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Excessive daytime sleepiness and its predictors among medical and health science students of University of Gondar, Northwest Ethiopia: institution-based cross-sectional study

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Abstract

Background: Excessive daytime sleepiness (EDS) is a condition of sleepiness when a person would not be expected to sleep. University students are prone to EDS due to the competitive learning environment and fragmented night sleep. No study was conducted in Ethiopia on EDS. Therefore, this study aimed to determine EDS and its predictors among University of Gondar (UoG) Medical and Health Science students.

Methods: Institution-based cross-sectional study was carried out on 383 Medical and Health Science students of UoG who were recruited using a computer-generated simple random sampling technique. We used a validated Epworth daytime sleepiness tool to collect data. Epi-Info™ 7 and Stata 14 were used for data entry and analysis, respectively. Bivariable and multivariable binary logistic regression analyses were performed to find out predictors. Odds ratio with 95% uncertainty interval were computed. In the final model, a variable with a $p < 0.05$ was declared as a predictor of EDS.

Results: Three hundred and eighty-three students completed the questionnaire. Males were 69.97% and the mean age of participants was 20.79 (± 1.83) years. In the current study, the prevalence of EDS was 31.07% (95% UI: 26.62–35.91). The odds of getting EDS was 1.83 (AOR = 1.83, 95% UI: 1.14–2.96) and 1.84 (AOR = 1.84, 95% UI: 1.13–3.00) higher among students who reported night sleep behaviour disorders and depression, respectively.

Conclusion: This study revealed that EDS is high and predicted by depression and night sleep behaviour disorders. These findings suggest the need to set preventive strategies such as counselling of students to reduce depression and night sleep behaviour disorders. Further studies particularly qualitative studies are required to find out more factors affecting EDS.

Keywords: Daytime sleepiness, Epworth sleepiness scale, Ethiopia

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Background

Normal sleep is essential for memory consolidation and cellular growth [1]. In normal adults, healthy sleep duration is estimated to be 7 to 9 h [2, 3]. Even though napping for less than 30 min during the day enhances learning by promoting alertness, EDS disrupts learning and the overall health condition [4]. It is a condition of sleepiness and increased falling asleep associated with tiredness and loss of mental alertness when a person would be expected to be awake [5, 6].

An EDS can exist among individuals with different morbidity such as asthma [7], renal failure [8], and gastro-oesophageal reflux disease [9] or apparently healthy people [10, 11]. As sleepiness is circumstance dependent [12], it also common in educational institutions as reported in high-school students of Korea with 15.9% of EDS [13], Malaysian Medical students (35.5%) [14], and Indian college students (45%) [15]. In Ethiopia, poor sleep quality was observed among 52.7% of university students [16], and 26% daytime sleepiness among college students [17]. University students particularly Medical and Health Science students have a huge academic load which leads to sleep deprivation and daytime sleepiness [18].

Multiple factors are associated with EDS such as nightmare and poor academic outcome [13]. The risk of EDS was higher among individuals with the difficulty of night sleep (insomnia) [19]. Contradictory reports have been sought by different researchers about the effect of sex on EDS. A study in Australia reported females are more likely to get EDS than males [20] whereas a study conducted in Japan revealed male sex is associated with EDS [21]. Besides this, a study in Japan showed no association of EDS with sex [22]. Metabolic disturbances, changes in neurotransmitter, and hormonal alterations are claimed for the genesis of EDS [23]. Long-term EDS can lead to poor health [24], reduced quality of life [23], higher risk of accidents [25], reduced productivity, and poor social dealings [26], psychological distress and poor academic performance [14].

In Ethiopia, there is rarity of studies regarding EDS among students and no study was conducted among health and medical students. Therefore, the current study aimed to determine the magnitude of EDS and identifying predictor factors among UoG Medical and Health Science students.

Methods

Study setting, design and period

This institution-based cross-sectional study was carried out at the University of Gondar, northwest Ethiopia. The actual data collection period was from 01-June-10 July, 2019.

Population and eligibility criteria

All regular Medical and Health Science students of the University of Gondar available during the data collection period were included for this study. Students who were severely ill during data collection period were excluded from the study.

Sample size determination and sampling technique

The sample size was determined using a single population proportion formula with the following assumptions; the magnitude of EDS ($P = 50\%$; no previous study in the study area), 95% UI, the margin of error ($d = 5\%$). The minimum sample size was 384 and after adding a non-response rate of 5%, the final sample size was 404. We recruited study participants voluntarily from each department with proportional allocation. A computer-generated simple random sampling technique was used to recruit study participants. Facilitators explained the purpose of the study to participants. After obtaining consent from each participant, facilitators delivered the questionnaire to participants.

Data collection instruments and procedure

We used a self-administered questionnaire to collect the data which comprised sociodemographic characteristics (sex, age in years, place of residence before coming to university, and pocket money), cigarette smoking, neurological conditions (depression, stress and night sleep behaviour disorder), and EDS assessment section.

Epworth daytime sleepiness scale [27] was used to collect data on EDS and it is validated in Ethiopia [28]. Night sleep behaviour disorder, depression and stress were assessed using rapid eye movement sleep behaviour disorder screening tool [29], Becks depression inventory second edition (BDI-II) [30], and perceived stress scale [31], respectively.

The BDI-II tool is validated in South Africa (but not yet in Ethiopia) [32] and is consisted of 21 items with total scores ranging from 0 to 63.

Night sleep behaviour disorder screening tool is validated elsewhere (not in Ethiopia) and is comprised of 10-items with a total score of 13 [29].

We used the perceived stress scale that is validated in Ethiopia [33], composed of 10 items each with five possible responses, and the overall value of a scale ranges from zero to 40.

Orientation was given for facilitators about the purpose of the study and ethical issues to dispatch the questionnaire, explain the purpose of the study, and receive the completed questionnaire. After obtaining written consent from each participant, respondents fill the questionnaire.

Data quality control

We adapted the standard questionnaire for the assessment of EDS. Trained MSc Medical Physiology students were engaged for distributing, instructing students to fill the questionnaire and collecting them after filling. Trained students facilitated the data collection process explaining the purpose of the study.

Study variables**Dependent variable**

Excessive daytime sleepiness.

Independent variables

Sex of participants, place of residence before coming to university, age in years, monthly pocket money in ETB, year of study, cigarette smoking, stress, depression, the field of study, and night sleep behaviour disorder.

Operational/term definitions**Excessive daytime sleepiness**

A person who scored 11 and above from the total score of 24 was considered as having EDS [27].

Night sleep behaviour disorder is a sleep disorder manifested by rapid eye movement, and problematic behaviours like dream enactment, talking, sleepwalking and atonia [34]. A person is considered as having night sleep behaviour disorder when he/she scored 5 and above the screening items [35].

Depression

It was assessed with Beck's depression inventory second edition (BDI-II) revised in 1996. A person with a score of 21 and above from the total scores of BDI-II was considered as depressed [36].

Stress

A person is defined stressed when he/she scored 5 and above of the 10 item questions of perceived stress scale (PSS-10) [37].

Data management and statistical analysis

Data entry was performed using Epi-Info™ version 7.1. After inspection of its completeness and consistency, it was then exported into Stata 14 for statistical analysis. Categorical descriptive results were expressed using an actual number (frequency) and continuous variables were stated using mean value, range, and standard deviation. For determining measures of association between independent and dependent variables binary logistic regression was performed. The bivariable analysis was performed to determine the simple association between independent variables and EDS to select variables for multivariable analysis. Variables in bivariable analysis with a $p < 0.2$ were selected for multivariable logistic

regression. In multivariable analysis, variables with a $p < 0.05$ with 95% UI were treated as predictors of EDS. Hosmer and Lemshow goodness of fit was performed to assess model fitness at $p > 0.05$. Besides p -values, crude odds ratio and adjusted odds ratio with 95% UI were reported.

Reliability

We performed Cronbach's alpha coefficient to test the reliability of the Epworth sleepiness scale which was used to assess EDS and we found a scale reliability coefficient of 0.725 which is acceptable. Furthermore, the reliability of BDI-II in this study was 0.86 (good), night sleep behaviour disorder was 0.7 (acceptable), and perceived stress scale was 0.79 (acceptable) according to Mallery P et al. [38].

Results**Characteristics of study participants**

From a required 404 participants, 383 students took part in the study with 94.8% response rate. The mean age of the study participants was 20.79 (± 1.83 , range = 18–34) years. Male participants were 69.97 and 61.35% of students were second-year and above. Students with night sleep behaviour disorder, depression, and perceived stress were 46.21, 34.73, and 81.2%, respectively. Students from health science represent 78.85% of total participants and 28.2% students were from the department of Environmental and Occupational Health and Safety (Table 1).

The magnitude of excessive daytime sleepiness

From the total participants, 31.07% (95% UI = 26.62, 35.91%) students reported EDS (Table 1). The mean score of Epworth sleepiness was 8.73 (± 4.73) (Table 2).

Predictors of excessive daytime sleepiness

All exposure variables were tested for association using bivariable logistic regression. Age in years, cigarette smoking, year of study, and presence of night sleep behaviour disorders, depression, and stress were selected (because the p -value was less than 0.2) and entered into multivariable binary logistic regression. After running multivariable binary logistic regression, only night sleep behaviour disorders and depression were significantly associated with EDS. Study participants who reported night sleep behaviour disorders were 1.83 times (AOR = 1.83, 95% UI: 1.14–2.96) more likely to get EDS than those without night sleep behaviour disorders. The odds of having EDS was 1.84 (AOR = 1.84, 95% UI: 1.13–3.00) times more likely to be higher among students who reported depression than those without depression (Table 3).

Table 1 Descriptive characteristics of Medical and Health Science students of UoG, northwest Ethiopia, 2019 ($n = 383$)

Variables	Categories	Frequency	Percent (%)	
Age in years	Mean(\pm SD) = 20.79 \pm 1.83, minimum = 18 and maximum = 3			
Monthly pocket money	Mean (\pm SD) = 689.3 \pm 503.6, minimum = 50 and maximum = 3800			
Sex	Male	268	69.97	
	Female	115	30.03	
Residence before coming to University	Urban	224	58.49	
	Rural	159	41.51	
Field of study	Medicine	81	21.15	
	Health sciences	Environmental and Occupational Health and Safety	108	28.2
		Health informatics	21	5.48
		Health officer	21	5.48
		Medical laboratory	36	9.40
		Nursing	28	7.31
		Pharmacy	42	10.97
		Psychiatry	33	8.62
		Physiotherapy	13	3.39
Cigarette smoking	No	359	93.73	
	Yes	24	6.27	
Religion	Orthodox	319	83.29	
	Muslim	24	6.27	
	Protestant	35	9.14	
	Catholic	5	1.30	
Year of study	First	148	38.64	
	Second-year and above	235	61.36	
Night sleep behavior disorder	No	206	53.79	
	Yes	177	46.21	
Depression	No	250	65.27	
	Yes	133	34.73	
Stress	No	72	18.80	
	Yes	311	81.20	
Excessive daytime sleepiness	No	264	68.93	
	Yes	119	31.07	

SD Standard deviation

Discussion

The current study aimed to assess the magnitude of EDS and its predictors among University of Gondar Medical and Health Science students. The prevalence of EDS was 31.07% (95% UI, 26.62–35.91). Night sleep behaviour disorders and depression were predictors of EDS.

The prevalence of EDS in this study is similar to other studies from Southern University of United States (31% vs 27%) [39], Universidad San Martin de Porres in Lima, Peru (31% vs 35%) [40], Nigeria (31% vs 32.5%) [41], Southern Taiwan (31% vs 35%) [42], and Ethiopia (31% vs 26%) [17]. High magnitude of EDS in students could

be explained by the highly competitive and demanding learning environment that disrupts the regular sleep time [12]. The prevalence of EDS in this study is slightly higher than other studies elsewhere as evidenced in Hunan province, central China (31% vs 24.6%) [43], Brazil (31% vs 22%) [44]. This might be because of differences in the academic culture of universities, sample size, and socioeconomic factors. Two studies from Saudi Arabia (31 vs 40%) [45] and (31 vs 68.8%) [46] reported a higher magnitude of EDS than the current study. The reason for the differences in prevalence might be attributed to variations in sample size, lifestyle, socio-cultural,

Table 2 The response of participants for each item of Epworth daytime sleepiness scale, University of Gondar, northwest Ethiopia 2019 ($n = 383$)

Items	No chance of sleeping	Slight chance of sleeping	Moderate chance of sleeping	High chance of sleeping
(Possibility of sleeping)	N (%)	N (%)	N (%)	N (%)
During sitting and reading	94(24.54)	138(36.03)	86(22.45)	65(16.97)
During watching TV	145(37.86)	127(33.16)	74(19.32)	37(9.66)
Sitting inactive in a public place (theater or meeting)	176(45.95)	104 (27.15)	66 (17.23)	37(9.66)
As a passenger in a car for an hour without break	125 (32.64)	113 (29.50)	89 (23.24)	56 (14.62)
Lying down to rest in afternoon when circumstances permit	60 (15.67)	102 (26.63)	142 (37.08)	79 (20.63)
Sitting and talking to someone	212 (55.35)	76 (19.84)	63 (16.45)	32 (8.36)
Sitting quietly after lunch without alcohol	125 (32.64)	105 (27.42)	84 (21.93)	69 (18.02)
In a car, while stopped for a few minutes in traffic	234 (61.10)	77 (20.10)	48 (12.53)	24 (6.27)
Overall Epworth sleepiness score	Mean	(\pm)SD	Min	max
	8.73	4.73	0	24

academic culture, and the demographic characteristics of the study participants and difference in environmental factors.

Night sleep behaviour disorders and presence of depression were predictors of EDS among the study participants. Students who reported night sleep behaviour disorders were 1.83 times more likely to get EDS than those students without night sleep behaviour disorders. This is supported by previous studies conducted among students of the University of Saskatchewan, Canada [47], and Indian college students [45]. This association might be because night sleep behaviour disorder disturbs the quality of sleep (sleep deprivation) at night which induces EDS because of unfinished sleep periods [48, 49] and variations in melatonin hormone, vital hormone in circadian rhythm [50]. Presence of depression and night

sleep disorders among university students could be due to various academic stressors [51], learning environment [52], and loneliness (homesickness) while they left family [53].

Participants who reported depression were 1.84 times more likely to have EDS than those who did not have depression. This is in agreement with another study [54]. The probable reason for this association might be a higher level of cortisol, corticotrophic releasing hormone, and norepinephrine during depression lead to sleep rhythm disruption that ends up with EDS [55]. The role of cortisol on the development of depression could be explained by the neurotoxic effect of cortisol on hippocampus [56]. Other studies reported the association of EDS to stress [45, 57], Khat chewing, alcohol consumption and cigarette smoking [17], female sex [20, 22] and

Table 3 Predictors of excessive daytime sleepiness in bivariable and multivariable logistic regression among Medical and Health Science students of UoG, northwest Ethiopia, 2019 ($n = 383$)

Variables		Excessive daytime sleepiness		Bivariable LR	Multivariable LR
		No (%)	Yes (%)	COR (95% UI)	AOR (95% UI)
Cigarette Smoking	No	253 (70.47)	106 (29.53)	Ref	Ref
	Yes	11 (45.83)	13 (54.17)	2.82 (1.22–6.50)	1.89 (0.78–4.57)
Age in year ^c				1.11 (0.99–1.25)	1.00 (0.88–1.15)
Year of study	1st	111 (75)	37 (25)	Ref	Ref
	≥ 2 nd	153 (65.11)	82 (34.89)	1.61 (1.02–2.54)	1.61 (0.97–2.67)
Night sleep behavior disorders	No	159 (77.18)	47 (22.82)	Ref	Ref
	Yes	105 (59.32)	72 (40.68)	2.32 (1.49–3.61)	1.83 (1.14–2.96)*
Depression	No	188 (75.20)	62 (24.80)	Ref	Ref
	Yes	76 (57.14)	57 (42.86)	2.27 (1.45–3.56)	1.84 (1.13–3.00)*
Stress	No	55 (76.39)	17 (23.61)	Ref	Ref
	Yes	209 (67.20)	102 (32.80)	1.58 (0.87–2.86)	1.18 (0.63–2.21)

*Significant at $p < 0.05$, C = continuous variable, COR = Crude odds ratio, AOR = Adjusted odds ratio, UI = Uncertainty interval, Hosmer and Lemshow goodness of fit (Prob > chi2 = 0.4151)

male sex [21]. However, these factors were not predictors of EDS in our study which might be due to variations in sample size and sociocultural factors.

The findings of this study suggest that university students are prone to EDS that is associated with depression and night sleep disturbances. If not properly handled, EDS could lead to poor academic performance [39], and psychopathology [58].

Limitations of the study

Although the tools were widely used in Ethiopia, the tools used for the assessment of few independent variables (depression and night sleep behavior disorder) were not validated in study area. Other limitations could be social desirability and recall bias in some instances.

Conclusion

From this study, we can conclude that EDS is high and associated with depression and night sleep behaviour disorders. This suggests the need to encourage students to get counselling on how to deal with the competitive learning environment which is important to reduce depression and night sleep behaviour disorders. Universities should establish guidance and counselling service to ease access to students. Furthermore, we recommend future researchers to undertake studies using strong designs and qualitative studies to find out the neuroendocrine connections underlying sleepiness and more factors affecting EDS.

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Authors' contributions

BD (MSc, Assistant Professor): Conceptualization, methodology, software, validation, formal analysis, investigation, resources, data curation, writing - original manuscript draft, writing - review & editing, visualization, supervision, project administration. ZA (MSc, Lecturer): Took part in methodology, software, validation, formal analysis, investigation, writing - review & editing, visualization. HD (MSc, Assistant Professor): Methodology, software, validation, formal analysis, investigation, writing - review & editing, visualization. All authors reviewed and approved the final manuscript.

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Availability of data and materials

The dataset containing all the required data is found at the primary author which can be accessed with a justifiable request.

Ethics approval and consent to participate

Ethical clearance letter was gained from the ethical committee of Department of Environmental and Occupational Health and Safety, University of Gondar. Before delivering the questionnaire, written consent was obtained from every participant. No names and possible identifying issues written on the questionnaire to secure the data confidential.

Consent for publication

Not applicable

Competing interests

No conflicts of interest are raised by authors.

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