

## Original Research Article

# Correlation of sleep quality with anthropometric parameters in young healthy individuals

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### ABSTRACT

**Background:** Obesity, which is the harbinger of various diseases, is considered as the epidemic of this era. Various lifestyle changes have resulted in a younger generation being prone to obesity. On investigating the etiology of obesity in young individuals, besides the change in food habits, sleep has also found a place. Various investigators have come up with conflicting results regarding the correlation between sleep and anthropometric parameters. In this backdrop, the present study was planned to analyze the correlation of sleep quality with anthropometric parameters.

**Methods:** 100 first year MBBS students were given the Pittsburgh sleep questionnaire which gives a self-reported assessment of their sleep quality. Anthropometric parameters of the students were recorded along with body fat analysis using Omron body fat analyzer. The results obtained were tabulated and analyzed.

**Results:** Out of the 100 students 45 were found to be poor sleepers. On analyzing the anthropometric parameters, no significant difference was noted between good sleepers and poor sleepers. The body fat content also did not show any significant difference between the two groups.

**Conclusions:** The findings of the present study show a nonmonotonic relationship between sleep quality and anthropometric parameters. This shows that the response of the adolescent population may differ in comparison with other groups. Hence it is recommended that the poor sleepers in the adolescent group need to be followed up in future.

**Keywords:** Anthropometry, Adolescents, Obesity, Sleep quality

### INTRODUCTION

Sleep is considered to be most vital for both physical and mental development and lack of sleep is considered to be a very common problem with severe consequences. The advent of technology and overuse of communication networks has resulted in sleep deprivation. Sleep being an important modulator of neuroendocrine function, decrease in sleep can trigger both endocrine and metabolic alterations. The relation of sleep with attention, memory, etc has been investigated in detail, but there are very few studies documenting the effects of sleep deprivation or poor quality sleep on the anthropometric parameters of individuals. Obesity is considered as the

epidemic of this era. The world wide prevalence of obesity has doubled since 1980, and obesity being the harbinger of various diseases, research in this field had escalated over the decades.<sup>1</sup> A burgeoning area of research in the field of obesity is the potential link between sleep and obesity. Evidences from both epidemiological and laboratory studies have highlighted that poor sleep quality is associated with increase in obesity risk.<sup>2,3</sup>

Students in professional colleges are faced with the burden of academics and also stress to meet the demands of their professions resulting in major lifestyle changes which make them prone to lifestyle diseases. The

association of stress with poor sleep quality has been the major arena of research.<sup>4</sup> Researchers have tried to shed light on the role of sleep on anthropometric parameters but the results are conflicting.<sup>5-7</sup> Further there are very few studies documenting the correlation between poor sleep and fat levels in young healthy people.

In this background of conflicting results, the present study was designed to assess whether there is an association between poor sleep quality and fat levels of young healthy individuals.

## METHODS

This study was conducted in Jubilee Mission Medical College and Research Institute, Thrissur, Kerala. 100 I year medical students (67 females and 33 males) were recruited for this study, after obtaining written informed consent. They were asked to fill a questionnaire to assess their sleep quality. Anthropometric measurements were taken including their height, weight, waist and hip circumference, fat %. The ethical approval was obtained from the Institutional ethics committee.

### Anthropometry

The fat % was measured by bio-impedance analysis technique using a body fat analyzer (OMRON body composition monitor, Omron Healthcare, India). The subjects were grouped into 4 categories: normal, obese, invisible obese, muscle obese based on their BMI and fat %. This is according to the standards put up by the instrument. The BMI of 18.5 – 22.9 kg/m<sup>2</sup> with body fat % of 20-29.9% or ≤ 20% for female subjects, 10-19.9% or ≤ 10% for male subjects were considered to be under normal category. In invisible obese category, BMI of <18.5 or 18.5 – 22.9 kg/m<sup>2</sup> with body fat % of 30-34.9% or ≥ 35% (female) and 20-24.9% or ≥ 25% (male) were considered. BMI of 23.0- 24.9 or ≥ 25 kg/m<sup>2</sup> with body fat % of 30-34.9% or ≥ 35% for females and males with body fat % of 20-24.9% or ≥ 25% were grouped under obese category. BMI of 23.0- 24.9 or ≥ 25 kg/m<sup>2</sup> with body fat % of 20-29.9% or ≤ 20% (female), 10-19.9% or ≤ 10% (male) subjects were grouped under muscle obese category.

A stadiometer was used to measure height to the nearest 0.1cm. To measure the height, head was positioned in Frankfurt horizontal plane with heels together and toes apart. A digital weighing scale was used to measure weight to the nearest of 0.1kg. BMI was calculated with the formula weight in kg/(height in m)<sup>2</sup>. Waist and hip circumference were measured using a stretch resistant tape that provides a constant 100g tension with close skin contact and without underlying skin compression.

The approximate midpoint between the lower margin of the last palpable rib and the top of the iliac crest was measured as waist circumference. The widest portion of the buttocks was taken as the level of measurement of hip

circumference. From the above measured parameters, the waist hip ratio was estimated (Waist in cm)/ (Hip in cm).

### Sleep quality

The sleep quality was assessed using Pittsburgh sleep quality questionnaire (PSQI), which is based on self reported questions (18 in number); measuring the different components of sleep. These are sleep quality, sleep latency, habitual sleep efficiency, duration of sleep, any use of sleeping medication, sleep disturbances, and daytime dysfunction. The global score (GPSQI) was attained by adding up all the scores obtained from each category. A cutoff score of above 5 is indicative of a poor sleep quality or a sleep disturbance. Based on this, subjects were grouped into two groups: poor sleep quality and good sleep quality (global score >5 and ≤ 5 respectively).

### Statistical analysis

Data was checked for normality by using Q-Q plot and was normally distributed. The correlation between the sleep quality and anthropometric measurements were demonstrated by Pearson's correlation. Independent t test was used to assess the difference in anthropometric parameters between two groups (poor and good sleep quality). To analyze the significant difference in sleep quality between groups based on BMI and fat %, one way ANOVA was performed. The data was statistically analyzed using SPSS software version 22.0

## RESULTS

In the current study, out of 100 subjects, 33 were boys and 67 were girls. The anthropometric parameters of the subjects are given in Table 1. On the basis of their BMI, 16 were underweight (<18.5kg/m<sup>2</sup>), 55 were normal (18.5 – 22.9 kg/m<sup>2</sup>), 29 were overweight (>22.9kg/m<sup>2</sup>).

**Table 1: Subject characteristics.**

Parameter	Mean ± SD (n=100)
Height (cm)	164.39 ± 0.90
Weight (kg)	57.97 ± 1.1
BMI (kg/m <sup>2</sup> )	21.37 ± 0.31
Waist circumference (cm)	71.80 ± 0.82
Hip circumference (cm)	93.81 ± 0.66
WHR	0.76 ± 0.01
Fat %	24.6 ± 6.61

Data represented as mean ± standard deviation. BMI, body mass index; WHR, waist hip ratio.

Table 2 shows the mean scores of each parameter of sleep measured by the Pittsburgh sleep quality index questionnaire.

The mean scores of male and female subjects are also showed and there is no significant difference between the two groups.

**Table 2: Sleep quality of I year medical students.**

Sleep quality	Total (n=100)	Male (n=33)	Female (n=67)
Overall sleep quality	1.12 ± 0.74	1.51 ± 0.13	1.10 ± 0.09
Sleep latency	0.52 ± 0.73	0.61 ± 0.14	0.48 ± 0.09
Sleep duration	1.59 ± 0.74	1.67 ± 0.12	1.55 ± 0.09
Sleep efficiency	0.1 ± 0.33	0.06 ± 0.04	0.12 ± 0.04
Sleep disturbance	1.01 ± 0.48	1.09 ± 0.05	0.97 ± 0.07
Sleep medication	0.04 ± 0.32	0.03 ± 0.03	0.045 ± 0.05
Daytime dysfunction	1.34 ± 0.84	1.36 ± 0.13	1.33 ± 0.11
GPSQI	5.72 ± 2.44	5.97 ± 0.35	5.60 ± 0.32

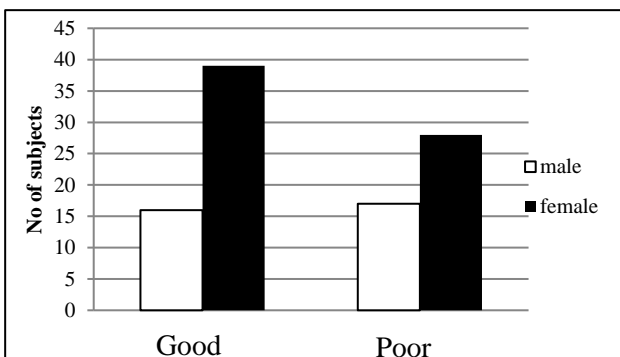
Independent t test, significant at p<0.05. GPSQI, global Pittsburgh sleep quality index.

Table 3 shows the association between the anthropometric variables and sleep quality (global score). Though all variables show a negative correlation, it is not significant.

**Table 3: Correlation between the anthropometric parameters and sleep quality.**

Sleep quality (GPSQI)		
Parameter	Correlation coefficient	P value
Weight (kg)	-0.0092	0.93
BMI (kg/m <sup>2</sup> )	-0.03341	0.74
Waist (cm)	-0.04336	0.67
Hip (cm)	-0.016869	0.87
WHR	-0.10439	0.30
Fat %	-0.10473	0.30

Pearson’s correlation, significant at <0.05. GPSQI, global Pittsburgh sleep quality index; BMI, body mass index; WHR, waist hip ratio.



Sleep quality score (GPSQI) ≤ 5 considered as good sleep quality, score of > 5 considered as poor sleep quality.

**Figure 1: Distribution of sleep quality among I year medical students.**

Figure 1 represents the distribution of sleep quality among the subjects. 16 males and 39 females were good sleepers (global sleep quality ≤ 5) whereas among poor sleepers (global sleep quality >5) 17 were males and 28 were females.

The subjects with poor and good sleep quality were compared on basis of their anthropometric parameters in Table 4.

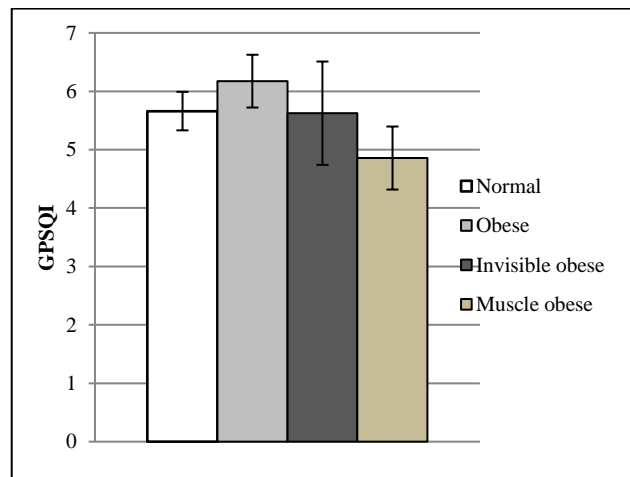
**Table 4: Comparison between sleep quality and anthropometry.**

Parameter	Poor sleep quality Mean ± SD (n=45)	Good sleep quality Mean ± SD (n=55)	P value
Weight(kg)	58.8 ± 11.57	57.30 ± 10.68	0.51
BMI (kg/m <sup>2</sup> )	21.51 ± 3.33	21.26 ± 2.95	0.69
Fat %	24.01 ± 7.83	25.09 ± 5.45	0.44
Waist cm	72.49 ± 8.63	71.24 ± 7.91	0.45
Hip cm	94.4 ± 7.12	93.34 ± 6.24	0.44
WHR	0.766 ± 0.05	0.76 ± 0.04	0.61

Independent t test, significant at p <0.05. BMI, body mass index; WHR, waist hip ratio.

Independent t test was performed to compare and found no significant difference between the two groups.

The difference in sleep quality was demonstrated between fat % groups (Figure 2).



One-way ANOVA. Data represented as Mean ± SE. GPSQI, global sleep quality index.

**Figure 2: Comparison of sleep quality with fat % and BMI groups.**

Out of 100 subjects, 62 of them belonged to normal category, 23 under obese category, 8 were under invisible obese category and 7 belonged to muscle obese group. It showed no significant difference between the groups (p=0.64).

## DISCUSSION

On investigating into the cause of worldwide increase in the prevalence of obesity in the last several decades, the role of reduced sleep trends has surfaced. Evidence from various epidemiological studies have shown reduced sleep quality and duration is associated with increased fat levels and the probable mechanism is due to the endocrine modulation brought about by decreased sleep.<sup>8</sup> Decreased sleep results in decreased leptin and increased ghrelin levels which in turn causes increase in appetite but this endomodulation is dependent on several factors, the role of which needs to be analyzed in detail.<sup>9</sup>

The present study investigates into the relation of sleep quality with anthropometric parameters in young healthy medical students. Six different components of sleep namely: Sleep latency, Sleep duration, Sleep efficiency, Sleep disturbance, Sleep medication, Daytime dysfunction were all subjectively recorded using Pittsburgh sleep quality questionnaire. On analyzing the difference between males and females it was found to be statistically insignificant, hence concluding that males and female medical students have no significant difference in sleep patterns. This finding is in conflict with data from other studies where males are found to have poor quality sleep in comparison with females.<sup>10</sup> On assessing the correlation of sleep quality with anthropometric parameters it was found that all the parameters are negatively correlated with sleep but not to a statistically significant level. An inverse relationship between sleep and anthropometric parameters was noted in majority of the epidemiological studies conducted in general population.<sup>11</sup> But this relationship between sleep and anthropometric parameters varies according to age as was noted in studies conducted in middle schoolers and high schoolers.<sup>12</sup> Researchers have noted a linear relationship between obesity and poor sleep quality in adults but the same is not applicable to adolescent population<sup>13-15</sup> where a U shaped pattern was observed.

In the present study sleep patterns of first year medical students were analyzed. It is a well known fact that professional course are very stressful and can result in disturbed sleep patterns. Of the hundred students included in our study, 55 were good sleepers and 45 poor sleepers. On comparing the anthropometric parameters of good and poor sleepers, though the values were higher for poor sleepers it was not statistically significant. This finding suggests that the relationship between anthropometric parameters and sleep is moderated by age as was noted in the studies done in adolescent population.<sup>12</sup> The conclusion drawn from our study goes hand in hand with other researchers who have done similar studies in students pursuing professional courses.<sup>16</sup> The mechanisms to explain this lack of correlation in the adolescent population is still not clear. One probable cause may be due to higher physical activity in this age group to meet the demands of daily classes and shuttling between various classrooms and locations.<sup>16</sup> Lack of

sleep is considered as a stressor which triggers the body to conserve energy resulting in alterations in hormone levels and metabolic rates. The present study did not assess the hormone levels hence future research with a larger group of adolescent population would highlight the cause for this nonmonotonic relationship status of anthropometric parameters and sleep quality in adolescents.

## CONCLUSION

The duration and quality of sleep are related to cardiometabolic risks hence the importance of analyzing the relation between poor sleep and anthropometric parameters. Though the results of our study is not statistically significant the knowledge that in adulthood poor sleep can result in obesity needs to be highlighted on. It would be better if poor sleepers are identified early and lifestyle modifications done so that the development of obesity in later years can be curbed.

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