Prevalence of Overweight and Obesity among Medical Students and its Correlation with Sleep Pattern and Duration

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ABSTRACT

Introduction: Overweight and obesity are defined as abnormal or excessive fat accumulation, which may impair health. Body mass index is a simple index of weight-for-height that is commonly used in classifying overweight and obesity in adult population and individuals. Sleep deficiency and sleep related disorders are colossal among the general population. Sleep deficiency and irregularity in sleep patterns has also been a common occurrence among doctors, as well as medical students for many years now. The aim of the study was to know the prevalence of overweight and obesity its association with sleep pattern and duration among medical students.

Material and Methods: The present study was conducted on the 320 subjects, 160 males and 160 females, using a pre-tested questionnaire and measuring their body mass index.

Result: This study showed a negative correlation between sleep duration and BMI and a positive correlation of sleep pattern, as measured by PSQI, was observed with BMI in medical students.

Conclusion: This study showed that sleep duration and sleep pattern are significantly correlated to increase in BMI of the medical students.

Keywords: Overweight, Obesity, Sleep Duration, Sleep Pattern.

INTRODUCTION

For centuries, the human race struggled to overcome food scarcity, disease, and a hostile environment. With the onset of industrial revolution, the great powers understood that increasing the average body size of the population was an important social and political factor. Moving the body mass index (BMI) distribution of the population from underweight range towards normality had an impact on survival and productivity, playing a central role in the economic development of industrialized societies.[1]

Obesity is emerging as a serious problem throughout the world, not only among adults but also amongst children, teenagers and young adults. Of the factors contributing to obesity, stress seems to be particularly important as stressful conditions lead to irregularity in diet, lack of exercise and addiction, each being considered an independent factor leading to obesity. Professional students, including medical students, are at a high risk where obesity is concerned. This is mainly because medical education is stressful throughout the whole course of training. The amount of material to be absorbed, social isolation, pressure of examinations, discrepancies between expectation and reality, all can be anticipated to bring psychological stress.[2]

A surrogate marker for body fat content is the body mass index (BMI), which is calculated as

BMI = Weight in kg/Height in m^2

In clinical terms, a BMI between 25 and 29.9 kg/m^2 is called overweight, and a BMI greater than 30 kg/m^2 is called obese.[3]

Modern humans are experiencing two parallel trends, increasing body mass index (BMI) and a decline in average sleeping time.

In the last few years, there has been a growing attention to sleep and sleeplessness-related problems. This interest is mainly due to the recognition that sleepiness and fatigue are becoming endemic in the population.[4] Indeed, over the past 40 years, daily sleep duration in the United states population has decreased by 1.5 to 2 hours, and the proportion of young adults sleeping less than 7 hours per night has more than doubled between 2001-2002 (from 15.6% to 37.1%).[5] Thus lack of sleep has become a widespread habit, driven by the demands and opportunities of our modern 24-hour lifestyle. Nearly one third of adults report sleeping less than 6 hours per night, leading some to suggest that we live in a sleep-deprived society.[6]

Sleep research shows that the average adult needs about 7 to 9 hours of sleep each night, teenagers need about 9.5 hours, and infants generally require around 16 hours per day.[7]

Medical students are a unique group of young adults whose academic commitments and lifestyle can impact their sleep habits and result in sleep deprivation.[8]

The sleep-wake cycle of medical students is characterized by insufficient sleep duration, delayed sleep onset, and occurrence of napping episodes during the day.[9]

Medical students are at higher risk of developing obesity because of the life style and time-consuming demands of medical studies. The average lifestyle of a medical student involves sleep deprivation and irregular sleep patterns, leading to lethargy and decreased concentration. Sleep is an important factor for many physiological processes. Researchers have shown that sleep deprivation may lead to

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How to cite this article: Reqaya Hameed, Anjali Nadir Bhat, Nida Nowreen. Prevalence of overweight and obesity among medical students and its correlation with sleep pattern and duration. International Journal of Contemporary Medical Research 2019;6(6):F1-F5.

DOI: http://dx.doi.org/10.21276/ijcmr.2019.6.6.6

obesity directly or indirectly. Increased levels of appetite stimulating hormone ghrelin and decreased levels of satiety inducing hormone leptin have been observed in sleep deprived individuals. Sleep deprivation may also give people more time to eat and decrease exercise due to disturbed sleep pattern.[10]

Accumulating evidence indicates that inadequate sleep is a novel risk factor for obesity. However, consequences of inadequate sleep extend well beyond obesity. Improving sleep duration and quality may improve somatic and psychosocial health, school performance, and risk taking behavior among youth and reduce hypertension, coronary heart disease, and stroke in adulthood.[11] Current research aimed to Study the prevalence of overweight among medical students, to Study the prevalence of obesity among medical students and to Study association of overweight and obesity with sleep duration and pattern.

MATERIAL AND METHODS

The present study was undertaken 320 subjects, 160 males and 160 females. Subjects were medical students from 3rd, 5th, 7th, and 9th semesters. 320 students were selected randomly by drawing lots (lottery method), 80 students from each semester (40 boys and 40 girls). After detailing the purpose and methodology of the study, all eligible subjects were requested to participate in the study.

Ethical clearance was obtained from the Institutional Ethical Committee.

Students excluded from the study were those:

- Suffering from major diseases like hypothyroidism and diabetes**.**
- Suffering from any psychological disorders**.**
- On any medications (Steroids, sedatives, antihistaminics).

Assessment of Obesity was carried out by using the body mass index (BMI) formula according to the American journal of clinical nutrition[12] — where BMI = Weight (kg) / Height (m^2).

Normal range for BMI: 18.5-24.9 kg/m^2 (according to World Health Organization).

The weight of subjects was measured by using a calibrated weighing machine. The weight was recorded to the nearest kilogram (kg).[13]

For recording the height of subjects, a vertical measuring rod was fixed to wall and subjects were asked to remove shoes and stand on flat floor in front of measuring rod with the feet parallel and heels, buttock, shoulders and back of head touching vertical rod. The head was held completely erect with lower border of orbit in the same horizontal plane as the external auditory meatus. The arms were kept hanging by the sides in natural manner. The horizontal bar of the measuring rod was lowered to touch the head. The height was recorded to the nearest centimeter (cm).[14]

Grading of BMI was done according to WHO grading,[15] in which individuals with BMI below 18.5kg/m^2 are underweight, individuals with BMI ranging from 18.5-24.9kg/m^2 are considered normal, those with BMI ranging from 25-29.9kg/m^2 are overweight and those with BMI above 30 are labelled obese.

Assessment of sleep durations and patterns was done by using a self-administered and validated questionnaire, the Pittsburgh sleep quality index (PSQI).[16] The PSQI contains 19 self-rated questions, which are combined to form seven "component" scores, having a range of 0 to 3, "0" indicating no difficulty while "3" indicating severe difficulty in sleeping. The seven component scores were then added together to yield one "global" score with a range of 0 to 21 points, "0" indicating no difficulties and "21" indicating severe difficulties in all areas of sleep. The 7 components of the PSQI which were used to analyze various aspects of sleep patterns and durations are subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medications, and daytime dysfunction.

Grading and scoring of the PSQI was done according to the preformed scoring instructions of the Pittsburgh sleep quality index.

STATISTICAL ANALYSIS

Statistical analysis was performed by the SPSS program for Windows, version 17.0. Continuous variables are presented as mean ± SD, and categorical variables are presented as absolute numbers and percentage. Data was checked for normality before statistical analysis using Shaipro Wilk test. Normally distributed continuous variables were compared using ANOVA. If the F value was significant and variance was homogeneous, Tukey multiple comparison test was used to assess the differences between the individual groups; otherwise, Tamhane's T2 test was used. Categorical variables were analyzed using the chi square test. Pearson correlation was also used among various variables. For all statistical tests, a p value less than 0.05 was taken to indicate a significant difference.

RESULTS

As per post hoc analysis, it was observed that in underweight and normal BMI range, the sleep duration (hrs) was significantly more as compared to overweight and obese categories. However, no difference was found in the overweight and obese categories. Post hoc analysis also showed that in underweight and normal BMI range, the PSQI was significantly more as compared to BMI categories of overweight and obese. Also, there was also significant difference in PSQI between overweight and obese categories

The table-1 shows the distribution of subjects according to various BMI ranges. It was observed that 69.4% of subjects were under the BMI range of 18.5-24.9 while 19.4% of subjects were under the BMI range of 25-29.9, 6.9% of subjects had BMI <18.5 and 4.4% of subjects had BMI >=30.

The table-2 shows the distribution of subjects according to the sleep duration. It was observed that 39.4% of subjects had a sleep duration of 7 hrs while 24.4% of the subjects had a sleep duration of 6 hrs, 20.3% of subjects had sleep duration of 8 hrs, 12.8% of the subjects had a sleep of 5 hrs

BMI (kg/sq. m)	Frequency	%
<18.5	22	6.9%
18.5 - 24.9	222	69.4%
25 - 29.9	62	19.4%
>=30	14	4.4%
Total	320	100%

Table-1: BMI distribution

Sleep duration (hrs)	Frequency	%
4 hrs	2	0.6%
5 hrs	41	12.8%
6 hrs	78	24.4%
7 hrs	126	39.4%
8 hrs	65	20.3%
9 hrs	8	2.5%
Total	320	100%
Mean ± SD	6.73 ± 1.02	
Median	7 hrs	
Min - Max	4 - 9 hrs	

Table-2: Sleep Duration (hrs)

PSQI	Frequency	%
<5	133	41.6%
5 - 7	147	45.9%
>7	40	12.5%
Total	320	100%
Mean ± SD	4.93 ± 2.14	
Median	5	
Min - Max	0 – 11	

Table-3: PSQI distribution

duration, 2.5% subjects had a sleep of 9 hrs and 0.6% had a sleep duration of 4 hrs. Further, it was observed that the mean sleep duration among the subjects under the study was 6.73 ± 1.02 hrs.

The table-3 shows the distribution of subjects according to various PSQI ranges. It was observed that 45.9% of subjects were under the PSQI range of 5 -7, while 41.6% subjects were in < 5 range and 12.5% of subjects were in >7 range. Further, it was observed that the mean PSQI of the group was 4.93 ± 2.14.

The table-4 shows the comparison of mean Sleep Duration and PSQI in different BMI categories. It was observed that the mean sleep duration for the subjects with BMI <18.5 kg/m² was 6.82 ± 1.05 hrs and for subjects with BMI in the range of 18.5–24.9 kg/m², 25–29.9 kg/m² and >=30 kg/m² the sleep durations were 6.94 ± 0.95 hrs, 6.21 ± 0.94 and 5.71 ± 1.14 respectively.

For PSQI, it was observed that the mean PSQI for the subjects with BMI <18.5 kg/m² was 4.36 ± 1.43 and for subjects with BMI in the range of 18.5 – 24.9 kg/m², 25 – 29.9kg/m² and >=30 kg/m²s the PSQI were 4.31 ± 1.89, 6.56 ± 1.85 and 8.36 ± 1.15 respectively.

Further, it was observed that there was a significant difference for both sleep duration and PSQI across the various BMI ranges (p value of <0.001).

The table-5 shows the correlation of PSQI distribution with BMI. It was observed that in the group with PSQI of <5, 89.5% of the subjects had BMI in the range of 18.5-24.9 kg/m², 4.5% of the patients had BMI in the range of 25-29.9 kg/

	BMI (kg/sq. m)					P Value
	<18.5	18.5 - 24.9	25 - 29.9	>=30	Total	
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	
Sleep duration (hrs)	6.82 ± 1.05	6.94 ± 0.95	6.21 ± 0.94	5.71 ± 1.14	6.73 ± 1.02	<0.001
PSQI	4.36 ± 1.43	4.31 ± 1.89	6.56 ± 1.85	8.36 ± 1.15	4.93 ± 2.14	<0.001

Table-4: Correlation of Sleep duration (in hrs) and PSQI with BMI

PSQI	BMI (kg/sq. m)					P Value
	<18.5	18.5 - 24.9	25 - 29.9	>=30	Total	
	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)	
<5	8 (6.0%)	119 (89.5%)	6 (4.5%)	0 (0.0%)	133 (100%)	<0.001
5-7	14 (9.5%)	92 (62.6%)	38 (25.9%)	3 (2.0%)	147 (100%)	
>7	0 (0.0%)	11 (27.5%)	18 (45.0%)	11 (27.5%)	40 (100%)	
Total	22 (6.9%)	222 (69.4%)	62 (19.4%)	14 (4.4%)	320 (100%)	

Table-5: Correlation of PSQI distribution with BMI

		BMI (kg/sq. m)	Sleep duration (hrs)	PSQI
BMI (kg/sq. m)	Pearson Correlation	1.000	-.314**	.486**
	p value		<0.001	<0.001
	N	320	320	320
Sleep duration(hrs)	Pearson Correlation	-.314**	1.000	-.279**
	p value	<0.001		<0.001
	N	320	320	320
PSQI	Pearson Correlation	.486**	-.279**	1.000
	p value	<0.001	<0.001	
	N	320	320	320

Table-6: Pearson correlation showing the relationship between Sleep duration, PAQI and BMI

m², 6.0% of the subjects had BMI <18.5 kg/m² and 0.0% had BMI >=30. In the group with PSQI of 5-7, 62.6% of subjects had BMI in the range of 18.5-24.9 kg/m², 25.9% of subjects had BMI in the range of 25-29.9 kg/m², 9.5% of subjects had BMI <18.5 kg/m² and 2.0% had BMI >=30 kg/m². Under the PSQI of >7, 27.5% of subjects had BMI in the range of 18.5-24.9 kg/m², 45% of subjects had BMI in the range of 25-29.9 kg/m², 0.0% of the patients had BMI <18.5kg/m² and 27.5% had BMI >=30 kg/m².

Further, it was observed that there was a significant difference in distribution of subjects across BMI ranges for three PSQI categories of <5, 5 -7 and >7 (p value of <0.001.

A significant correlation was observed between BMI and sleep duration (in hrs) and PSQI (table-6).

DISCUSSION

Medical students have to enhance their retention power and memory skills, that are required for their professional careers. During this training, which encompasses hard-work and irregular working hours, stress may take a toll on their health, leading to sleeplessness and other diseases. Also, peer pressure, lifestyle changes, lack of sleep and academic pressures may lead to alcohol intake and use of other drugs in the absence of adult supervision. This stress might also lead to weight gain and in some students, to obesity.

The hypothesis of this study was designed assuming that gain of weight in medical students might be related to number of sleeping hours and the quality of sleep (as reported by medical students). Sleep pattern and duration both may have some correlation on the Body Mass Index (BMI) of the students.

This study was conducted to find the prevalence of overweight and obesity in a specific group of population, i.e, medical students and effect of sleep pattern and duration on their BMI.

Emerging evidences from the current literature have shown a positive correlation between sleep pattern, sleep duration and weight gain in college students. However, majority of these studies have been conducted on a milieu of college students and not on any course specific group. The current study, however, highlights the importance of sleep pattern and duration on a high stress prone course (medicine).

The current study includes a total of 320 participants. Maximum number of participants (78.8%) had the mean age of 20 years and the mean age was calculated as 19.94±0.62 years. The range of age was 18-23 years. The participants were in 3rd /5th /7th and 9th semesters of their course.

The mean height of the participants was 166.97 with mean weight as 64.71 and an average BMI of 23.23 was recorded according to the inclusion/ exclusion criteria as already mentioned before. In this study, BMI range has been defined as per WHO standards. As per enrollments, 19.4% participants were overweight (BMI:25-29.9) and 4.4% participants were obese (BMI>=30). Maximum number of participants (69.4%) presented with normal range of BMI (18.5-24.9). Participants categorized as underweight (BMI <18.5) were only 6.9%.

The over-weight BMI range (25-29.9kg/m²) showed a variable distribution of participants through the age groups (18->21 years). Interestingly, 44.4% (out of 100%) of participants fell into the overweight category, even being as young as 18 years. Of the Participants aged 19 years, 26.5% were obese/ overweight and in the age group of 20 years and above 17.5%-20% were obese/ overweight.

Although, 44.4% participants aged 18 years were overweight, none of them fell in the obese category. However, 8.8% students were obese at 19 years of age. Similar occurrence pattern was observed with participants aged 20 or above (4%).

The calculations have been done taking 100% frequency rate in each age group. An important observation from this analysis was that within all the age groups, maximum participants (8.8%) who fell in the category of obese were aged 19 years. The tendency to be obese was however significantly lower in other age groups (18, 20 and 21 years) as compared to that of the group aged 19 years.

As per the results, 41.6% participants had minimum sleeping disorders (score range: 0-5), 45.9% participants had moderate sleep difficulties (score range: 5-7) and 12.5% participants had significant sleep disorders (score range: 8-11). This result was further co-related with sleep duration and BMI suggesting that a significant difference for sleep duration and PSQI score was evident as per the standard BMI ranges (p<0.001).

Literature has shown studies that correlate short, medium and long duration of sleep with BMI.[17,18] In our study also, of the participants reporting sleep duration of less than 7 hours, 39% were overweight and 10% were obese, whereas 80.4% of participants reporting sleep duration of more than or equal to 7 hours had normal range of BMI, with 11.6% of participants overweight and 2% obese.

A study by Kumar and Nagar[19] also showed that of 30 participants 24 obese and 12 overweight students had PSQI scores ranging from 7 to 9, indicating higher difficulties in sleep pattern.

A review by Beccuti and Pannian[20] suggests that obesity epidemic has been paralleled by a trend of reduced sleep duration.

As in our study, other published literature also negatively relates sleep duration and BMI.[21,22,23,24,25,26]

CONCLUSION

Overall, the data revealed a negative correlation between sleep duration and BMI. Consistent with the hypothesis, duration of sleep might be responsible for increase in body weight leading to being overweight/ obese.

Further, a positive correlation of sleep pattern, as measured by PSQI, was observed with BMI in medical students. A positive correlation refers to both the variables increasing or decreasing in a similar pattern. The BMI was seen to increase with increase in PSQI score (indicating difficulty in sleep; abrupt sleep pattern).

This study shows that sleep duration and sleep pattern are significantly correlated to increase in BMI of the medical

students. Hence, it is of utmost importance that more of such studies be conducted in order to spread awareness about the importance of ample sleep duration, along with good quality of sleep, in students as well as their parents. Educational and wellness programs must be an integral part of the course structure of students, enlightening them about the importance of quantity and quality of sleep.

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Source of Support: Nil; **Conflict of Interest:** None

Submitted: 20-04-2019; **Accepted:** 20-05-2019; **Published:** 09-06-2019