The Chronotype (Eveningness-Morningness) Effects on Academic Achievement among Medical Students in Tabuk City, Saudi Arabia

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ABSTRACT

Background: Thereis increasing awareness about theeffects of chronotype and sleep qualityand academic performance among medical students.

The aim of the work: This study assessed the relationship between chronotype, sleep quality, and academic performance among Saudi medical students.

Materials and Methods: A cross-sectional study was conducted among169 clinical phase medical students during the period from May 2017 to January 2018. Participants were invited to sign a written informed consent then responded to a self-administered questionnaire, using the Pittsburgh Sleep Quality Index (PSQI) and the weekdays and weekends bedtime and wake-up time, the chronotype was calculated from mid-sleep and wake up time during weekends and sleep dept. Students also completed a diary detailing their sleep habits fortwo weeks priorto filling out the questionnaire. The chi-square and Pearson's correlation were used for the statistical analysis. **Results:**Participants (48.5% males), their meanage was22.90±1.27, 83.4% had poor sleep quality. No correlation was found between cumulative grades (GPA), sleep quality, chronotype, body mass index, and sleep duration during weekdays and weekends (p>0.005), the females medical students had good sleep quality and lower body mass index, were more likely morning chronotype, and had higher GPA compared to males.

Conclusion: No correlation was evident between the GPA, chronotype, and sleep quality. The women had better sleep quality and GPA, they were more likely morning chronotype and had lower body mass index.

Keywords: sleep quality, chronotype, academic performance, medical students, Saudi Arabia.

INTRODUCTION

There is considerable variation in human cognitive and physiologic function during the day along the circadian rhythm, although the sleep-wake cycle is regulated extensively by neural mechanisms (e.g., suprachiasmaticnucleus). However, environmental factors can substantially influence the timing and expression of sleep and wakefulness [1]. Sleep can be altered by various factors like the overuse of the internet and social media, sleep medications, and coffee intake. Furthermore, the sleep can be profoundly altered by different medical conditions including depression, obstructive sleep apnea, idiopathic hypersomnia, and chronic sleep deprivation [2].

Previous literature reported the negative association of bad sleep quality and physical and mental health, academic achievement, andwell-being of college students [3,4].

Morningness-eveningness is the difference between individuals regarding diurnal preference, the sleep-wake pattern of activity, and alertness in the evening or morning. Persons with an extreme morning tendency (a trend towards rising early in the morning, perform mentally and physically best in morning hours, and go to bed early in the evening) are called early Larks, while those who rise later in the morning, stay awake later at night, and perform at their best in the late afternoon or evening are Night Owls. These preferences are assumed to have unique, genetic, biological, contextual, and psychosocial components. Diurnal preferences had been linked to various habitual and nonhabitual issues like eating habits, sleeping behavior among University students, smoking, and drug use [5].

Early chronotype or morningness have been linked to physical and mental health, self-esteem, school functioning, and intimate relationship while late or eveningness have been shown to be associated with mental illness, infections, smoking, and poor sleep quality [6].

There is an increasing awareness about sleep effect on physical and mental health, sleep disturbances could adversely affect medical students academic performance and is reflected on the whole community in terms of medical errors. Evening chronotypes work against their circadian clock and behave like shift workers in colleges that adopt morning schedules. Thus it is important to estimate the degree of the problem to help to implement preventive measures to improve the academic achievement.

The quality of sleep and morningness-eveningness have been studied individually; fewer researchers have examined the relationship between sleep quality and chronotype. The Kingdom of Saudi

Arabia is a vast country with social and climate diversity, so sleep studies conducted in Western countries may not apply to Saudi Arabia. Thus, we did this research to study sleep quality and morningness-eveningness among college students in Tabuk University and their relation to academic achievement.

MATERIALS AND METHODS
Across-sectional descriptive study conducted to assess the sleep quality and chronotype among the clinical phase medical students in Tabuk City Saudi Arabia during the period from May 2017 to January 2018.

Study areas and setting: The Medical College, University of Tabuk.

Sample size and technique: Medical students in the 4th, 5th, and 6th classes were approached in a 2:1 ratio.

Study variables and data collection tools:
Subjects were asked to maintain a diary documenting sleep and wake times for two weeks and then complete the Pittsburgh Sleep Quality Index (PSQI). This instrument has been previously validated among college students and was shown to be consistent with objective measures[9]. The PSQIcontains seven components, each with ascore from 0-3with 3 indicating the greatest dysfunction. The global sleep quality score ranged from 0-21,and candidates with PSQI of more than five were labeled as having poor sleep quality, and those with PSQI of less than or equal five as good sleep quality [7].

The PSQI measures sleep-related habits in thepast month including sleep latency, sleep duration, sleep efficiency, sleep disturbance, subjective sleep quality,daytime dysfunction, and sleep medication use. Sleep efficiency is the ratio oftimespent in sleep (total sleep time)to the amount of time spent in bed.
The following data also will be collected: Age, sex, weekdays and weekend bedtime and wake up, subjective sleep duration during the weekdays and weekends, the time taken to sleep, and the lag in hours between weekend and weekends bedtime and wake up. The mid-sleep time will be estimated as the midpoint between sleep onset (bedtime plus sleep latency) and wake time, and the chronotype will be calculated from mid-sleep time on free days (weekends) subtracting 0.5 the sleep debt which is the sum of the weekend sleep duration (the length of sleep onset time until wake time) minus the weekly average sleep duration[8]. The weight and height were estimated, and the body mass index (BMI) was calculated using the formula: BMI= Weight in kg(Height in meters).

Data analysis
The data were exported to the Statistical Package for Social Sciences for the analysis. The t-test and Pearson correlation were used to compare males and females and to test the GPA correlation regarding sleep characteristics. A P-value of <0.05 will be considered significant.

Ethical consideration
Approval was obtained from the Research Committee of the Faculty of Medicine, University of Tabuk). Written informed consent will be achieved by all the participants.

RESULTS
The participantwere 169 clinical stage medical students; theirmean ages were 22.90±1.27 years, their mean GPA was 3.63±0.66, the mean body mass index was25.01±5.20, the weekday's bedtime was 23.33±5.17, while it was 25.63±2.39 during the weekends, the wake-up time during the weekdays and weekends were 6.12±2.58 and10.56±3.03 respectively. The sleep duration during the weekdays was 6.05±1.52 hours vs. 9.16±2.01 for weekends. The calculated chronotype was 6.19±1.91 and the sleep latency in minutes was 5.84±42.62. Table 1.
The study showed that, 48.5% were men, 30.8% were 4th-year medical students, 31.1% were 5th class, while 36.1% were final class medical students, it is interesting to note that 83.4% of the students had bad sleep quality. Table 2.
Regarding the Pittsburgh sleep quality components, the student's usual bedtime and wake-up time were23.62±4.48 and 6.36±2.94 respectively, the sleep latency was 43.88±38.53 minutes, the actual sleeping hours were 5.73±1.88 vs. 6.66±1.72 hours stayed in bed. The study showed thatthe sleep efficiency was 87.05%±14.32, and the overall sleep quality index was 8.99±3.83. Table 3.
The data showed that, no correlation was found between the GPA and chronotype (-.038, P-value=0.638), sleep quality (0.007, P-value=0.939), sleep duration during the weekdays and weekends (-.087, P-value=0.276, and-.013, P-value=0.869 respectively), and body mass index (-.098, P-value=0.221), Table 4. Table 5 illustrated a comparison between men and women in which, the GPA was higher among females (3.73±0.52 vs. 3.52±0.76) with significant statistical difference, P-value=0.045, the body mass index was higher among males (26.1±5.08 vs. 23.94±5.11) with significant statistical difference, P-value=0.005, no significant statistical differences were evident between males and females regarding sleep duration during weekdays and weekends (6.02±1.61 vs. 6.07±1.42, P-value=0.819, and 9.31±2.12 vs.

9.02±1.90, P-value=0.353 respectively).The study showed that menwere more likely to be late (evening chronotype) (6.56±1.94 vs. 5.85±1.82, P-value=0.016), and had bad sleep quality index (10.24±3.76 vs. 7.76±3.52, P-value-0.001).

Table 1. The characteristics of the study sample

Character	Mean±SD
Age	22.90±1.27
GPA	3.63±0.66
BMI	25.01±5.20
Weekdays Bedtime	23.33±5.17
Weekdays Wakeup	6.12±2.58
Weekends Bedtime	25.63±2.39
Weekends Wakeup	10.56±3.03
Chronotype	6.19±1.91
Weekdays sleep duration	6.05±1.52
Weekends sleep duration	9.16±2.01
Sleep latency/minutes	5.84±2.62

Table 2. The sex, class, and sleep quality among the study group

Character	No%
Sex	
Males	82 (48.5%)
Females	87 (51.5%)
Class	
4th year	52 (30.8%)
5th year	56 (33.1%)
6th year	61 (36.1%)
Bad sleep quality	141 (83.4%)

Table 3. The Pittsburg sleep quality index components of the study sample

Character	Mean ±SD
The usual bedtime	23.62±4.48
The usual wake-up time	6.36±2.94
Sleep latency/minutes	43.88±18.53
The actual sleeping hours	5.73±1.88
Time stayed in bed	6.66±1.72
Sleep efficiency	87.05%±14.32
Sleep quality index	8.99±2.83

Table 4. Correlation of GPA with sleep quality, chronotype, and sleep duration during the weekends and weekdays

Character	Correlation	P-value
BMI	-.098	0.221
Sleep duration weekdays	-.087	0.276
Sleep duration weekends	-.013	0.869
Chronotype	-.038	0.638
Sleep quality score	0.007	0.939

Table 5. A comparison between males and females regarding GPA and sleep characteristics

Character	males	Females	P-value
GPA	3.52±0.76	3.73±0.52	0.045
BMI	26.1±5.08	23.94±5.11	0.005
Sleep duration weekday	6.02±1.61	6.07±1.42	0.819
Sleep duration weekend	9.31±2.12	9.02±1.90	0.353
Chronotype	6.56±1.94	5.85±1.82	0.016
Sleep quality score	10.24±3.76	7.76±3.52	<0.001

DISCUSSION

In the present study, 83.4% of the clinical phase medical students had poor sleep quality. No correlation was found between the GPA, sleep quality, chronotype, and sleep duration during the weekends and weekdays. The females students had higher GPA, and BMI compares to males, they were less likely of evening chronotype and had a better sleep quality than men. The poor sleep quality observed in the current study is similar to a study conducted in Spain[9] among 217 medical students with a mean age of 21.7±3.3 years and reported a poor sleep quality in79.3% of medical students, the adoption of sleep hygiene educational programs is recommended to improve the sleep quality in our College. A study conducted in China [10] among 6044 medical students reported poor sleep quality in 27.8% and lower than the present observation. In the present study, females had better sleep quality than males in line with a survey conducted in Lebanon [11] and concluded that men experienced more sleep difficulties than females medical students (57.8% vs. 40.8%). The higher GPA among females in the present study was observed in previous studies [12]. In the current data, males were more likely evening chronotype in agreement with*Lehnkering et al*. [13] who found more eveningness among men. *Rique et al*. [14] conducted a study among 221 medical students in Brazil and found no association between gender and chronotype in contradiction to the present findings.In the present study, no correlation was found between academic grade and chronotype in accordance with *Genzel et al*. [15] who assessed chronotype among 31 medical students using Munich Chronotype Questionnaire and found no association between chronotype and academic achievement. *Lai et al.* [16] found no associations between academic grades and chronotype supporting the current observations. In the present study, no correlation between poor sleep quality and GPA in agreement with the previous study [16]. The present findings were in contradiction to *Mirghani et al*. [1] who observed better sleep quality among

excellent grades medical students. The current results could be explained by the time in which the study was conducted as we conducted our survey in days other than examinations to avoid stress which can disturb sleep leading to poor sleep quality [17]. In the present study, no association between sleep weekdays and weekends sleep duration and GPA in line with the previous observations [18] in which academic performance was associated with the time of sleep and wakefulness rather than sleep duration.It is interesting to note that the females had lower body mass index and higher GPAs compared to male. Similarly, previous studies[19] found the association between the lower body mass index. The limitations of the study were the reliance on a self-administered questionnaire which is more prone to subjectivity and the study was conducted at a single College so generalization cannot be insured.

CONCLUSION

Poor sleep quality was prevalent among medical students in Tabuk, Saudi Arabia, no correlation was found between the cumulative grade (GPA), sleep quality, chronotype, and sleep duration during the working days and weekends. The females were less likely obese, had higher GPA, good sleep quality, and were less likely of the evening chronotype.

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