habit and academic performance among the studied male students

	Academic performance		P value
	Excellent and very good (n= 35)	Good and below (n= 23)	
Weekday bed time			
< 9:00 pm	3 (8.6)	2 (8.7)	0.36
9:00 - 12:00	15 (42.9)	14 (60.9)	
> 12:00 am	17 (48.5)	7 (30.4)	
Sleep latency time			
< one hour	11 (31.4)	5 (21.7)	0.70
1-2 hours	14 (40.0)	10 (43.5)	
> 2 hours	10 (28.6)	8 (34.8)	
Weekday rise time			
< 6:00 am	9 (25.7)	8 (34.8)	0.73
6-7:00 am	18 (51.4)	11 (47.8)	
> 7:00 am	8 (22.9)	4 (17.4)	
Total sleep hour at night			
< 6 hours	18 (51.4)	6 (25.1)	0.07
6-8 hours	11 (31.4)	14 (60.9)	
> 8 hours	6 (17.2)	3 (13.0)	
Weekend bed-time			
< 9:00 pm	-	-	0.15
9:00 pm - 12:00 am	2 (5.7)	4 (17.4)	
> 12:00 am	33 (94.3)	19 (82.6)	
Weekend rise time			
7:00 am and earlier	5 (14.3)	4 (17.4)	0.92
7:00 am - 12:00 pm	18 (51.4)	12 (52.2)	
> 12:00 pm	12 (34.3)	7 (30.4)	
Napping			
No	11 (31.4)	10 (43.5)	0.11
1-2 hours	4 (11.4)	6 (26.1)	
> 2 hours	20 (57.2)	7 (30.4)	
Good sleep quality			
Yes	23 (65.7)	17 (73.9)	0.50
No	12 (34.3)	6 (26.1)	

*GAP (Grade point Average): (Excellent (GPA 4/5-5/5) and very good (GPA=3.5/5-3.9/5), and good or below (GPA <3.5/5).

**Significant

Table 5. Logistic regression for the association of sleep-wake habit variables with the excellent academic performance among the studied students

	Total students		Female students		Male students	
	OR	95% CI	OR	95% CI	OR	95% CI
Weekday bed-time						
< 9:00 pm	1.00	Ref.	1.00	Ref.	1.00	Ref.
9:00 - 12:00	1.50	0.45-5.30	2.70	0.45-16.1	0.70	0.10-4.93
> 12:00 am	2.00	0.60-7.12	2.50	0.45-14.8	1.60	0.22-11.8
Sleep latency time						
< one hour	1.00	Ref.	1.00	Ref.	1.00	Ref.
1-2 hours	1.08	0.44-2.70	1.80	0.50-6.50	0.65	0.20-2.40
> 2 hours	0.70	0.30-1.80	0.96	0.30-3.34	0.55	0.15-2.32
Weekday rise time						
< 6:00 am	1.00	Ref.	1.00	Ref.	1.00	Ref.
6-7:00 am	2.00	1.05-4.90*	3.10	1.01-10.3*	1.45	0.50-4.90
> 7:00 am	1.30	0.40-4.50	-	-	1.80	0.40-8.12
Total sleep hour at night						
< 6 hours	1.00	Ref.	1.00	Ref.	1.00	Ref.
6-8 hours	0.20	0.10-0.46*	0.15	0.05-0.49*	0.30	0.10-0.88*
> 8 hours	0.50	0.15-1.30	0.40	0.11-1.60	0.70	0.12-3.52
Weekend rise time						
7:00 am and earlier	1.00	Ref.	1.00	Ref.	1.00	Ref.
7:00 am - 12:00 pm	1.20	0.40-3.30	1.20	0.27-5.42	1.20	0.30-5.40
> 12:00 pm	0.80	0.30-2.60	0.50	0.10-2.59	1.40	0.30-6.90
Napping						
No	1.00	Ref.	1.00	Ref.	1.00	Ref.
1-2 hours	0.70	0.22-2.41	1.01	0.15-6.70	0.60	0.15-2.80
2 hour <	1.30	0.60-2.90	0.90	0.30-3.05	1.60	0.80-8.70
Good sleep quality						
Yes	1.00	Ref.	1.00	Ref.	1.00	Ref.
No	0.75	0.30-0.99*	0.50	0.21-0.98*	0.85	0.50-4.70

(CI (confidence interval), OR (odd ratio))

**Significant

Abbreviation:

- 1- grade point average (GPA)
- 2- body mass index (BMI)
- 3- World Health Organization (WHO)
- 4- statistical package for social science (SPSS)
- 5- odds ratio (OR)
- 6- confidence interval (CI)
- 7- Number(N)
- 8- kilogram / meter (kg/m²)
- 8- Standard deviation (SD)