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# Prevalence and associated factors of sleep deprivation among Haramaya University students, Ethiopia, 2021: cross-sectional study

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## Abstract

**Background:** Sleep deprivation is the lack of sleep that is associated with an increased risk of cardiovascular illness, diabetes, obesity, cognitive impairment, vehicle accidents, and workplace accidents, as well as being a direct source of daily dysfunction. Despite the fact that some studies have been undertaken, there is a shortage of data on the incidence of sleep deprivation and associated factors among university students in Africa, particularly in Ethiopia, where the study area is located. As a result, the purpose of this study was to determine the incidence of sleep deprivation and its associated factors among Haramaya University students in Eastern Ethiopia.

**Methods:** A cross-sectional study design was employed among Haramaya University students. A total of 624 students participated in this study. A multistage sampling technique was used to select the participants. A pretested structured self-administered questionnaire was used to collect data. Using Epi Data Version 3.1, the data was checked, coded, entered, and cleaned before being exported to SPSS Version 20 for analysis. Bivariate and multivariate logistic regression analysis was undertaken. For statistical significance,  $P \leq 0.001$  was used as the cutoff point.

**Results:** In this study, 586 study participants were participated, with a response rate of 96.2%. Among participants, the majority of 324(55.3%) were males, and the majority of 311(53.1%) were in the age range of 17–20 years with a median age of 19. Most of the study participants were single 561(95.7%). The overall prevalence of sleep deprivation was 68.4% (95% CI: 64.8–72.4). Coffee/tea drinkers (AOR = 2.83, 95% CI:1.17–6.86), Khat chewers (AOR = 2.33, 95%CI: 1.20–4.50), participants with stress (AOR = 3.49,95% CI: 1.22–9.95), participants exposed to moderate stage of anxiety (AOR = 2.87,95% CI:1.14–7.18), and being in the third and fourth study years (AOR = 0.33,95% CI:0.13–0.85) were significantly associated factors with sleep deprivation.

**Conclusion:** The prevalence of sleep deprivation was found to be high in this study. Coffee/tea users, khat chewers, being stressed, exposed to moderate levels of anxiety, and being in the third and fourth study years were all found to be significantly associated with sleep deprivation.

**Keywords:** Anxiety, Depression, Sleep deprivation, Stress, Ethiopia

## Background

Sleep deprivation is characterized by a lack of sleep, a poor sleeping pattern, insufficient sleep, or a disordered sleep–wake cycle (Bandyopadhyay and Sigua 2019; Medic et al. 2017). It was defined as not obtaining enough sleep in relation to one's physiological and developmental demands in order to maintain optimal attentiveness during the day (Bandyopadhyay and Sigua 2019; Colten and

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Altevogt 2006). Acute sleep deprivation and chronic partial sleep deprivation are the two most common types of sleep deprivation (Potter and Kaplan 2012). Deprivation in the short term (acute sleep) occurs when a person is wake-up for 24 h or more and is connected with reduced immunological function, increased pain, impaired performance, more errors, and a higher risk of accidents, as well as affecting the judgment, learning, and memory. Sleeping less than 7 h every night for lengthy periods of time has negative health consequences, including daytime sleepiness, exhaustion, clumsiness, obesity, diabetes, hypertension, heart disease and stroke, depression, and an increased chance of death (Medic et al. 2017; Alhola and Polo-Kantola 2007; Benjamins et al. 2021). Sleep deprivation increases the chances of having a heart attack, stroke, asthma, metabolic illnesses, insomnia, sleep apnea, narcolepsy, hallucinations, and mood swings (Kulkarni et al. 2017; Chattu et al. 2018).

University students are at a high risk of poor sleep practices by disrupting and destabilizing their sleeping phenomenon due to the demands of constant study time for examinations, duty for their clinical attachment fieldwork, academic activities, living in a dorm together, active social interaction, scheduling difficulties, work obligations, and a new level of independence (Negussie et al. 2021; Gruba et al. 2021). Increased use of the internet and social media, poor sleep hygiene, use of alcohol and caffeinated beverages before night, khat chewing, exam frequency, and the complexity of the academic curriculum are all variables that contribute to sleep deprivation (Molla and Wondie 2021). Additionally, certain medical conditions such as obstructive sleep apnea and depression can interrupt a healthy sleeping schedule (Schlarb et al. 2017; Raley et al. 2016).

According to a study conducted in the United States, university students reported at least twice as much sleep trouble as the general population (Azad et al. 2015). Among US college students, 70.6% of students get less than 7 h of sleep (Hershner and Chervin 2014). According to various studies, 24% in the United Kingdom, 30% in Korea, 49% in Taiwan, 62.7% in the United Arab Emirates, 76.7% in India, 32.9% in Northern Malaysia, 12.1% in Egypt, and 52.7% in Addis Ababa University, and 62.4% in Haramaya University got less than 7 h of sleep per night (Negussie et al. 2021).

Emotional instability, impaired mood, daytime sleepiness, forgetfulness, drowsiness, fatigue, impairments in academic functioning, depression, stress, anxiety, suicidal ideation, reduced ability to fight infection, lack of physical strength, decreased psychomotor functions, impaired perception, increased number of errors, depreciated interpersonal responses, and use of drugs and alcohol are

some of the negative consequences of sleep deprivation (Negussie et al. 2021).

According to the National Commission on Sleep Disorders, sleep disorders cost the US \$150 billion a year in lost productivity and workplace mishaps. According to the National Highway Traffic Safety Administration, it is a primary cause of at least 100,000 collisions per year, resulting in more than 1,500 deaths and 71,000 injuries in the United States (Kulkarni et al. 2017; Sleep Health Foundation 2021). More than half of all fall-asleep crashes involve drivers under the age of 25. Direct sleep-related medical costs amount to hundreds of billions of dollars per year. Sleep deprivation led to higher healthcare costs and class absences (Bliwise 1999). “Losing just 4 h of sleep in a single night can make a person’s reflexes and attentiveness 45 percent slower and feel overtired,” according to a Stanford University study conducted on college students (Bliwise 1999; Machleidt and Brockmann 1985). Therefore, accurate screening, teaching, group discussion, and self-evaluation convince university students that excellent sleep hygiene is required (Pilcher and Morris 2020; Wise 2018). Despite the fact that some studies have been undertaken, there is a shortage of data on the incidence of sleep deprivation and associated factors among university students in Africa, particularly in Ethiopia, where the study area is located. As a result, the purpose of this study was to determine the incidence of sleep deprivation and its associated factors among Haramaya University students in Eastern Ethiopia.

## Methods and materials

### Study area and period

This study was conducted at Haramaya University from March 2–20, 2020. Haramaya University is located 510 km from Addis Ababa in the East Hararaghe Zone between Harar and Dire-Dawa administrations. It is one of the oldest universities in the country, next to Addis Ababa University. The university has eleven (Molla and Wondie 2021) colleges and one (Bandyopadhyay and Sigua 2019) directorate. There are 66 departments in these colleges and directorates. This university has a total of 13,919 undergraduate students, with 9,043 males and 4,876 females.

### Study design and population

A facility-based quantitative cross-sectional study design was conducted on all regular undergraduate students of Haramaya University. The study population was made up of students who were randomly chosen, present during the data collection time, and had at least last semester’s worth of grades prior to the study. Students with

psychiatric issues and depression were not allowed to participate.

#### Sample size determination and sampling technique

The sample size is computed using single population proportions formula with the following assumptions: The confidence level was set at 95%, with a 5% margin of error, a 10% non-response rate, and 1.5 design effects, and by estimating that the prevalence of sleep deprivation in the prior study was 60.8 percent (Negussie et al. 2021). Based on this, the final sample size is 624 (S1). The final sample size was determined using a multistage sampling procedure. There are nine (Negussie et al. 2021) colleges and one institute in total. Four (Potter and Kaplan 2012) colleges, namely the College of Health and Medical Sciences, College of Social Sciences and Humanity, College of Natural & Computation Sciences, and College of Business and Economics, are chosen by using a simple random method, and two schools and ten (Gruba et al. 2021) departments are chosen purposefully from these colleges. Then, based on the year of the study and the gender of the respondents, proportional allocation was used to assign study participants. Finally, one student is chosen from designated departments using the lottery method (write zero and one) to be enrolled in the study.

#### Operational definition

- Academic performance: -marks scored by the students in the final CGPA at the end of their previous academic semester (as it will be reported their previous academic semester by students) (Ogundokun et al. 2019).
- Sleep latency: -time it takes minutes to fall asleep after the light turns off. By Specific categories were long sleep latency  $\geq 30$  min and short sleep latency  $< 30$  min (Mello et al. 2017).
- CGPA: is the current cumulative grade point average (GPA) which was broken down into four categories: (high  $\geq 3.5$ , v. good (Mostly As), 3–3.49 (Mostly Bs), normal: 2.5–2.99 (Some Bs and Cs), low  $< 2.5$ ) (Mostly Cs)
- Electronic device use—Time spent on the screen-based activity, which is, they watched or using a computer, tablet, mobile phone, television, or audio player in bed before going to sleep. A 2 h per day was cut-off used as most recommendations for screen-based (Kementerian Kesehatan Republik Indonesia 2018).
- Sleep deprivation is insufficient sleep or poor sleep quality defined by the Stanford Sleeping Scale (SSS)

and the Groningen Sleep Quality Scale (GSQS) (Phatrabuddha et al. 2018).

- Stress: according to DASS-21, if the respondent scores 15 and above (Beaufort et al. 2017).
- Depression: according to DASS-21, if the respondent scores 9 and above (Maharlouei et al. 2021).
- Anxiety: according to DASS-21, if the respondent scored 7.
- Khat chewing is the act of chewing the leaves of the khat plant (*Catha edulis* Forsk), an evergreen shrub or small tree native to Ethiopia and the southern Arabian Peninsula. Chewing khat is a part of various social traditions in the Middle East, such as Saudi Arabia and Yemen, and in Eastern Africa, such as Somalia and Ethiopia (Akalu et al. 2020; Teklie et al. 2017).

#### Data quality control

To ensure the quality of data, training was been given to data collectors and supervisors for two days regarding the objective of the study, data collection tools, ways of data collection, and how to maintain confidentiality by coding the information. A pretest was been done on 33 students before one week of the actual data collection date from Dire-Dewa University students that were not included in the main data. After the pretest, any ambiguity, confusion, difficult words, and differences in understanding are revised based on the pretest experience. All data were been checked for completeness and consistency by the principal investigator and supervisors, on the day of data collection. Simple frequencies and cross-tabulation were done and cross-checked with hard copies of the collected data.

#### Methods of data analysis

The data was entered, and cleaned using Epi Data Version 3.1 and exported to SPSS Version 20 software for analysis. Univariable analysis was been used to describe the characteristics of participants and the information presented in tables and figures. Bivariable analysis, COR with 95% CI was computed to see the association between the independent variables and outcome variables by using binary logistic regression. Independent variables with  $P \leq 0.001$  were included in the multivariable analysis to control confounding factors. Multi-Collinearity has been checked to see the linear correlation among the independent variables by using variance inflation factor (VIF) and standard error. Variables with variance inflation factor (VIF)  $> 10$  and standard error of  $> 2$

were dropped from the multivariable analysis. For model fitness, Hosmer Lemeshow (0.382) and Omnibus tests (0.00) were computed.  $P \leq 0.001$  at 95% confidence interval were considered as statistically significant.

### Ethical consideration

The study was conducted after ethical clearance, and an official letter was written to the head of each department by Haramaya University College of Health and Medical Sciences (CHMS), Institutional health Research Ethics

Review Committee (IHRERC). The aim of the study was explained to participants, informed consent was obtained from each participant. Furthermore, they were given assurance that they are free to withdraw consents and discontinue participation without any form of prejudice. To maintain the confidentiality of information gathered from each study, participant, a code number was used throughout the study.

## Results

### Sociodemographic characteristics of study participants

In this study, 586 study participants were participated, with a response rate of 96.2%. Among participants, the majority of 324(55.3%) were males, and the majority of 311(53.1%) were in the age range of 17–20 years with a median age of 19. Most of the study participants were single 561(95.7%) (Table 1).

### Prevalence of sleep deprivation

In this study, it was found that 401 (68.4%) of the respondents slept less than seven hours per day. Hours of actual sleep ranged from 4 to 10 h with a time in bed of 6:16 h each night. Of the total participants, 273 (46.6%) had not taken medications to help them sleep during the past month (Table 2).

**Table 1** Socio-demographic characteristics of the participants of Haramaya university students, Eastern Ethiopia, 2020

Variable	Category	Frequency (%)
Age	17–20	311(53.1%)
	21–24	235(40.1%)
	25–27	40(6.8%)
Sex comparison	Male	324(55.3%)
	Female	226(44.7%)
Marital status	Single	561(95.7%)
	Married	24(4.1%)
	Widowed	1(0.2%)
Monthly income	> 1000 ETB	32(5.5%)
	≤ 1000 ETB	554(94.5%)

**Table 2** Distribution of sleeping pattern among Haramaya University students, Eastern, Ethiopia, 2020

Variable	Category	Number (%)
Sleep duration (hours)	< 5.0	35(6.0%)
	5.0–5.9	158(27.0%)
	6–6.9	208(35.4%)
	≥ 7	185 (31.6%)
Time usually go to bed at night at local time	< 4 h	73(12.5%)
	4–6 h	296(50.5%)
	≥ 6 h	217(37.0%)
Time taken to fall asleep (minutes)	≤ 15	51(8.7%)
	16–30	284(48.5%)
	31–60	191(32.6%)
	≥ 60	60(10.2%)
Waking up during sleep in mid night	never	178(30.4%)
	1 time a week	230(39.2%)
	1–2 times a week	109(18.6%)
	> 3 times a week	69(11.8%)
Time to wake up in the morning local time (hours)	11–12 am	254(43.3%)
	12–12:45 am	88(14.7%)
	1–2:30 am	244(41.6%)
Taking sleep medication during past month	Never	273(46.6%)
	< once a week	207(35.3%)
	1–2 times per week	65(11.1%)
	≥ 3 times per week	41(7.0%)

### Factors associated with sleep deprivation

From a total of 17 variables initially considered, a Multi-variable logistic regression analysis revealed that daily coffee/tea drink, khat chewing, stress, moderate stage of anxiety, and study year were significantly associated with sleep deprivation. Daily coffee/tea drinkers were 2.83 times more likely to have sleep deprivation than non-drinkers were (AOR: 2.83, 95%CI: 1.17–6.85). Khat chewers were 2.33 times more likely to have sleep deprivation than non-chewer (AOR: 2.33, 95% CI: 1.20–4.51). Participants who stressed were 3.49 times more likely to have sleep deprivation than non-stressed (AOR = 3.49, 95% CI: 1.22–9.95). Participants who had developed a moderate stage of anxiety were 2.87 times more likely to have sleep deprivation than other stages of anxiety (AOR = 2.87, 95% CI: 1.14–7.18). Participants in the third and fourth study years were 0.33

times less likely to have sleep deprivation than in other study years (AOR = 0.33, 95% CI: 0.13–0.85) (Table 3).

### Discussion

In this study, the overall prevalence of sleep deprivation was 68.4%. The results of this study were lower than those of studies conducted at South-Eastern State University (Hershner and Chervin 2014), Tripura Medical College & Dr. B.R.A.M. Teaching Hospital students (Datta et al. 2018), and medical students at the University of Botucatu in Brazil (Perotta et al. 2021). The possible explanation for the observed variations might be due to differences in methodology and sample size used to assess the prevalence of sleep deprivation among university students by individual studies conducted in each country. Moreover, the difference could be due to the difference in a geographical area, study environment (our studies comprised

**Table 3** Bivariable and multivariable logistic regression model of factors associated with sleep deprivation among Haramaya university students, Eastern Ethiopia, 2020

Variable	Category	Sleep deprivation		COR (95% CI)	AOR (95% CI)
		Absent	Present		
Age	17–20	119(64.3%)	192(47.9%)	1	1
	21–24	58(31.4%)	177(44.1%)	1.89(1.30–2.75)	1.53(0.93–2.52)
	25–27	8(4.3%)	32(8.0%)	2.48(1.11–5.56)	1.15(0.39–3.33)
electronic device	No	80(43.2%)	101(25.2%)	1	1
	Yes	105(56.8%)	300(74.8%)	2.26(1.57–3.27)	1.31(0.79–2.15)
Coffee drink	Monthly	14(10.6%)	14(4.0%)	1	1
	Weekly	19(14.4%)	43(12.2%)	2.26(0.91–5.66)	2.48(0.89–6.97)
	<b>Daily</b>	<b>99(75.0%)</b>	<b>296(83.9%)</b>	<b>2.99(1.38–6.49)</b>	<b>2.83(1.17–6.86) *</b>
Alcohol drink	No	150(81.1%)	232(57.9%)	1	1
	Yes	35(18.9%)	169(42.1%)	3.12(2.06–4.74)	1.25(0.72–2.17)
Cigarette smoking	No	174(94.1%)	336(83.8%)	1	1
	Yes	11(5.9%)	65(16.2%)	3.06(1.57–5.95)	0.95(0.39–2.27)
Khat chewing	No	157(84.9%)	260(64.8%)	1	1
	<b>Yes</b>	<b>28(15.1%)</b>	<b>141(35.2%)</b>	<b>3.04(1.94–4.78)</b>	<b>2.33(1.20–4.51) *</b>
Stage of depression	Normal	159(85.9%)	256(63.8%)	1	1
	Mild	12(6.5%)	61(15.2%)	3.16(3.16–1.65)	2.21(0.82–5.95)
	Moderate	14(7.6%)	84(20.9%)	3.73(3.73–2.05)	1.53(0.52–4.49)
Stress prevalent	No	169(91.4%)	332(82.8%)	1	<b>1</b>
	<b>Yes</b>	<b>16(8.6%)</b>	<b>69(17.2%)</b>	<b>2.20(2.20–1.24)</b>	<b>3.48 (1.22–9.95) *</b>
Stages of Anxiety	Normal	149(80.5%)	235(58.6%)	1	1
	Mild	9(4.9%)	19(4.7%)	1.34(0.59–3.04)	0.70(0.25–1.94)
	<b>Moderate</b>	<b>18(9.7%)</b>	<b>114(28.4%)</b>	<b>4.016(2.34–6.87)</b>	<b>2.87(1.14–7.18) *</b>
	Severe	7(3.8%)	28(7.0%)	2.54(1.08–5.95)	0.731(0.18–3.03)
	Ex/severe	2(1.1%)	5(1.2%)	1.59(0.30–8.28)	0.19(0.02–1.64)
Year of study	≥4 <sup>th</sup> yrs	10(5.4%)	61(15.2%)	1	1
	<b>3<sup>rd</sup>–4<sup>th</sup> yrs</b>	<b>37(20.0%)</b>	<b>77(19.2%)</b>	<b>0.34(0.16–0.74)</b>	<b>0.33 (0.13–0.85) *</b>
	≤2 <sup>nd</sup> yrs	138(74.6%)	263(65.6%)	0.31(0.16–0.63)	0.44(0.18–1.07)

Significant at \*  $P \leq 0.001$ , 1 = constant, CI Confidence Interval, COR Crude odds Ratio, AOR Adjusted Odds Ratio



multiple colleges), study participants' sleeping patterns, sampling technique, and academic pressure, which have an unlimited effect to assess the prevalence of sleep deprivation among university students.

The finding of this study is higher than a study conducted among the Universities of Ethiopia (Gondar and Haramaya) (Lemma et al. 2012), Debre bran university (Abebe et al. 2018), Iran university (Akhlaghi and Ghalebani 2009), Saudi Arabi (Ahmed et al. 2017), and UAE University (Mahfouz et al. 2020), among 5 pre-university Indian students (Durka and Jagannath 2019), in Egypt among medical students (Elwasify et al. 2016). The possible reason may be differences in socioeconomic level, cultural variables, social situation, less organized environment; issues dealing with roommates, sample size, and environmental factors in different study sites are all plausible explanations.

In the current study, several factors were associated with sleep deprivation among university students. Being a coffee drinker was significantly associated with sleep deprivation among university students and the study agrees with research conducted previously (Smith et al. 2019; Lemma et al. 2012a). This indicated that drinking coffee every day causes a shorter sleep onset and shorter nights' sleep, as well as a decrease in rapid eye movement, an increase in the wake-up time during sleeping time, and more time awake at night.

Being a Khat chewer was significantly associated with sleep deprivation among university students. This finding is supported with a prior study conducted in Ethiopia (Akalu et al. 2020; Abdeta et al. 2017; Berhanu 2020). This could be the result of sympathomimetic effects of khat (*Catha edulis*) which are structurally similar with amphetamine-like effect which induces the release of serotonin and dopamine that causes to increase alertness and reduce fatigue. These stimulants disrupt sleep pattern, and it's possible that long-term use lead in poor sleep quality and long term adverse health effects (Negussie et al. 2021; Office et al. 2005; Sallam et al. 2016).

This study found that having anxiety and or stress was strongly associated with sleep deprivation among university students. This study is supported by prior studies (Alfian et al. 2018). For this reason, perhaps in Ethiopian communities, families, friends, relatives, and neighbors can all share vital beliefs. This could be attributable to the students' socio-demographic position as well as their living environment.

The finding of this study showed that being third and four years were significantly associated with sleep deprivation. This study disagreed with prior studies (Negussie et al. 2021; Guadiana and Okashima 2021; Chattu et al. 2019). The reason for this could be related to future concerns about underemployment, an increase in credit

hours, and increased exposure to substance addiction as their seniority rises, resulting in sleep deprivation.

#### Limitations of the study

This study could not prove the cause-effect relationship between variables because it used a cross-sectional study design. Another drawback is that our data was based on self-reported information from students, which could have resulted in recall bias. There was also no objective sleep assessment utilizing polysomnography or actigraphy devices, no sleep log, no data on morningness-eveningness, no comparison of sleep duration between weekdays and weekends, and no clinically recorded stress symptoms.

#### Conclusions

In conclusion, sleep deprivation is predominant among university students, and they are more susceptible to the short- and long-term consequences of inadequate sleep. Coffee/tea drinkers, khat chewers, stress, moderate anxiety, and being in the third and fourth study years were all found to be strongly associated with sleep deprivation among the study participants. As a result, in partnership with the Ministry of Education, Haramaya University should design a system that restricts substance use among university students. Students should get health education about sleep hygiene, sleep quality, the effects of sleep loss, and how to adjust to university life. To investigate the aspects not addressed in this study, more research on large sample sizes and clinical study design at the national level is required.

#### Abbreviations

AOR: Adjusted Odds Ratio; NSF: National Sleep Foundation; PSQI: Pittsburgh Sleep Quality Index; REM: Rapid Eye Movement; SPSS: Statistical Package for Social Sciences; WHO: World Health Organization; YRBS: Youth Risk Behavior Surveillance System.

#### Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s41606-022-00080-y>.

**Additional file 1.** Sample size determination S1.

#### Acknowledgements

We would like to acknowledge Haramaya University College of Health and Medical Science for technical support to conduct this research. We also acknowledge the data collectors, supervisors, study participants, librarians, and computer lab staff for their respective contribution

#### Authors' contributions

TLA, KEH, and BGW: involved in reviewing the study design, data analysis, drafting, analysis of the data, and critically reviewing of the manuscript. The author(s) read and approved the final manuscript.

**Funding**

Not applicable.

**Availability of data and materials**

All data and materials in this manuscript are available from the corresponding authors on reasonable request.

**Declarations****Ethics approval and consent to participate**

The Ethical Review Committee of the College of Medicine and Health Sciences, Haramaya University, provided ethical clearance and an approval letter to conduct this research through an ethical letter with protocol number 05437/2021, written on August 27, 2021. Informed, voluntary, written, and signed consent was obtained from each study participant prior to the data collection period. Information on the study was explained to the participants, including the procedures, potential risks, and benefits of the study. The respondents were informed of their right to refuse in the study at any time and refusing to participate in the study was not affecting them. Participants' confidentiality of information is assured by excluding names and identifiers in the questionnaire used throughout the study.

**Consent for publication**

We ensure that the publisher has the authors' permission to publish this research finding, because all participants were signed on consent form by agreeing to participant on this study.

**Competing interest**

On behalf of all authors, the corresponding author states that there is no conflict of interest.

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Received: 18 January 2022 Accepted: 23 August 2022

Published online: 30 September 2022

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