

Excessive daytime sleepiness and academic performance among dental students in north-east of peninsular Malaysia

*Rosmaliza Ramli, Nurhafizah Ghani, Nurulezah Hasbullah**

Basic and Medical Sciences Unit, School of Dental Sciences, Health Campus, Universiti Sains Malaysia, Kubang Kerian, Kelantan, Malaysia

drezah@usm.my

Abstract

Introduction: The prevalence of excessive daytime sleepiness (EDS) is high among college and university students. EDS has been associated with poor concentration and forgetfulness that affect poor academic performance. **Objective:** This study aimed to evaluate the effect of EDS on academic performance among undergraduate dental students at the School of Dental Sciences in Universiti Sains Malaysia. **Materials and Methods:** A cross-sectional study involving 198 students of year two through year five were selected. Subjects were asked to complete a guided questionnaire which consists of socio-demographic profiles and Epworth Sleepiness Scale (ESS). Data were analyzed and presented as percentages of occurrence. Chi-square test and multiple regression analysis were performed to assess the association between ESS score and end of year examination results as a measure of students' academic performance as well as other potential confounders—gender, body mass index (BMI) and ethnicity. Statistical significance was set at $p < 0.05$. **Results:** The prevalence of EDS was 45% with students having mild, moderate and severe sleepiness were 38.4%, 5.5% and 1.5%, respectively. EDS was more common in males (51.9%) than females (43.2%). There was no significant association between ESS score and end of year results for each year ($p > 0.05$). Similarly, BMI, gender and ethnicity also were not significantly associated with sleepiness. **Conclusion:** The high prevalence of EDS among dental students is a call for concern as it may affect their clinical practice and their mental and health wellbeing.

Keywords: excessive daytime sleepiness, academic performance, dental students

*Author for Correspondence

Cite as: Rosmaliza, R., Nurhafizah, G., Nurulezah, H. (2022). Excessive daytime sleepiness and academic performance among dental students in north-east of peninsular Malaysia. Asian Journal of Medicine and Biomedicine, 6(1), 48–56.

DOI: <https://doi.org/10.37231/ajmb.2022.6.1.469>

Introduction

Sleep is an essential component of life for human being and all other animal species ^[1]. Sleep saves energy up to 4-folds ^[2] and restores vigilant attention important for cognitive performance tasks ^[3]. Both sleep loss (duration of less than 5 or 6 hours) and excessive sleep (duration of more than 9 or 10 hours) are associated with a significant increase in mortality, diabetes, cardiovascular disease, coronary heart disease and obesity ^[4,5].

The biological drive to sleep, known as sleepiness is a common problem across the globe ^[6-9]. The International Classification of Sleep Disorders-3 (ICSD-3) defines excessive daytime sleepiness (EDS) as daily episodes of an irrepensible need to sleep or daytime lapses into sleep ^[10]. EDS is associated with sleep deprivation, sleep apnea, insomnia, restless leg disorder and periodic limb movement disorder, circadian rhythm sleep disorders and hypersomnia ^[10,11].

EDS is associated with numerous negative consequences. It is related to a greater risk of motor vehicle accidents ^[12-14], has negative impacts on professional performance ^[15-17] and poor academic performance in students at all education levels ^[18-22]. A wealth of evidence also suggests that there exist other predictors for sleepiness: these include age ^[23,24], gender ^[6,23,25], body mass index (BMI) ^[8,26-29], and ethnicity ^[30-33].

Sleepiness is a subjective feeling and may be accompanied by bodily physiological changes—the cognitive, behavioral and biological changes. Due to its subjectivity, several methods to measure sleepiness have been developed to assess the severity of sleepiness and the need for intervention. Sleepiness can be measured using several methods such as the assessment of level of sleepiness that looks into its introspective, physiological, and manifest components ^[34] or via objective or subjective tools ^[35]. The Epworth Sleepiness Scale (ESS) developed by Johns in 1991 ^[36], is an example of a subjective tool for measuring daytime sleepiness. ESS is a set of questionnaires which measures sleepiness propensity taking into account the behavioral changes related to sleepiness. Wealth of evidence supports the use of ESS as a reliable measurement tool for group assessment as it shows internal consistency within the studied group but not at the individual level ^[37-41].

In Malaysia, studies on sleepiness in different population have been reported. However, to the best

of our knowledge, studies on local undergraduate dental students are still lacking. As dental students in Malaysia are already exposed to performing clinical practice in real patients during undergraduate training, having a sound cognitive function to perform clinical tasks is of utmost importance. Previous study comparing EDS among undergraduate art/commerce, science and dental/medical students also showed that EDS was higher in undergraduate dental and medical students compared to other study streams ^[42], which could be due to excessive academic load in dental/medical stream. Thus, this study was aimed to determine the prevalence of sleepiness and its association with academic performance among undergraduate dental students at the School of Dental Sciences, Universiti Sains Malaysia (USM).

Materials and Methods

This study was conducted in accordance with ethical approval by the Human Research and Ethics Committee, Universiti Sains Malaysia (Ethics no. USMKK/PPP/JEPeM [267.3.(1.18)]). The questionnaire was self-administered, and informed consent was obtained from all respondents.

One hundred and ninety-eight dental students (n=198) from the School of Dental Sciences, USM aged between 20 to 26 years old were involved in this cross-sectional study. All dental students of year two through year five were included in this study as they underwent the same dental curriculum and examination format. The first-year dental students were excluded from this study as they underwent the new dental curriculum and examination format which might contribute to different sleeping patterns and academic performance between these students. Academic performance was assessed by referring to the end of year exam results for each particular year. Selected students were asked to complete a guided questionnaire which consists of socio-demographic profiles, academic details, pre-university courses, entrance qualifications and Malaysian University English Test (MUET) results as well as Epworth Sleepiness Scale (ESS). ESS was used as an instrument to measure the degree of daytime sleepiness among the students. Students were classified as having normal, mild, moderate, and severe sleepiness according to their ESS score. A score between 0 to 10 was categorized as “normal” while scores of 11 to 14, 15 to 17 and 18 and more were categorized as mild, moderate and severe sleepiness, respectively.

BMI was categorized using the BMI cut-off point for Asian population^[43] which values are slightly lower than that of the international BMI cut-off point. For Asian population BMI for underweight is an index of <18.5, normal >18.5 to 22.99, overweight 23 to 27.5 and obese >27.5.

Data were analyzed using IBM SPSS Statistics version 26. The demographic data of the students involved in this study were presented as percentage. Chi-square test and multiple regression analysis were performed to assess the association between ESS score and the hypothesized predictors— end of year examination results, BMI, gender, and ethnicity. Statistical significance was set at $p < 0.05$.

Results

One hundred and ninety-eight dental students (n=198) aged between 20 to 26 years participated in this study. Majority of the students were female (73.7%) with the most common ethnic group was Malay (51.5%) followed by Chinese (43.9%), Indians (4.0%) and other ethnicities (0.5%). The measurement of BMI was categorized into underweight, normal, overweight and obese according to the BMI cut off points for Asian population^[43,44]. Majority of the students had their BMI fell within normal range (112 (56.6%)), while similar number of students were underweight and overweight, [38 (19.2%)] and only few students were obese [10 (5.1%)] (Table 1).

Table 1 Sociodemographic profile of participants

Sociodemographic variable	Category	N (%)
Gender	Males	52 (26.3)
	Females	146 (73.7)
Ethnicity	Malay	102 (51.5)
	Chinese	87 (43.9)
	Indian	8 (4.0)
	Others	1 (0.5)
BMI	Underweight	38 (19.2)
	Normal	112 (56.6)
	Overweight	38 (19.2)
	Obese	10 (5.1)
Academic qualification	Matriculation	159 (80.3)
	STPM	28 (14.1)
	A-level	5 (2.5)
	Others	6 (3.0)
MUET	Band 2	2 (1.0)
	Band 3	27 (13.6)
	Band 4	127 (64.1)
	Band 5	40 (20.2)

Data on academic qualification revealed that majority of the students were from matriculation (80.3%), followed by Sijil Tinggi Pelajaran Malaysia (STPM) (14.1%), A-level (2.5%) and others i.e. diploma (3.0%). As for MUET, the pre-requisite entrance English test for all Malaysian universities, of which higher band reflects better performance, most of the students scored Band 4 (64.1%), followed by Band 5 (20.2%), and Band 3 (13.6%) while both Band 2 and Band 6 contributed the least (1.0%) (Table 1).

The level of sleepiness among dental students was measured using ESS score. Sleepiness was observed in 90 students with the prevalence of 45%. There was a female predilection for sleepiness with male to female ratio 3:7. With regard to the severity of sleepiness, most students had only mild sleepiness with a slightly higher percentage of male (42.30%) compared to female (36.98%). Lower percentage of students had moderate sleepiness (5.76.7% and 5.47% in male and female, respectively) and only two males and one female had severe sleepiness (3.84% and 0.68%, respectively) (Table 2).

The mean ESS score for each year was 10.11 ± 3.20 (9.22 - 11.00), 9.57 ± 2.63 (8.73 - 10.41), 10.27 ± 3.45 (9.39 - 11.15) and 10.06 ± 3.40 (9.03 - 11.10) for year 2, year 3, year 4 and year 5, respectively. Year 2 had the most students with sleepiness problem (mild, moderate and severe sleepiness were 51.92%, 1.92% and none, respectively), followed by year 4 (mild, moderate and severe sleepiness were 45.16%, 3.22% and 3.22%, respectively), year 3 (mild, moderate and severe sleepiness were 30.00%, 5.00% and none, respectively) and year 5 (mild, moderate and severe sleepiness were 20.45%, 13.63% and 2.27, respectively) (Table 2).

With regard to BMI category, the underweight students had ESS score mean of 10.97 ± 3.48 (9.82 - 12.11), the normal students 9.67 ± 3.03 (9.11 - 10.24), overweight students 10.02 ± 2.94 (9.05 - 10.99) and the obese students 10.7 ± 4.59 (7.41 - 13.98). Most students with sleepiness problem were either overweight or obese. The mild, moderate and severe sleepiness for overweight students were 47.36%, 2.63% and none, respectively while for obese students were 30.00%, 20.00%, and none, respectively. The total number and percentage of each BMI category with regard to the severity of sleepiness is presented in Table 2. However, even when EDS was categorized into “yes EDS” for students having ESS score >10 and “no EDS” for student with ESS score ten or less, there was no

significant association between overweight and obese with students with EDS (Table 3).

Table 2 Sleepiness profiles according to sociodemographic categories

Sociodemographic variable	Total ESS score mean \pm SD (95% CI)	ESS category [n (%)]			
		Normal (0-10)	Mild (11-14)	Moderate (15-17)	Severe (\geq 18)
Gender					
Male	10.19 \pm 3.56 (9.19 - 11.18)	25 (48.07)	22 (42.30)	3 (5.76)	2 (3.84)
Female	9.99 \pm 3.08 (9.48 - 10.49)	83 (56.84)	54 (36.98)	8 (5.47)	1 (0.68)
Year of study					
Year 2	10.11 \pm 3.20 (9.22 - 11.00)	24 (46.15)	27 (51.92)	1 (1.92)	0
Year 3	9.57 \pm 2.63 (8.73 - 10.41)	26 (65.00)	12 (30.00)	2 (5.00)	0
Year 4	10.27 \pm 3.45 (9.39 - 11.15)	30 (48.38)	28 (45.16)	2 (3.22)	2 (3.22)
Year 5	10.06 \pm 3.40 (9.03 - 11.10)	28 (63.63)	9 (20.45)	6 (13.63)	1 (2.27)
BMI					
Underweight	10.97 \pm 3.48 (9.82 - 12.11)	18 (47.36)	14 (36.84)	4 (10.52)	2 (5.26)
Normal	9.67 \pm 3.03 (9.11 - 10.24)	66 (58.92)	41 (36.60)	4 (3.57)	1 (0.89)
Overweight	10.02 \pm 2.94 (9.05 - 10.99)	19 (50.00)	18 (47.36)	1 (2.63)	0
Obese	10.7 \pm 4.59 (7.41 - 13.98)	5 (50.00)	3 (30.00)	2 (20.00)	0
Academic performance					
<50	10.37 \pm 2.86 (9.42 - 11.33)	17 (45.94)	19 (51.35)	1 (2.70)	0
50 - 59	10.17 \pm 3.52 (9.41 - 10.93)	44 (51.76)	33 (38.82)	5 (5.88)	3 (3.52)
60 - 69	9.69 \pm 2.94 (8.97 - 10.42)	40 (60.60)	23 (34.84)	3	0
70 - 100	10 \pm 3.56 (7.45 - 12.54)	7 (70.00)	1 (10.00)	2 (20.00)	0
Ethnicity					
Malay	10.45 \pm 2.89 (9.88 - 11.02)	51 (50.00)	44 (43.13)	6 (5.88)	1 (0.98)
Chinese	9.62 \pm 3.54 (8.86 - 10.37)	53 (60.91)	27 (31.03)	5 (5.74)	2 (2.29)
Indian	9.75 \pm 3.01 (7.23 - 12.26)	3 (37.50)	5 (62.50)	0	0
Others	-	1 (100.00)	0	0	0

Table 3 Association of sociodemographic categories with subjects with EDS and without EDS

Sociodemographic variable	Category	Excessive daytime sleepiness		χ^2	p
		No N (%)	Yes N (%)		
Gender	Male	25 (48.08)	27 (51.92)	1.19*	0.331
	Female	83 (56.85)	63 (43.15)		
Ethnicity	Malay	51 (50.00)	51 (50.00)	2.684**	0.249
	Chinese	53 (60.92)	34 (39.08)		
	Indian and others	4 (44.44)	5 (55.56)		
BMI	Underweight	18 (47.37)	20 (52.63)	2.057*	0.358
	Normal	66 (58.93)	46 (41.07)		
	Overweight & obese	24 (50.00)	24 (50.00)		
Year of study	Year 2	24 (46.15)	28 (53.85)	5.655*	0.133
	Year 3	26 (65.00)	14 (35.00)		
	Year 4	30 (48.39)	32 (51.61)		
	Year 5	28 (63.64)	16 (36.36)		
Academic performance	< 50 marks	91 (56.52)	70 (43.48)	1.357*	0.275
	>50 marks	17 (45.95)	20 (54.05)		

*Pearson Chi-Square

** Fisher's Exact Test

A multiple regression analysis was performed to assess the association between ESS score and end of year examination results, BMI, gender and ethnicity. All of the assumptions were met. Results of the analysis indicated that there was no significant correlation between sleepiness and end of year examination results, BMI, gender and ethnicity of the study among all students year 2 through year 5. The overall model explains only 8.1% variation of ESS score for year 2, 2.6% for year 3, 5.9% for year 4, and 7.5% for year 5 (Table 4).

Table 4 Multiple regression analysis for variables predicting EDS (N = 198)

Year of study	R ² value	p value
2	0.081	0.397
3	0.026	0.915
4	0.059	0.474
5	0.075	0.541

Discussion

The prevalence of daytime sleepiness among college and university students ranges from 10.5% to 71.1% [19,21,42,45-48]. Finding from our study falls within this range; we found 45% of the undergraduate dental students has EDS assessed by the ESS score. Indeed, different methods are available for sleepiness measurement [35,49]. Thus, the variation in the prevalence of sleepiness between studies may be contributed by the tool used to assess sleepiness. The use of ESS as a measurement tool for sleepiness has been shown to be a reliable tool for group assessment as it shows internal consistency within the studied group but not at the individual level [38,39]. A meta-analysis on measurement of sleepiness in the diagnoses of obstructive sleep apnea further demonstrated that although snoring, tiredness, observed apnea, blood pressure, BMI, age, neck circumference, and gender (STOP-BANG) questionnaire which assesses clinical features of apnea via eight “yes/no” items is more sensitive in detecting sleep apnea, its specificity is less compared to ESS in the detection of this disorder [50]. The different courses taken by the students may also have an impact on the variation in daytime sleepiness prevalence as reported by Kaur and Singh [42] and Abdalqader [51]. In both studies, they found that dental and medical students had higher prevalence of daytime sleepiness compared to those

of non-medical students due to the higher medical course academic load and hectic schedule.

Many studies reported female preponderance when looking at the EDS within their study population [42,45,47,52]. We found similar gender predilection in our study. However, despite the female preponderance, gender was not a significant predictor for daytime sleepiness in our study. A study conducted on similar group involving 430 undergraduate dental students at the University of Pernambuco, Brazil also found no significant association between gender and daytime sleepiness among their study population [48]. However, a study on 658 Japanese college students was not in agreement with our finding. Their findings showed that females had a significantly higher daytime sleepiness compared to males, and the severity of daytime sleepiness in females increased with the severity on the premenstrual syndrome with the severest form of premenstrual dysphoric disorder was also reported among their female subjects [53].

Ethnicity has also been associated with sleepiness [30-33]. Sleepiness measured with ESS score, was found to be higher in African-Americans than Caucasians [31]. Another study that measured sleepiness using ESS score and self-report of feeling sleepy less than or equal to 5 days per month, reported that White participants were less likely to have sleepiness problem compared to African-Americans and Hispanic participants [32]. However, a more recent study comparing daytime sleepiness using Stanford Sleepiness Scale between Black, Latinx and Asian youth found no racial differences within study population [33]. Within three major ethnicities exist in Malaysia involved in our study, Indian and other ethnicities have the highest prevalence of excessive sleepiness (55.56%), followed by Malay (50.00%) and Chinese (39.08%). An interesting finding from an epigenome-wide analysis of daytime sleepiness in multi-ethnic study suggests that several methylation sites in multiple genes could be implicated in daytime sleepiness [54].

Obesity has also been linked to sleepiness [8,26-29]. Obstructive sleep apnea (OSA) is one of the comorbidities that has been closely associated with obesity [55-57]. OSA consists of episodes of recurrent partial or complete collapse of the upper airway flow during sleep which result in reduced (hypopnea) or absent (apnea) for at least 10 seconds. During these episodes, there could be cortical arousal or a fall in blood oxygen saturation which in turn, could result in EDS. In our study, obesity is determined using the BMI cut-off point adjusted for Asian population. Our results found no significant association between EDS and BMI among our study participants. Several studies are in agreement with our findings. Kaur and Singh studied EDS among 1215 college students

pursuing various degrees including dental and medical degrees in the city of Chandigarh, India [42]. They found EDS was associated with coffee/tea consumption, alcohol consumption and smoking but not BMI. Similar findings on BMI and EDS have also been reported by Ng and Tan [21,30,45]. Indeed, EDS have been associated with other factors such as sleep behavior, work/activity- and medical-related factors, psychological stress and premenstrual syndrome [21,30,53,58,59].

Daytime sleepiness has negative impacts on work and academic productivity [19,21,22]. However, our findings showed that the ESS score and academic performance assessed by end of year examination results were not significantly associated with EDS. Our findings are in favor with El Hangouche [47] who reported that the quality of sleep but not daytime sleepiness was significantly associated with low academic performance. The similarity between our finding and Hangouche's could be attributed by the similar method of assessment for academic performance which was measured by the annual end of year exam results. Assessment of academic performance via student self-report in several other studies also reported similar findings [60,61]. Findings from Hangouche and other studies also demonstrated that sleep deprivation and the quality of sleep were more significantly associated with poor academic performance than that of EDS [22,62-64]. Other cofounders for poor academic performance have also been reported previously. For example, psychological stress has been associated with low academic performance among college and university students [65-67]. Amidst the Covid-19 pandemic, the psychological stress is made worse due to uncertainties of their academic performance and future career prospects as reported in a cross-sectional multicountry study on Asian university students, which includes Malaysia [68]. Besides that, sleep wake cycle, study habits and lifestyle have also been linked to poor academic performance [69-74].

Some limitations in this study are worth mentioning. This study was conducted in USM, hence the results cannot be generalized to all dental students in Malaysia. In addition, assessment of daytime sleepiness in this study was solely based on the questionnaire and may have a degree of interpersonal subjectivity. There are other factors that can contribute to excessive sleepiness and affect academic performance such as socioeconomic status, life habits, and psychological factors that were not assessed in this study. These cofactors may also affect findings from this study and as such, should be considered in future studies.

Conclusion

Within our study population, almost half of the dental students had EDS. Although EDS was not significantly associated with academic performance of our subjects, the high prevalence of sleepiness is a cause for concern especially for students in clinical years, as it can affect their performance during clinical practice. There is also a need to look into other factors associated with EDS among the students especially with regard to psychological problem which has been shown to be associated with sleepiness in other studies. Similar studies on larger scale are also necessary to confirm our findings which could serve as a baseline in providing guideline for students to improve their sleep quality subsequently have a better focus performing their academic activities.

Conflict of interests

Authors have no conflict of interests.

Funding

This research was funded by an internal incentive grant from Universiti Sains Malaysia.

Author's contribution

NH owned the research idea and contributed to study design, data gathering and analysis. NG and RR contributed to data gathering and manuscript editing. NH and RR contributed to manuscript writing. All authors contributed to data interpretation and approved the final manuscript.

Acknowledgement

We would like to extend our appreciation to Nur Alisa Akram and Liew Sook Wei for their contribution in data collection and to Ts. Dr Mohamad Arif Awang Nawi for his assistance in statistics.

References

1. Anafi RC, Kayser MS, Raizen DM. Exploring phylogeny to find the function of sleep. *Nature Reviews Neuroscience*. 2019;20(2):109-116.
2. Schmidt MH, Swang TW, Hamilton IM, Best JA. State-dependent metabolic partitioning and energy conservation: A theoretical framework for understanding the function of sleep. *PLoS One*. 2017;12(10):e0185746.
3. Hudson AN, Van Dongen HP, Honn KA. Sleep deprivation, vigilant attention, and brain function: a review. *Neuropsychopharmacology*. 2020;45(1):21-30.
4. Jike M, Itani O, Watanabe N, Buysse DJ, Kaneita Y. Long sleep duration and health outcomes: a

- systematic review, meta-analysis and meta-regression. *Sleep medicine reviews*. 2018;39:25-36.
5. Itani O, Jike M, Watanabe N, Kaneita Y. Short sleep duration and health outcomes: a systematic review, meta-analysis, and meta-regression. *Sleep medicine*. 2017;32:246-256.
 6. Kolla BP, He J-P, Mansukhani MP, Frye MA, Merikangas K. Excessive sleepiness and associated symptoms in the US adult population: prevalence, correlates, and comorbidity. *Sleep health*. 2020;6(1):79-87.
 7. Liu Y, Zhang J, Li SX, et al. Excessive daytime sleepiness among children and adolescents: prevalence, correlates, and pubertal effects. *Sleep medicine*. 2019;53:1-8.
 8. Maugeri A, Medina-Inojosa JR, Kunzova S, et al. Sleep duration and excessive daytime sleepiness are associated with obesity independent of diet and physical activity. *Nutrients*. 2018;10(9):1219.
 9. Suzuki H, Fujimoto K. A retrospective study about the causes of excessive daytime sleepiness except for sleep-disordered breathing in Japan. 2018;52(62):PA4369.
 10. Sateia MJ. International classification of sleep disorders. *Chest*. 2014;146(5):1387-1394.
 11. Thorpy M. International classification of sleep disorders. *Sleep disorders medicine*. Springer; 2017:475-484.
 12. Bioulac S, Franchi J-AM, Arnaud M, et al. Risk of motor vehicle accidents related to sleepiness at the wheel: a systematic review and meta-analysis. *Sleep*. 2017;40(10):1-10.
 13. Gottlieb DJ, Ellenbogen JM, Bianchi MT, Czeisler CA. Sleep deficiency and motor vehicle crash risk in the general population: a prospective cohort study. *BMC medicine*. 2018;16(1):1-10.
 14. Moradi A, Nazari SSH, Rahmani K. Sleepiness and the risk of road traffic accidents: A systematic review and meta-analysis of previous studies. *Transportation research part F: traffic psychology and behaviour*. 2019;65:620-629.
 15. Mullins HM, Cortina JM, Drake CL, Dalal RS. Sleepiness at work: a review and framework of how the physiology of sleepiness impacts the workplace. *Journal of Applied Psychology*. 2014;99(6):1096.
 16. Lin M-H, Huang Y-C, Chen W-K, Wang J-Y. Sleepiness and injury risk in emergency medical service workers in Taiwan. *PLoS one*. 2020;15(2):e0229202.
 17. Gharibi V, Mokarami H, Cousins R, Jahangiri M, Eskandari D. Excessive daytime sleepiness and safety performance: comparing proactive and reactive approaches. *The international journal of occupational and environmental medicine*. 2020;11(2):95.
 18. Hershner SD, Chervin RD. Causes and consequences of sleepiness among college students. *Nature and science of sleep*. 2014;6:73-84.
 19. Zeek ML, Savoie MJ, Song M, et al. Sleep duration and academic performance among student pharmacists. *American journal of pharmaceutical education*. 2015;79(5):1-8.
 20. Kohyama J. Self-reported academic performance and lifestyle habits of school children in Japan. *International Journal of Child Health and Nutrition*. 2017;6(3):90-97.
 21. Demir G. Daytime sleepiness and related factors in nursing students. *Nurse education today*. 2017;59:21-25.
 22. Al Shammari MA, Al Amer NA, Al Mulhim SN, Al Mohammedsaleh HN, AlOmar RS. The quality of sleep and daytime sleepiness and their association with academic achievement of medical students in the eastern province of Saudi Arabia. *Journal of Family & Community Medicine*. 2020;27(2):97.
 23. Fatani A, Al-Rouqi K, Al Towairky J, et al. Effect of age and gender in the prevalence of excessive daytime sleepiness among a sample of the Saudi population. *Journal of epidemiology and global health*. 2015;5(4):S59-S66.
 24. Campbell IG, Burright CS, Kraus AM, Grimm KJ, Feinberg I. Daytime sleepiness increases with age in early adolescence: a sleep restriction dose-response study. *Sleep*. 2017;40(5):zsx046.
 25. Berger M, Hirotsu C, Haba-Rubio J, et al. Risk factors of excessive daytime sleepiness in a prospective population-based cohort. *Journal of sleep research*. 2021;30(2):e13069.
 26. Vgontzas AN, Bixler EO, Tan T-L, Kantner D, Martin LF, Kales A. Obesity without sleep apnea is associated with daytime sleepiness. *Archives of internal medicine*. 1998;158(12):1333-1337.
 27. Panossian LA, Veasey SC. Daytime sleepiness in obesity: mechanisms beyond obstructive sleep apnea—a review. *Sleep*. 2012;35(5):605-615.
 28. Slater G, Pengo MF, Kosky C, Steier J. Obesity as an independent predictor of subjective excessive daytime sleepiness. *Respiratory medicine*. 2013;107(2):305-309.
 29. Minkwitz J, Sander C, Himmerich H, et al. Reported and Recorded Sleepiness in Obesity and Depression. *Frontiers in psychiatry*. 2020;11:1-12.
 30. Ng TP, Tan WC. Prevalence and determinants of excessive daytime sleepiness in an Asian multi-ethnic population. *Sleep medicine*. 2005;6(6):523-529.
 31. Sanford SD, Lichstein KL, Durrence HH, Riedel BW, Taylor DJ, Bush AJ. The influence of age, gender, ethnicity, and insomnia on Epworth sleepiness scores: a normative US population. *Sleep Medicine*. 2006;7(4):319-326.
 32. Baron KG, Liu K, Chan C, Shahar E, Hasnain-Wynia R, Zee P. Race and ethnic variation in excessive daytime sleepiness: the multi-ethnic study of atherosclerosis. *Behavioral Sleep Medicine*. 2010;8(4):231-245.
 33. Yip T, Cheon YM, Wang Y, Cham H, Tryon W, El-Sheikh M. Racial disparities in sleep: Associations with discrimination among ethnic/racial minority adolescents. *Child development*. 2020;91(3):914-931.
 34. Carskadon MA, Dement WC. Daytime sleepiness: quantification of a behavioral state. *Neuroscience & Biobehavioral Reviews*. 1987;11(3):307-317.
 35. Shen J, Barbera J, Shapiro CM. Distinguishing sleepiness and fatigue: focus on definition and measurement. *Sleep medicine reviews*.

- 2006;10(1):63-76.
36. Johns MW. A new method for measuring daytime sleepiness: the Epworth sleepiness scale. *sleep*. 1991;14(6):540-545.
37. Spira AP, Beaudreau SA, Stone KL, et al. Reliability and validity of the Pittsburgh Sleep Quality Index and the Epworth Sleepiness Scale in older men. *Journals of Gerontology Series A: Biomedical Sciences and Medical Sciences*. 2012;67(4):433-439.
38. Kendzerska TB, Smith PM, Brignardello-Petersen R, Leung RS, Tomlinson GA. Evaluation of the measurement properties of the Epworth sleepiness scale: a systematic review. *Sleep medicine reviews*. 2014;18(4):321-331.
39. Taylor E, Zeng I, O'Dochartaigh C. The reliability of the Epworth Sleepiness Score in a sleep clinic population. *Journal of sleep research*. 2019;28(2):e12687.
40. Lapin BR, Bena JF, Walia HK, Moul DE. The Epworth Sleepiness Scale: validation of one-dimensional factor structure in a large clinical sample. *Journal of Clinical Sleep Medicine*. 2018;14(8):1293-1301.
41. Lee JL, Chung Y, Waters E, Vedam H. The Epworth sleepiness scale: Reliably unreliable in a sleep clinic population. *Journal of sleep research*. 2020;29(5):e13019.
42. Kaur G, Singh A. Excessive daytime sleepiness and its pattern among Indian college students. *Sleep medicine*. 2017;29:23-28.
43. Consultation WE. Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. *Lancet*. 2004;363(9403):157-163.
44. Misra A, Jayawardena R, Anoop S. Obesity in South Asia: phenotype, morbidities, and mitigation. *Current obesity reports*. 2019;8(1):43-52.
45. Zailinawati A, Teng C, Chung Y, Teow T, Lee P, Jagmohani K. Daytime sleepiness and sleep quality among Malaysian medical students. *The Medical journal of Malaysia*. 2009;64(2):108-110.
46. Huang C-F, Yang L-Y, Wu L-M, Liu Y, Chen H-M. Determinants of daytime sleepiness in first-year nursing students: a questionnaire survey. *Nurse education today*. 2014;34(6):1048-1053.
47. El Hangouche AJ, Jniene A, Abouddrar S, et al. Relationship between poor quality sleep, excessive daytime sleepiness and low academic performance in medical students. *Advances in medical education and practice*. 2018;9:631-638.
48. Angelin TJ, Mota KR, Santos VEd, Silva LC, Heimer MV. Evaluation of sleep quality and daytime sleepiness in Dentistry students. *Pesquisa Brasileira em Odontopediatria e Clínica Integrada*. 2020;20:e0003.
49. Baiardi S, Mondini S. Inside the clinical evaluation of sleepiness: subjective and objective tools. *Sleep and Breathing*. 2020;24(1):369-377.
50. Chiu H-Y, Chen P-Y, Chuang L-P, et al. Diagnostic accuracy of the Berlin questionnaire, STOP-BANG, STOP, and Epworth sleepiness scale in detecting obstructive sleep apnea: a bivariate meta-analysis. *Sleep medicine reviews*. 2017;36:57-70.
51. Abdalqader MA, Mohammed MF, Alhoot MA, Alwan MR, Halim A. Daytime sleepiness among medical and non-medical students and its impact on their academic performance. *Indian Journal of Physiotherapy & Occupational Therapy*. 2018;12(3):38-42.
52. Alotair H, BaHammam A. Gender differences in Saudi patients with obstructive sleep apnea. *Sleep and Breathing*. 2008;12(4):323-329.
53. Miura J, Honma R. Daytime sleepiness in relation to gender and premenstrual symptoms in a sample of Japanese college students. *Sleep and Biological Rhythms*. 2020;18(1):3-8.
54. Barfield R, Wang H, Liu Y, et al. Epigenome-wide association analysis of daytime sleepiness in the Multi-Ethnic Study of Atherosclerosis reveals African-American-specific associations. *Sleep*. 2019;42(8):zsz101.
55. Carter III R, Watenpaugh DE. Obesity and obstructive sleep apnea: or is it OSA and obesity? *Pathophysiology*. 2008;15(2):71-77.
56. Xu Z, Wu Y, Tai J, et al. Risk factors of obstructive sleep apnea syndrome in children. *Journal of Otolaryngology-Head & Neck Surgery*. 2020;49(1):1-7.
57. Fruh SM. Obesity: Risk factors, complications, and strategies for sustainable long-term weight management. *Journal of the American Association of Nurse Practitioners*. 2017;29(S1):S3-S14.
58. Isac C, Abraham J. Daytime sleepiness among Omani Nursing Students: Estimate of its determinants and impact on perceived stress. *Clinical Epidemiology and Global Health*. 2020;8(3):739-743.
59. Jaussent I, Morin C, Ivers H, Dauvilliers Y. Incidence, worsening and risk factors of daytime sleepiness in a population-based 5-year longitudinal study. *Scientific reports*. 2017;7(1):1-11.
60. Sameer HM, Imran N, Tarar TN. Excessive daytime sleepiness and its relation with quality of life and academic performance in medical students. *Khyber Medical University Journal*. 2020;12(4):299-304.
61. Perotta B, Arantes-Costa FM, Enns SC, et al. Sleepiness, sleep deprivation, quality of life, mental symptoms and perception of academic environment in medical students. *BMC Medical Education*. 2021;21(1):1-13.
62. Thomas PC, Sundar B. Sleep quality, day time sleepiness and academic performance in first year medical students. *Journal of Evolution of Medical and Dental Sciences*. 2019;8(39):2934-2939.
63. Maheshwari G, Shaikat F. Impact of poor sleep quality on the academic performance of medical students. *Cureus*. 2019;11(4):e4357.
64. Lawson HJ, Wellens-Mensah JT, Attah Nantogma S. Evaluation of sleep patterns and self-reported academic performance among medical students at the University of Ghana School of Medicine and Dentistry. *Sleep disorders*. 2019;2019:1-8.
65. Sohail N. Stress and academic performance among medical students. *J Coll Physicians Surg Pak*. 2013;23(1):67-71.

66. Kötter T, Wagner J, Brüheim L, Voltmer E. Perceived medical school stress of undergraduate medical students predicts academic performance: an observational study. *BMC medical education*. 2017;17(1):1-6.
67. Alipio M. Predicting academic performance of college freshmen in the philippines using psychological variables and expectancy-value beliefs to outcomes-based education: a path analysis. *EdArXiv*. 2020;
68. Chinna K, Sundarasan S, Khoshaim HB, et al. Psychological impact of COVID-19 and lock down measures: An online cross-sectional multicounty study on Asian university students. *Plos one*. 2021;16(8):e0253059.
69. Toscano-Hermoso MD, Arbinaga F, Fernández-Ozcorta EJ, Gómez-Salgado J, Ruiz-Frutos C. Influence of sleeping patterns in health and academic performance among university students. *International journal of environmental research and public health*. 2020;17(8):2760.
70. Alotaibi AD, Alosaimi FM, Alajlan AA, Abdulrahman KAB. The relationship between sleep quality, stress, and academic performance among medical students. *Journal of Family & Community Medicine*. 2020;27(1):23-28.
71. Phillips AJ, Clerx WM, O'Brien CS, et al. Irregular sleep/wake patterns are associated with poorer academic performance and delayed circadian and sleep/wake timing. *Scientific reports*. 2017;7(1):1-13.
72. Rabia M, Mubarak N, Tallat H, Nasir W. A study on study habits and academic performance of students. *Int J Asian Social Sci*. 2017;7(10):891-897.
73. Dubuc M-M, Aubertin-Leheudre M, Karelis AD. Lifestyle habits predict academic performance in high school students: The adolescent student academic performance longitudinal study (ASAP). *International journal of environmental research and public health*. 2020;17(1):243.
74. Bou-Hamad I. The impact of social media usage and lifestyle habits on academic achievement: Insights from a developing country context. *Children and Youth Services Review*. 2020;118:105425.