E-ISSN: 2378-654X

Recent Advances in Biology and Medicine

Original Research Article

Association of Epworth Sleepiness Score with Anthropometric Measurements in Malaysian University Students

HATASO

Association of Epworth Sleepiness Score with Anthropometric Measurements in Malaysian University Students

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Received: Feb 01, 2020; Accepted: Feb 19, 2020

Citation: Kumar KA, Othman WAMBW, Jeppu AK. Association of epworth sleepiness score with anthropometric measurements in Malaysian university students. Recent Adv Biol Med. 2020; 6(1): 972504. https://doi.org/10.18639/RABM.2020.972504

Abstract
Malaysia has high prevalence of obesity in young adults. Obesity leads to health problems such as obstructive sleep apnea (OSA). It is a condition where nocturnal breathing cessation occurs during sleep. Thus, the quantity and quality of sleep is affected. Epworth Sleepiness Score (ESS) is a standardized tool to determine the quality of sleep. The aim of this study was to find the relationship between students' sleep quality using this questionnaire and their anthropometric measurements. This study adopted a cross-sectional study design, with the convenience sampling technique applied on students of a private university in Malaysia. The participants answered the ESS questionnaire. Their height, weight, neck circumference, and abdominal circumference were obtained and the body mass index (BMI) was calculated. This study was conducted on 200 students with a mean age of 21.55 years. Their average BMI was 23.24 ± 6.1. The mean duration of sleep in the study population was 6.3 ± 1.4 SD hours. In the study population, the mean score for ESS was 10.32. A negative correlation between ESS scores and the BMI was noted. Pearson correlation showed —0.026 with a significance of 0.712. ESS scores showed that 17.9% of the study population had high risk of developing OSA. This study shows that as the BMI increases, the quality of sleep decreases, although it is not statistically significant.

Keywords: ESS; Anthropometric measurements; Students.

1. INTRODUCTION

Sleep plays an important role in our lives. It is essential for growth, tissue repair, and consolidation of memory. An average adult needs 7–8 h of sleep per day [1]. Sleep disorders are common but remain underdiagnosed. They are frequently associated with obesity [2]. In recent years, being overweight and obesity have been the two major concerns with regard to Malaysians' health [3]. Malaysia ranked sixth among the Asia Pacific countries with obese population. The National Health and Morbidity Survey statistics, in the year 2011, indicated that the prevalence of being overweight and obesity among Malaysian youth aged 18 and 19 years was 14.1 and 9.9%, respectively. The corresponding rates rose to 18.1 and 10.8% among young adults aged 20 and 24 years (Institute of Public Health, 2011) [4]. Boo *et al*. also stated that 11.7% of Malaysian children aged 15 years and older are obese [5]. The causes of obesity stated were unhealthy diet, genetic factors, lack of physical activities, and also behavioral factors [4]. The adverse effects of obesity include hypertension, diabetes mellitus, and cardiovascular diseases. In addition, diseases such as arthritis, cancer, and obstructive sleep apnea (OSA) are common among the obese. Body mass index (BMI) is a standard measurement that is commonly used by health practitioners to evaluate whether a person's weight correlates appropriately to his or her height, age, and gender [6]. A BMI of 30 and above was considered obese.

Snoring is a common problem that people feel embarrassed about and often deny. However, if snoring is excessively loud, chronic, and associated with daytime sleepiness or fatigue, it may be a warning sign of sleep apnea. Obstructive sleep apnea is a condition where there is repetitive nocturnal breathing cessation. It occurs when the soft palate blocks the airway completely and leads to asphyxia. A standard test that is frequently used to diagnose sleeping disorders is the multiple sleep latency test. However, the test is inconvenient, time consuming, and expensive. The Epworth Sleepiness Scale (ESS) was invented by Dr. Murray Johns in 1991 [7] to calculate the occurrence of daytime sleepiness. Previous studies on OSA patients have concluded that adding BMI and neck circumference (NC) with ESS scores has a predictive value in diagnosing OSA [8]. This study was therefore conducted to investigate the quality of sleep in young university students using the ESS questionnaire and to evaluate its relationship with students' anthropometric measures.

2. METHOD(S)

This cross-sectional study was conducted on students attending a private university located in Shah Alam, Malaysia. Ethical clearance was taken from the Institutional Ethical Board to conduct this study. The sample size was calculated, and the convenience sampling technique was used to collect the data, as it is convenient and cost-effective. Informed consent was sought from all the participants of the study group. Individuals with alcohol and drug abuse as well as pregnant women were excluded from this study.

This study was done in two phases. Phase 1 involved the survey-answering session, where the Epworth Sleepiness Score (ESS) questionnaire was administered to all the participants. It is a standardized tool consisting of eight questions that ask people about their daytime sleepiness in specific situations. These questions are self-administrated, where participants rate their sleepiness on a 0–3 scale. "0" indicates no sleepiness, while "3" indicates significant sleepiness. The ESSs were interpreted as lower normal daytime sleepiness (0–5), higher normal daytime sleepiness (6–10), mild excessive daytime sleepiness (11–12), moderate excessive daytime sleepiness (13–15), and severe excessive daytime sleepiness (16–24).

During phase 2, the anthropometric measurements of all the participants were recorded. The weight was measured with the student standing barefoot on a scale (capacity of 150 kg with a precision of 0.1 kg), wearing light clothing. The height was checked using a measuring tape with participants standing erect, motionless, hands by their side, and head adjusted to the Frankfurt plane. The BMI was calculated using this formula: weight (kg) divided by height squared (m^2). The values of the BMI were interpreted using the following guideline: below 18.5 denotes underweight, 18.5–24.9 denotes normal weight, 25–29.9 denotes overweight, and 30 and higher denotes obese.

The neck and abdominal circumferences were measured using an inelastic tape. For neck circumferences (NC), the participants were asked to stand erect with eyes facing forward and head positioned in the Frankfurt horizontal plane. The measuring tape was placed just below the participant's thyroid prominence. It was easier on males, as the tape could be placed on the Adams apple, which is clearly visible. The measurement cutoff for males was ≥39 cm and for females, it was ≥35 cm [9]. For abdominal circumferences (ACs), the participants were required to sit upright, and the tape was placed at the midpoint between the last rib and upper edge of iliac crest during expiration. The values for male ≥102 cm and female ≥88 cm were considered high [10]. The analysis of data was done using Microsoft Excel and SPSS version 22. Independent *t*-test was applied to find correlations between the ESS scores and anthropometric measurements.

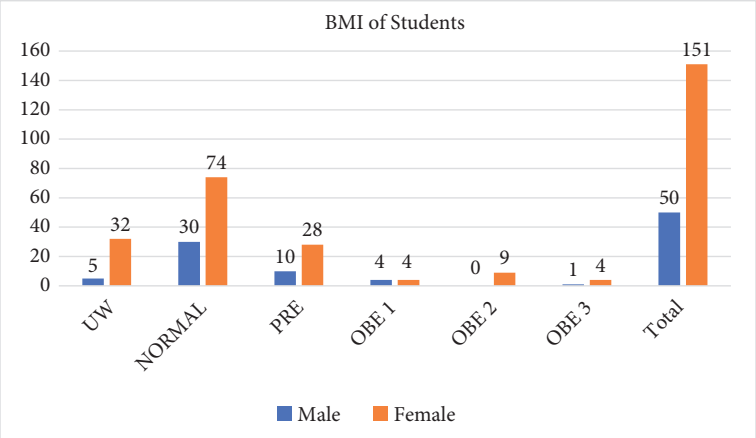
3. RESULTS

A total of 201 students from different faculties, including health sciences, engineering, and business and accountancy, participated in this study. The majority of the volunteers for this study were females, constituting 75.1%. The mean age of the study group was 21.55 years (SD ± 2.13 years). Most of the students involved in this study were Malay (63.7%), followed by Indians (29.9%), and the rest being Chinese.

The majority were undergraduate students (91%), with most of them being full-time students, while 9% of them were working students. About 64.7% of the participants have a family income of less than RM 3000. The majority of the students were unmarried and were currently living in dormitories with housemates.

On calculating the BMI of the study population, 104 out of 201 had normal BMI, while 22 of the study group (10.9%) were obese (Figure 1). There were more underweight students among the female students (21.2%) as compared to males (10%). There were also more pre-obese and obese among female students (Figure 1).

Figure 1: BMI of students



In the study, the majority of the students (54.7%) had an average of 5–6 h of sleep per day, with 15 males and 44 females having 6 h of sleep. The least hours of sleep per day obtained by male students was 4 h, and for females, it was 2 h. The most hours of sleep per day obtained by both male and female students was 12 h, seen in 0.99% of the study population (Figure 2).

In this study, most of the students had an average ESS score of 9–12. About 71 (35.3%) had normal daytime sleepiness, while 130 (64.6%) had excessive daytime sleepiness. Among them, 65 (32.3%) showed mild excessive daytime sleepiness, 47 (23.3%) showed moderate excessive daytime sleepiness, and 18 (8.9%) showed severe excessive daytime sleepiness. The majority of female students had scored normal (41%), while only 18% of male students had normal ESS scores. On the other hand, the majority of male students (76%) had mild-to-moderate daytime sleepiness, while 49% of female students had mild-to-moderate daytime sleepiness based on ESS scores. About 9.9% of female students and 6% of male students had severe daytime sleepiness (Figure 3).

3.1. Correlation Between ESSs and BMI of Students

In the study, 37 students were underweight, 104 had normal weight, 38 were pre-obese, and 8 were obese students. The mean ESS for underweight students was 10.08 (SD ± 3.94), while the mean ESS for students with normal weight was 10.66 (SD ± 4.83). Independent samples *t*-test done to compare the ESSs among the students under the BMI class of underweight (UW) and normal weight showed no significant difference between the two groups (p=0.511).

Figure 2: Average sleep hours obtained by the students

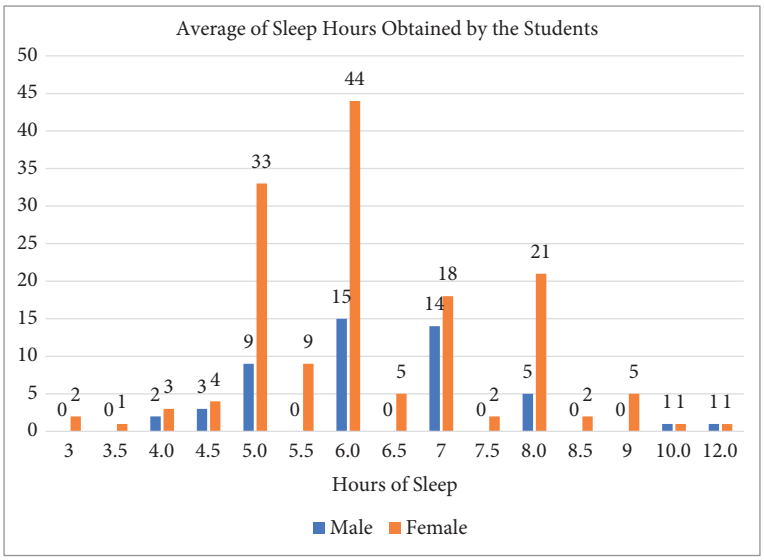


Figure 3: ESSs obtained in the study group

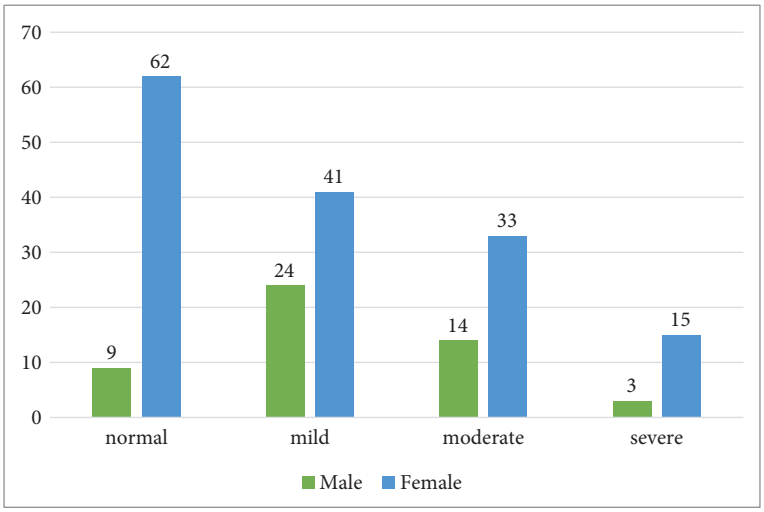


Figure 4: Group statistics of ESSs among students with a BMI of being underweight (UW) and normal

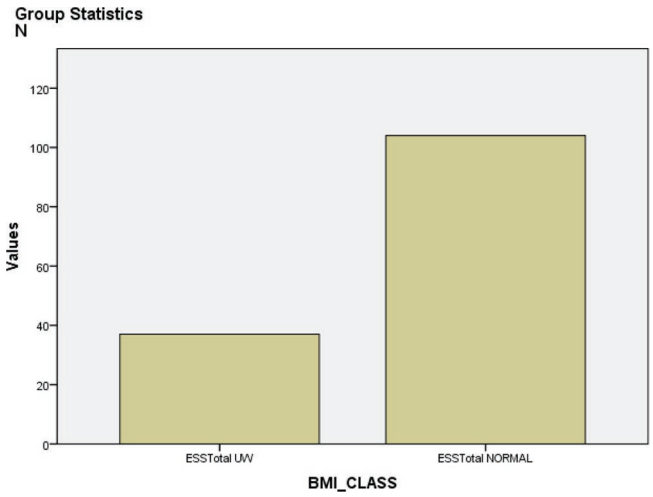
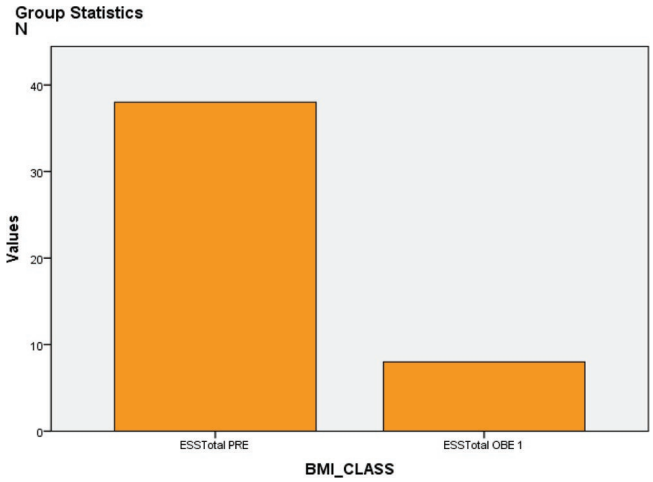


Figure 5: Group statistics of BMI classes (pre-obese or overweight and obesity class 1) with the ESSs



There were 38 pre-obese students, with mean ESSs of 9.74 (SD ± 4.422), while 8 students who belonged to the obesity class had mean ESSs of 10.13 (SD ± 4.842). Independent samples *t*-test was done on this to compare the ESSs among the students with BMI class of pre-obese and obese, which showed no significant difference between the groups ($p = 0.711$) (Figure 5).

4. DISCUSSION

The current study involved 201 students from various courses and semesters of a private university in Shah Alam, Malaysia. The mean age of the study group was 21.55 years. The mean age of the sample population was similar to a study conducted by Vasconcelos HC *et al*. on Brazilian university students [11]. However, the current study population was younger than most other similar studies on ESS [2, 8, 13]. The majority of the students (75.1%) were females, which is similar to the study by Vasconcelos HC *et al*., who also had reported that 62.6% of their study group were women. However, there are other studies that have reported a higher percentage of males when compared to females [10]. Most of the students involved in this study were Malay (63.7%) and Indians (29.9%). Full-time students living in hostels made up most of the participants of this study.

Anthropometric measurements were employed: NC, AC, height, and weight, and the BMI was calculated and related to the ESS, which was used to measure the daytime sleepiness among students.

The average BMI of the study group was 23.2. Most of the students (51.7%) in the study had normal BMI, while 10% of male students had class 1 obesity and 10% of female students were overweight. An interesting observation was that 32% of female students were underweight. Similar observations were reported on Brazilian female university students by Vasconcelos *et al*. in 2013, and the reason cited for females being underweight was the quest for a small and lean body to attain a specific beauty standard [10].

Aside from the BMI, NC and AC were also measured. In this study population, the average NC was 34.7 cm, without taking into account the gender. In a previous study done in Brazil, their average NC, without taking into account gender, was 33.7 cm, which is comparable with our results. In other similar studies on older populations, NC >40 has been reported [8].

The average AC of the students in our study without taking into account the gender was 77.1 cm, which is within the normal range. A previous study on university students also reported an average of AC being 79.1 cm [10]. Thus, it can be concluded that the current study population has slightly smaller AC values. Both the NC and AC in this study were within the normal range, which is much lesser than the values in previous similar studies [8, 18] on slightly older populations. Higher values of AC and NC have been revealed in previous studies [13]. A study in Rio de Janeiro also reported an increase in AC in 15% of university students [14]. The lower AC in this study can be attributed to the smaller stature of the south–east Asian population and the study being conducted on young adults.

It is a well-known fact that an adequate amount of sleep relieves mental and physical stress. Students have challenging lifestyles that may lead to stress, and the stress may lead to altered sleep schedules. Effects of inadequate sleep include adverse effects on learning process and bodily function. It also may lead to depression, anxiety, hypertension, cardiovascular diseases, diabetes, and obesity. Research studies have shown that students who sleep more perform better. In the current study, majority of the students had 6 h of sleep, while the National Sleep Foundation has suggested that the sufficient sleeping hours for young adults is from 7 to 9 h. Shilpa *et al.,* in their study in 2018, made an observation that all the anthropometric parameters were higher in individuals who had inadequate sleep [1].

For evaluating the sleep quality, we used the ESS questionnaire. We observed that the average ESS of the study population was10.32. About 71 (35.3%) had normal daytime sleepiness, while 130 (64.6%) had excessive daytime sleepiness. Among them, 65 (32.3%) showed mild excessive daytime sleepiness, 47 (23.3%) showed moderate excessive daytime sleepiness, and 18 (8.9%) showed severe excessive daytime sleepiness. The majority of female students had scored normal, while the majority of male students had mild-to-moderate daytime sleepiness on ESS. This finding was supported by research done by Boyes *et al*. in 2017 [15]. Previous studies have stated that the male population was more prone to being overweight and having sleep disorders. Furthermore, there have been claims that women tend to have higher basic wake drive, which leads them to have lower ESSs [16]. There are other studies that have reported no significant association between gender and sleep quality [12, 17].

The results of this study show no statistical significant correlation between the ESSs and BMI of students. A study done by Singla *et al*. has also concluded similarly [18].

This study also investigated the correlation between the sleep quality using the ESS questionnaire with anthropometric measurements such as NC and AC. Multiple previous studies [8] have shown a positive correlation between the ESS and NC. They discovered that the ESS increases as the BMI and NC increase [8]. Pinto *et al*. also concluded that NC is the best anthropometric measurement for predicting respiratory obstruction [19]. In the study done by Rusu *et al*., in 2010, on subjects having type II diabetes, obesity, and OSA, they observed that the tendency to have OSA increases with the increase of AC and BMI [20]. However, this study showed no significant correlation between the NC, AC, and BMI with ESSs. This can be explained by taking into consideration the age of the study population in the previous studies that was from 18 to 74 years, which is much elder to the current student population. The current study also involved students with normal BMI, smaller NC, and lesser AC. Besides, most of the subjects (90%) of previous studies already had OSA, while the current study was on mostly healthy university students who had never undergone an overnight polysomnography, which is a standard OSA diagnostic tool. Hence, the different outcomes between this study and previous studies.

5. CONCLUSION

In conclusion, the findings in this study are a variation from earlier studies on this topic, as the majority of students involved in this study had a normal BMI and a small percentage of the students were underweight and overweight. Furthermore, the anthropometric measurements of this study population were slightly smaller than what were suggested to be the cutoff values in multiple previous studies. The majority of the male subjects had higher normal daytime sleepiness in ESS, while most of the female subjects had ESSs, which were normal. The current study has observed that there is no correlation between the sleep quality and the BMI. No significant correlation between ESSs and anthropometric measurements of students was observed. However, an abnormal amount of weight having a negative impact on the sleep quality was observed.

5.1. Limitations of This Study

In this study, there is oversampling of the female population by three-fold. This is due to the large number of female university students on campus. Furthermore, some of the subjects involved in this study were noncooperative; both female and male students expressed their uneasiness when asked for permission to measure their height, weight, and abdominal circumference.

Female students, especially, are insecure when it comes to measurements of their body parts. The small sample size in this study may have affected the results. BMI reference levels of western populations were used for studying Asian subjects.

5.2. Recommendation

The authors recommend the use of appropriate BMI references for Asian populations in future studies on a larger population.

Acknowledgment

The authors would like to thank the Management and Science University for its support. They are grateful to all the participants for their time and cooperation.

Authors' Contributions

This work was carried out with the collaboration of all authors. All authors contributed equally to this work.

Conflict of Interest

None.

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