

ORIGINAL RESEARCH ARTICLE

ASSOCIATION BETWEEN SLEEP DURATION, SLEEP QUALITY AND BODY MASS INDEX IN MEDICAL STUDENTS

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Received: 7 Sept, 2020

Accepted: 1 Dec, 2020

Published: 16 Dec, 2020

Key words: Body mass index; Medical students; Obesity; Sleep duration; Sleep quality.

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Citation

Maharjan N, Karki PK, Adhikari B, Bhaila A, Shrestha H. Association between sleep duration, sleep quality and body mass index in medical students. Journal of Chitwan Medical College. 2020;10(34):34-38.



Peer Reviewed

ABSTRACT

Background: Medical students are normally under extreme pressure due to the vast syllabus they have to cover within few years of their student life. The stress due to academic pressure and sudden change in lifestyle tend to affect their sleeping habits, which is considered as one of the potential risk factors for obesity. This study aimed to observe the association between sleep duration, sleep quality and body mass index in medical students.

Methods: This is a cross-section study conducted among 269 medical students. Self-reported sleep duration was noted, sleep quality was assessed with Pittsburgh Sleep Quality Index (PSQI) questionnaire. Height in cm and weight in kg was recorded and BMI was calculated. The data obtained was divided into different groups according to sleep duration, sleep quality and BMI. ANOVA and independent t-test was done using Statistical Package for the Social Sciences version 25 for statistical analysis. $p < 0.05$ was considered statistically significant.

Results: In general, 24 (8.9%) of students were underweight, 187 (69.5%) had normal weight, 51 (19%) were overweight and 7 (2.6%) were obese. 94 (34.9%) students reported to spent <7 hours in bed and 98 (36.4%) students had poor sleep quality. Mean BMI was significantly higher in students with short sleep (p -value=0.001, ANOVA) and in students with poor sleep quality (p -value=0.000, independent t-test).

Conclusions: Higher BMI was observed in the group of students having poor sleep quality and short sleep duration. Furthermore, poor sleep quality was more prominent in women than in men.

INTRODUCTION

Sleep is a vital process which is essential for normal growth and development of mind and body.¹ National sleep foundation has recommended 7-9 hours of sleep for young adults (between 18-25 years old) each night in order to maintain and improve health.² Several previous studies have reported that insufficient sleep and poor sleep quality has negative impact on health and can increase the risk of various health conditions such as diabetes, cardiovascular diseases and obesity.³⁻⁶

Obesity and overweight are defined as accumulation of abnormal or excessive fat that may cause a risk to health. Each year at least 2.8 million people die due to overweight or obesity. Obesity is usually expressed by Body mass index (BMI) which relates the body's weight with height. WHO considers BMI equal to or more than 25 as overweight, and BMI equal to or more than 30 as obesity.^{7,8}

Obesity was a major public health burden in high-income countries, but now it is also prevalent in middle and low-income countries like Nepal.^{7,9} Apart from general population, prevalence of overweight and obesity is also on the rise among med-

ical students. According to a study done in Nepal, prevalence of overweight and obesity is moderate in Nepalese medical students.¹⁰

As sleep loss is common among college students especially medical students due to high academic demand, frequent examination and vastness of academic curriculum,^{11,12} the present study was conducted to study association between sleep duration, sleep quality and body mass index in medical students.

METHODS

The present quantitative cross-sectional study was carried out from December 2019 to March 2020 at Department of Physiology, KIST Medical College and Teaching Hospital, Imadol, Lalitpur, Nepal. The research proposal was approved by Institutional Review Board of KIST Medical College and Teaching Hospital (IRC no. 2076/77/2). In this study, 526 MBBS and BDS students of KIST Medical College and Teaching Hospital from first year to fourth year were considered under the sampling frame. From 526 students, 269 healthy students from MBBS and BDS program were enrolled by simple random sampling.

Each student from MBBS and BDS program was given a unique number according to their class roll number and batch and selected by lottery method. Students with recent history of any illness, and past history of metabolic, cardiovascular, respiratory, digestive, or other disorders and students currently using any medication were excluded. The enrolled students were explained about the procedure and informed consent was taken.

The duration of sleep was obtained with the help of questionnaires. All students were asked to answer their usual time to go to sleep and their time to wake up during weekdays and weekends. Average time spent in bed each night was calculated. Students were grouped as those having short sleep (< 7 hours), adequate sleep (7-9 hours) and long sleep (> 9 hours) accordingly.

To assess sleeping habits, Pittsburgh Sleep Quality Index questionnaire (PSQI) was used. It is highly reliable and valid instrument to measure the quality and patterns of sleep in adults.¹³ PSQI consists of 19 questions grouped under 7 major components. Each component was scored from 0 to 3 points, in which lower point indicated no problems, while higher score indicated severe problems. All 7 components scores were then added to get a single "Global score" with a scale from 0 to 21 points. For the purpose of the present study, we have divided the result into two categories: (1) ≤5 (good sleep quality) vs. (2) >5 (poor sleep quality).

Weight in kilograms (kg) was measured by using a weighing machine and height in centimeters (cm) was measured with a height scale. Both were measured in light clothes and without shoes. Body mass index was calculated with a formula,

$BMI = \text{weight (kg)} / \text{height (m)}^2$.¹¹ Depending on BMI, students were grouped into four groups: underweight (BMI < 18.5), normal weight (18.5 to 24.9), overweight (25 to 29.9), and obese (BMI ≥30). All the information were entered in a proforma.

All the statistical analysis was done using IBM Statistical Package for the Social Sciences (SPSS), version 25. ANOVA and independent t-test were done to check the differences in mean BMI among different groups. $p < 0.05$ was considered statistically significant.

RESULTS

Among 269 medical students enrolled in the present study, 124 (46.1%) were male and 145 (53.9%) were female (Figure 1). 182 of students belonged to MBBS (108 male, 74 female) and 87 belonged to BDS (16 male, 71 females) (Figure 1).

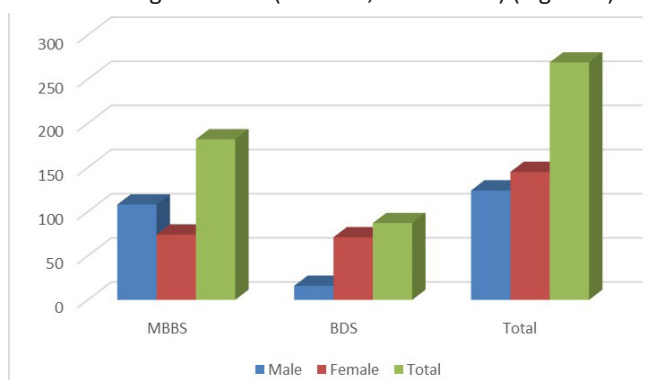


Figure 1: Distribution of students according to program and gender

Table 1: BMI categories according to different variables

BMI (Kg/m ²)	Sleep duration			Sleep quality		Gender		Program	
	Short sleep	Adequate sleep	Long sleep	Good	Poor	Male	Female	MBBS	BDS
Underweight (24)	10 (41.67%)	14 (58.33%)	0 (0%)	16 (66.67%)	8 (33.33%)	10 (41.67%)	14 (58.33%)	18 (75%)	6 (25%)
Normal (187)	48 (25.67%)	134 (71.66%)	5 (2.67%)	143 (76.47%)	44 (23.53%)	84 (44.92%)	103 (55.08%)	123 (65.78%)	64 (34.22%)
Overweight (51)	31 (60.78%)	20 (39.22%)	0 (0%)	10 (19.61%)	41 (80.39%)	26 (50.98%)	25 (49.02%)	36 (70.59%)	15 (29.41%)
Obese (7)	5 (71.43%)	2 (28.57%)	0 (0%)	2 (28.57%)	5 (71.43%)	4 (57.14%)	3 (42.86%)	5 (71.43%)	2 (28.57%)
Total (269)	94 (34.94%)	170 (63.20%)	5 (1.86%)	171 (63.57%)	98 (36.43%)	124 (46.10%)	145 (53.90%)	182 (67.66%)	87 (32.34%)

In general, 24 (8.92%) of students were underweight, 187 (69.52%) had normal weight, 51 (18.96%) were overweight and 7 (2.6%) were found to be obese. Among 269 students, 94 (34.94%) students spent <7 hours in bed, 170 (63.2%) spent 7 to 9 hours in bed and only 5 (1.86%) spent >9 hours in bed. 171

(63.57%) students had good sleep quality and 98 (36.43%) of students were found to have poor sleep quality (Table 1).

Among overweight students, 31 (60.78%) and among obese, 5 (71.43%) were found to have short sleep (Table 1). There

was increase in BMI as sleeping hours decreased indicating negative co-relation between BMI and duration of sleep (Figure 2). Mean BMI was highest in students with short sleep (23.12 ± 3.87) than other groups, which was statistically significant with p -value < 0.05 (ANOVA test, Table 2). Similarly, 41 (80.39%) overweight students and 5 (71.43%) obese students had poor sleep quality (Table 1). Mean BMI was highest in students with poor sleep quality and was statistically significant (p value < 0.05 , Independent t-test) (Table 3).

Gender wise, among 145 females, 25 (17.24%) were overweight and 3 (2.07%) were found to be obese (Table 1). 43 (29.65%) of female students had short sleep and 58 (40%) of female students had poor sleep quality (Table 4). Similarly, in male students, 26 (20.96%) were overweight and 4 (3.23%) were found to be obese (Table 1). 51 (41.13%) of male students had short sleep and 40 (32.25%) had poor sleep quality (Table 4).

Table 2: Mean BMI values among different sleep duration groups

Variables	Sleep Duration			p-value
	< 7 hours (short)	7-9 hours (Adequate)	>9 hours (long)	
Numbers of students	94	170	5	0.001
Mean BMI (Kg/m ²)	23.12	21.63	20.88	
SD	3.87	2.74	1.73	

Table 3: Mean BMI values among good and poor sleep quality groups

Variables	Sleep quality		P-value
	Good	Poor	
Numbers of students	171	98	0.000
Mean BMI (Kg/m ²)	21.24	23.69	
SD	2.36	3.93	

Table 4: Duration and quality of sleep according to gender

	Duration of sleep			Sleep quality	
	Short sleep	Adequate sleep	Long sleep	Good	Poor
Male (124)	51 (41.13%)	72 (58.06%)	1 (0.81%)	84 (67.74%)	40 (32.26%)
Female (145)	43 (29.65%)	98 (67.59%)	4 (2.75%)	87 (60%)	58 (40%)

DISCUSSION

Sleep is one of the basic needs of human body as it plays a vital role in maintaining both mental and physical health.¹⁴ Several population based epidemiological studies have therefore commonly associated sleep deprivation with negative health outcome like cardiovascular diseases, diabetes and weight gain.^{3,6} As sleep loss is common among adolescents/college students, the present study was undertaken to study the association between sleep duration, sleep quality and BMI in medical students.

In the current study, we observed that 34.94% of medical students were sleeping < 7 hours per night and 36.43% of students reported to have poor sleep quality. Different studies conducted in countries like United Kingdom, Korea and Taiwan found that 24% to 49% of university students obtained < 7 hours of sleep each night which is similar to our study.^{15,16,17} In a study conducted in Nepal, Pramanik T et al. also revealed that about

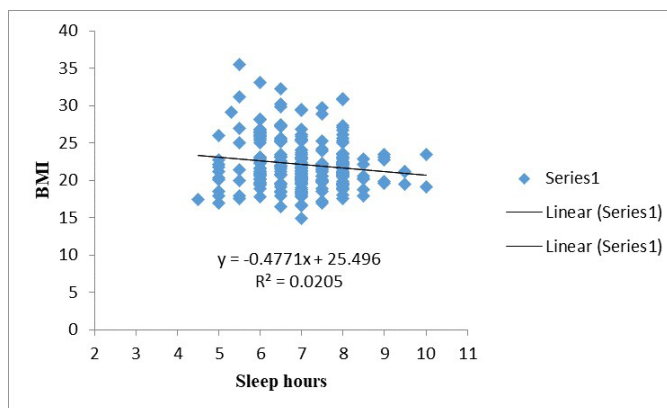


Figure 2: Scatter diagram showing negative association between sleep duration and BMI

31.5% of Nepalese medical students suffered from sleep deprivation.¹⁸ Similarly, several studies conducted among medical students and other college students assessing sleep quality using PSQI have indicated that higher percentage (40 to 70%) of students have reported to have poor sleep quality.^{19,20} In a study conducted among College Students in Kathmandu Valley, Khadka et al. observed that 58.30% of science students and 59.85% of management students had poor sleep quality.²¹ During college life, due to changes in lifestyle, newly found freedom, increasing use of electronic devices and stress due to academic performances, sleep deprivation and poor sleep quality is common among college students and more pronounced especially among medical students.^{11,22} Longer study times, studying just before to sleep, frequent examination, anxiety about results, irregular work and rest schedule can cause sleep deprivation and poor sleep quality among medical students.¹⁹

In this study, we observed that mean BMI was significantly

higher among the students with short sleep than students with adequate or long sleep. We found that BMI increases as sleep duration decreases indicating negative association between duration of sleep and overweight and obesity. Similarly, mean BMI was significantly higher in students with poor sleep quality. Students with PSQI score >5 tend to have higher BMI. Our observation was concordant with several other studies conducted across the world.^{5,11,22-24} Previous studies have proposed that as the sleep hours reduces there is increase in secretion of ghrelin and cortisol and reduction in leptin levels. These alteration in hormones level decreases energy expenditure and increases caloric intake thus causing weight gain.^{4,25} The mechanism behind sleep quality altering the BMI is still not clear but poor sleep quality seems to alter food regulating mechanism, possibly causing poor food choices high in calorie leading to weight gain.¹¹ In contradiction to our observation, several studies have found U-shaped association or even no association between sleep duration and obesity.^{9,11} The difference in result may be due to sample size, geographical and ethnic variation, difference in age group or it may be due to influence of co-variants like diet, physical activity and lifestyle on BMI. Due to the inconsistent results, the strength of association between sleep and BMI is still debatable.

Our study also demonstrated that higher percentage of female students (40%) reported poor sleep quality than male students (32.26%). Khadka et al. and Park SK et al. also observed in their studies that poor sleep quality is more prominent in women than men which is similar to our observation.^{21,24} It is common finding that female are more sensitive, emotional and anxious than male regarding different events in their life like academic performances, relationship and many more. In addition, each month, they may suffer from sleep loss due to premenstrual symptoms or painful menstrual cramps which can cause poor

sleep quality in females.^{26,27}

The present study has few limitations as well. We used self-reported data to assess sleep duration and sleep quality which may affect the result. Even though PSQI questionnaire represents a valid and reliable instrument for assessing sleep quality, self-reported sleep duration may not reflect true sleeping duration. Using objective methods like actigraphy, polysomnography could be more valid and reliable. In the present study, we did not adjusted factors like diet, physical activity and lifestyle which may influence the body mass index.

CONCLUSION

In summary, our study revealed that significant number of medical students spend less time in bed than the recommended hours and have poor sleep quality. Our study also indicated that short sleep and poor sleep quality is associated with higher body mass index. Most of the medical students and medical/other colleges might be either unaware or ignorant about importance of sleep in the life and effect of sleep loss on the health and academic performances. Therefore, further studies on larger scale is recommended in different populations. These studies help to raise awareness among students and colleges which may motivate them to improve their sleeping habits.

ACKNOWLEDGEMENT

We are highly thankful to all the participants for their co-operation.

CONFLICT OF INTEREST: None

FINANCIAL DISCLOSURE: None

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