

Study of the Relationship Between Sleep Satisfaction and Academic Self-Efficacy in New Students at Tehran University of Medical Sciences

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Abstract

The transition from school to university disrupts lifestyle patterns that may shape academic self-efficacy, but it remains unclear whether subjective sleep satisfaction is independently associated with academic self-efficacy during this transition. This cross-sectional study examined this association among first-year students at Tehran University of Medical Sciences (TUMS) using data from the TUMS Student Lifestyle Cohort. Linear regression estimated differences in academic self-efficacy scores across good, moderate, and poor sleep satisfaction, adjusting for socioeconomic status, depression, and living status. Among 392 students (mean age, 19.42 ± 2.83 years; 53.8% female), 198 (50.5%) reported good, 117 (29.8%) moderate, and 77 (19.6%) poor sleep satisfaction. Compared with good sleep satisfaction, poor sleep satisfaction was associated with lower academic self-efficacy in the crude model ($\beta = -8.90$; 95% CI, -13.57 to -4.22; $p < 0.001$) and after adjustment (adjusted $\beta = -5.43$; 95% CI, -10.29 to -0.57; $p = 0.029$). Moderate sleep satisfaction was not associated with academic self-efficacy after adjustment (adjusted $\beta = -1.50$; 95% CI, -5.65 to 2.64; $p = 0.477$). These findings indicate an independent association between poor sleep satisfaction and lower academic self-efficacy. Assessing sleep satisfaction may help identify students who could benefit from targeted academic and well-being support.

Introduction

One of the most important indicators of motivation, learning, and academic success is academic self-efficacy. This concept refers to a student's belief in their ability to organize and execute the necessary tasks to achieve their learning goals [1]. Academic performance improves with academic self-efficacy, according to research. Students with higher self-efficacy adapt better to university and are less stressed [2]. Academic self-efficacy is not a fixed trait; instead, it is influenced by various factors, including lifestyle choices, mental health, and health-promoting behaviors. Since the transition from school to university is psychologically risky, these factors change, especially at admission. During this period, levels of stress and anxiety typically increase, sleep patterns and daily habits become disrupted, and some health-related behaviors are weakened; changes that can strengthen or undermine students' beliefs in their academic abilities [3, 4]. Among these, lifestyle-related factors, especially sleep, play a significant role as modifiable variables in academic performance and psychological well-being [5].

Sleep quality, rather than being just a physiological process, is a subjective experience that depends on an individual's internal feelings and personal assessment of their sleep; therefore, a person's perception of sleep quality may differ from its objective measures [6]. Sleep satisfaction, a broad evaluation of one's sleep, is affected by perceived quality, restfulness, and duration [7]. A study conducted in Tehran on first- and second-year medical students at Iran University of Medical Sciences found that, among 154 students, 42.2% had poor sleep quality, defined as a Pittsburgh Sleep Quality Index (PSQI) score > 5 , and 84.4% experienced some level of daytime dysfunction. It appears that sleep disturbances are common in early medical education [8]. The prevalence of poor sleep quality among medical students in developing countries, such as Iran (59%), Saudi Arabia (54.9%), and collectively in the Middle East and North Africa (MENA) region (59.1%), has been reported and linked to heightened stress levels and diminished

academic performance. [9–11]. The main factors include insufficient sleep, demanding schedules, and high levels of stress, which negatively impact academic self-efficacy [12, 13]. Such conditions have been associated with reduced concentration, decreased academic performance, and increased stress and anxiety [2].

Nevertheless, a substantial body of prior research has largely focused on multidimensional measures of sleep quality, such as the PSQI, and on academic performance, while paying less attention to subjective sleep satisfaction. Although comprehensive sleep quality indices capture multiple sleep dimensions, including subjective quality, duration, and daytime dysfunction, sleep satisfaction reflects whether students perceive their sleep as adequate, restorative, and acceptable in their daily lives. A student's personal cognitive appraisal of sleep may be more closely related to self-efficacy beliefs than specific sleep complaints [14, 15]. From a practical perspective, assessing sleep satisfaction using a single self-report item may provide a brief and low-burden approach, particularly in large-scale studies or settings where questionnaire length and respondent burden are important considerations [7]. Despite these conceptual and practical advantages, evidence on the association between subjective sleep satisfaction and academic self-efficacy among first-year students remains limited, especially in developing countries such as Iran. Newly enrolled medical sciences students face considerable academic pressure, lifestyle changes, and early professional expectations, all of which may affect both their sleep perceptions and academic confidence [16, 17]. Understanding this association may clarify how modifiable sleep-related perceptions shape psychological resources and inform early screening and targeted well-being support. Therefore, this study aimed to assess the association between sleep satisfaction and academic self-efficacy among first-year students at Tehran University of Medical Sciences (TUMS).

Methods

Study design and data collection process

This cross-sectional study design uses baseline data from the “TUMS Student Lifestyle Cohort,” a prospective study designed to follow newly enrolled students at TUMS to investigate student lifestyle changes [18]. The present analysis is based on baseline data collected during the first academic year (December 4, 2024, to February 19, 2025) and was conducted to examine the cross-sectional association between sleep satisfaction and academic self-efficacy. Baseline assessments included demographic and socioeconomic characteristics (sex, living status, and socioeconomic status), lifestyle-related behaviors (tobacco use, alcohol consumption, and physical activity), and mental health measures (depression and anxiety). Participants completed structured, self-administered questionnaires on dedicated computer systems at the research center using a secure electronic platform. Trained supervisors were physically present at the center to assist with system navigation and clarify instructions upon request, without interpreting questionnaire items or influencing participants' responses. Non-Iranian students were excluded to minimize potential language-related challenges with the Persian-language questionnaires.

Study population and sample size

Participants included newly enrolled first-year students at TUMS in professional doctorate programs (medicine, dentistry, pharmacy) and bachelor's programs across medical science disciplines. The required sample size was determined using the population proportion estimation formula, considering the prevalence of key variables derived from secondary data [18].

From the 422 students initially enrolled in the baseline cohort, participants with incomplete records were excluded. Specifically, 2 (0.5%) participants were excluded because of missing outcome data, 23 (5.5%) because of incomplete exposure information, and 5 (1.2%) because of missing covariates. Following these exclusions, the final analytic sample comprised 392 students (92.9% of the initial sample) (**Figure 1**).

Measurements

Sleep satisfaction

Sleep satisfaction was assessed at baseline using a single self-reported item adapted from the sleep quality component of the Pittsburgh Sleep Quality Index (PSQI): "How satisfied have you been with your sleep recently?" The reliability and validity of the PSQI had been previously assessed in Iran [19, 20]. The original five response categories (very satisfied, satisfied, moderate, dissatisfied, and very dissatisfied) were collapsed into three categories good (very satisfied/satisfied), moderate, and poor (dissatisfied/very dissatisfied) to mitigate limited sample distributions across certain subcategories and ensure adequate cell frequencies for robust statistical modeling.

Academic self-efficacy

Academic self-efficacy was assessed with the 5-item General Academic Self-Efficacy Scale (GASES) developed by Midgley et al [21]. The Persian version of the scale has demonstrated acceptable psychometric properties in Iran, as reported by Arianfar et al [22]. Respondents rated each item on a 5-point Likert scale from 1 (strongly disagree) to 5 (strongly agree), yielding a theoretical total score range of 5–25, with higher scores indicating greater academic self-efficacy. For descriptive purposes, participants were classified into three groups according to tertile cut-offs based on the observed distribution of scores: low (6–13), moderate (14–16), and high (17–20). While scores up to 25 were theoretically possible, no participant achieved a score greater than 20 in the study sample; consequently, the highest category encompassed all observed scores at the upper end of the distribution.

Covariate factors

Potential confounding variables were selected a priori based on their conceptual relevance and were categorized into three domains: demographic characteristics, lifestyle factors, and mental health status [23–25].

Demographic characteristics included sex (female/male), living status (dormitory vs. home), and socioeconomic status (SES). SES was measured by a single item asking participants to place their family's economic standing relative to the general Iranian population into one of five categories: lower, lower-middle, middle, upper-middle, and high. For analysis, these five levels were collapsed into three: low (lower and lower-middle), middle (unchanged), and high (upper-middle and high). This categorization approach is consistent with a previously published study using self-rated SES measures [26].

Lifestyle factors comprised physical activity, tobacco use, and alcohol consumption. Tobacco use was defined as current or ever use of any tobacco product (cigarettes, hookah, e-cigarettes, or cannabis) and dichotomized as yes/no. Alcohol consumption was defined as any use in the past 12 months or ever use, also dichotomized as yes/no. Physical activity was measured using the second version of the Global Physical Activity Questionnaire (GPAQ-v2) [27]. However, due to the students' unemployment, we excluded work-related physical activity items and assessed transportation-related activity, recreational activity, and sedentary behavior. Total physical activity was calculated as metabolic equivalent (MET)-minutes per week by combining the reported duration and intensity of activities across the assessed domains. Participants accumulating ≥ 600 MET-minutes per week equivalent to ≥ 150 minutes per week were classified as having sufficient PA, whereas those accumulating < 600 MET-minutes per week equivalent to < 150 minutes per week were classified as having insufficient physical activity.

Mental health status was evaluated using the Patient Health Questionnaire-9 (PHQ-9) [28] for depressive symptoms and the 7-item Generalized Anxiety Disorder scale (GAD-7) [29] for anxiety symptoms. The reliability and validity of both the PHQ-9 [30, 31] and GAD-7 [32, 33] had been evaluated in Iranian populations. Based on standard cutoffs, PHQ-9 scores were categorized as :no or minimal depressive symptoms (score 0-4) ,depressive symptoms (5-9), moderate-to-severe depressive symptoms (10-27) [34]. For the present analysis, the standard moderate (10–14), moderately severe (15–19), and severe (20–27) categories were combined into a single moderate-to-severe category. Similarly, GAD-7 scores were categorized as :no or minimal anxiety symptoms (score 0-4) ,mild anxiety symptoms (5-9), moderate-to-severe anxiety symptoms(10-21) [29], with the standard moderate (10–14) and severe (15–21) categories combined for analysis. No participants in the analytic sample had scores within the severe range for either depressive or anxiety symptoms.

Statistical analyses

Descriptive statistics were used to characterize the study population. Continuous variables were summarized as mean $\pm$ standard deviation (SD), and categorical variables were presented as frequencies and percentages. Analyses were conducted using complete cases, resulting in an analytic sample of 392 participants.

The distribution of sleep satisfaction across levels of academic self-efficacy was examined using cross-tabulations and column percentages. Academic self-efficacy was analyzed as a continuous outcome (EDU_SCALE100), while sleep satisfaction was categorized into good, moderate, and poor satisfaction

groups. The association between sleep satisfaction and academic self-efficacy was initially examined using an unadjusted linear regression model.

A multivariable linear regression model was subsequently fitted to assess the association between sleep satisfaction and academic self-efficacy after adjustment for potential confounding variables. The initial multivariable model included age, sex, living status, socioeconomic status, leisure-time physical activity, current tobacco use, lifetime alcohol use, depression category, and anxiety category. Covariate selection was performed using backward elimination with a retention criterion of $P < 0.20$. The final adjusted model included sleep satisfaction, depression category, living status, and socioeconomic status. Good sleep satisfaction was considered the reference category.

The assumptions of linear regression were assessed using diagnostic plots of the model residuals. Normality of the residuals was assessed using Q–Q plots, which indicated an approximately normal distribution of the residuals.

All statistical tests were two-sided, and a significance level of 0.05 was used. Exact P-values were reported where available. All analyses were performed using Stata version 17 (StataCorp, College Station, TX, USA).

Use of AI-assisted tools

During preparation of this manuscript, the authors used OpenAI's ChatGPT, Perplexity, and Consensus AI to assist with language editing, literature-search support, and source verification. All AI-assisted outputs were critically reviewed and independently verified by the authors against the sources. These tools were not used for data collection, statistical analysis, or generation of the study results. The authors take full responsibility for the final manuscript.

Ethics approval and informed consent

The study received ethical approval from the Research Ethics Committees of the Endocrine & Metabolism Research Institute at Tehran University of Medical Sciences (ID: IR.TUMS.EMRI.REC.1403.112). All procedures were performed in accordance with relevant institutional guidelines and the principles of the Declaration of Helsinki. All participants provided written informed consent. Participation was entirely voluntary, and participants retained the right to withdraw from the study at any point without penalty.

Results

In this study, 392 students with a mean age of 19.42 ± 2.83 years participated. Overall, 198 (50.51%) participants reported good sleep satisfaction, 117 (29.85%) reported moderate sleep satisfaction, and 77 (19.64%) reported poor sleep satisfaction. Females constituted 211 (53.8%) of the study population, compared with 181 (46.2%) males. A higher proportion of females was observed in both the good sleep satisfaction group (108 females, 54.6%; 90 males, 45.5%) and the moderate sleep satisfaction group (67

females, 57.3%; 50 males, 42.7%). In the poor sleep satisfaction group, males comprised 41 (53.3%) participants and females 36 (46.8%). Living at home (218, 55.61%) and having middle socioeconomic status (229, 58.42%) were the most frequently observed categories in the sample. Tobacco use and alcohol consumption were low across all sleep satisfaction strata, with the vast majority of participants reporting no substance use. Sufficient physical activity was reported by 110 (55.56%) students in the good sleep satisfaction group, 61 (52.14%) in the moderate sleep satisfaction group, and 45 (58.44%) in the poor sleep satisfaction group. As sleep satisfaction decreased, the prevalence of moderate-to-severe depressive and anxiety symptoms increased, with the highest levels of both indicators observed in the poor sleep group (Table 1).

Among the study participants, 146 (37.24%) had low academic self-efficacy, 137 (34.95%) had moderate academic self-efficacy, and 109 (27.81%) had high academic self-efficacy. The distribution of sleep satisfaction varied across levels of academic self-efficacy. Good sleep satisfaction was the most prevalent category across all academic self-efficacy strata, accounting for 61 (56.0%) participants in the high, 78 (56.9%) in the moderate, and 59 (40.4%) in the low self-efficacy groups. Conversely, the prevalence of poor sleep satisfaction was higher among students with low self-efficacy 39 (26.7%), compared with those in the moderate 20 (14.6%) and high 18 (16.5%) self-efficacy groups (**Table 2**).

To examine the association between sleep satisfaction and academic self-efficacy, linear regression analyses were performed using both crude and adjusted models (**Table 3**). In the crude model, students with poor sleep satisfaction had lower academic self-efficacy scores compared with the reference group (students with good sleep satisfaction), and this difference was statistically significant ($\beta = -8.90$, 95% CI: -13.57 to -4.22 , $p < 0.001$). Students with moderate sleep satisfaction also had lower academic self-efficacy scores compared with the reference group; however, this difference did not reach statistical significance ($\beta = -3.97$, 95% CI: -8.03 to 0.09 , $p = 0.056$). After adjustment for SES, depression, and living status, the association between poor sleep satisfaction and academic self-efficacy remained statistically significant, with an adjusted regression beta coefficient of -5.43 (95% CI: -10.29 to -0.57 , $p = 0.029$). In the adjusted model, students with moderate sleep satisfaction did not differ significantly in academic self-efficacy scores compared with those reporting good sleep satisfaction ($A\beta = -1.50$, 95% CI: -5.65 to 2.64 , $p = 0.477$).

Discussion

The present study aimed to investigate the association between sleep satisfaction and academic self-efficacy among newly enrolled students at TUMS. The findings showed that sleep satisfaction among these students was generally within the good range, whereas the prevalence of low academic self-efficacy was high. The most important finding was a significant inverse association between poor sleep satisfaction and academic self-efficacy, indicating that students with poor sleep satisfaction reported lower scores on the academic self-efficacy scale. This association remained significant after adjusting for potential confounding variables such as socioeconomic status, depression, and living status, although its magnitude was somewhat attenuated. In this study, the majority of participants were

female; however, the proportion of males was higher in the poor sleep satisfaction group. In addition, most participants belonged to the middle socioeconomic group and lived in their own homes. The prevalence of depression and anxiety increased as sleep satisfaction declined. Tobacco use and alcohol consumption were limited among students in this study, and more than half reported sufficient physical activity, regardless of sleep status.

Sleep is more than merely a physiological process; it is a subjective experience shaped by an individual's personal evaluation of its quality, restorativeness, and adequacy [6]. The present study assessed sleep through students' own satisfaction rating rather than a composite, multi-component instrument such as the PSQI, because satisfaction and composite sleep-quality scores do not always move together.

In a study conducted by Dagani et al. (2025) [5] among Italian university students, sleep was assessed with two single self-report items—average nightly sleep hours and a five-point satisfaction rating ranging from "very dissatisfied" to "very satisfied"—rather than a composite index, and a significant increasing trend in academic self-efficacy across satisfaction categories ($p < .001$), closely paralleling our findings obtained with a directly comparable measure.

Studies using composite indices offer a related but less direct comparison. In a study conducted by Aydin et al. (2024) [35] among university students in Turkey, a significant inverse association was reported between the PSQI and academic self-efficacy, such that declining sleep quality was accompanied by reduced confidence in students' academic abilities. In an interventional study among nursing students in Zanzan by Seyednazari et al. (2025) [17], implementation of a self-care program based on Orem's model resulted in simultaneous improvements in both sleep quality and academic self-efficacy, highlighting that both constructs are modifiable and functionally interrelated through health-promoting behaviors.

This finding aligns with the attenuation of the association observed in our adjusted model after controlling for psychological and contextual factors, suggesting that part of this relationship may be mediated through other variables rather than being solely attributable to sleep itself.

Previous studies conducted in Iran, the Middle East and North Africa, and globally have shown a substantial burden of poor sleep quality and sleep disturbances among medical students [9–11]. However, evidence regarding the relationship between sleep quality and academic performance has not been entirely consistent. While some studies link good sleep quality to better academic performance among university students, others associate it with lower academic performance [15]. Almalki et al. (2025) found no significant association between sleep quality or sleep–wake patterns and academic performance among medical students [13]. A study conducted at the University of Fallujah in Iraq also demonstrated a close association between anxiety and depression on the one hand, and sleep quality and academic performance among medical students on the other [36]. Taken together, these findings depict a pattern consistent with the results of the present study: students who experience poorer sleep also tend to carry a greater burden of depressive and anxiety symptoms, and this overlap may partly explain the attenuation of the association between sleep satisfaction and academic self-efficacy in the

adjusted model. Nevertheless, because most of the aforementioned studies focused on more objective aspects of sleep quality such as those measured by the Pittsburgh Sleep Quality Index—and paid less attention to subjective sleep satisfaction as a distinct construct, the present study contributes an additional dimension to the existing body of knowledge by focusing on newly enrolled students and employing a measure of sleep satisfaction.

Unlike sleep quality, which is typically assessed through multiple components, sleep satisfaction reflects an individual's overall, internal, and personal judgment regarding how satisfying their sleep feels [7]. This construct may predict psychological and behavioral outcomes independently of objective sleep measurements. Accordingly, the finding of the present study that only poor sleep satisfaction and not moderate sleep satisfaction was significantly associated with lower academic self-efficacy may reflect the subjective and threshold-dependent nature of sleep perception. It appears that only when individuals clearly perceive their sleep as bad does this perception extend to their beliefs about their academic capabilities.

This study has several limitations that should be considered when interpreting its findings. First, the cross-sectional design precludes causal inference regarding the relationship between sleep satisfaction and academic self-efficacy. Second, sleep satisfaction was assessed using a single self-reported item, which may increase the possibility of recall bias, although the primary objective was to capture the individual's own subjective perception. Third, the study sample was limited to first-year students at TUMS, and the exclusion of non-Iranian students due to language challenges limits the generalizability of the findings to the broader population of medical sciences students. Furthermore, because there were no cases of severe anxiety or severe depression in the study sample, it was not possible to evaluate the impact of these more severe psychological conditions. Finally, another limitation of this study was the challenge of recruiting and retaining student participation in the study. To address this, several strategies were implemented to encourage involvement, such as emphasizing the study's significance for both individual and public health and providing participants with feedback on their personal results throughout the study. In light of these limitations, future research could utilize follow-up data from the parent cohort, of which the students in the present study are a part, to examine changes in sleep satisfaction and academic self-efficacy throughout the course of their education and to clarify the direction of this relationship. Conducting multicenter studies across different medical universities in the country would also enable comparison of these findings across diverse academic settings.

Conclusions

Among first-year TUMS students navigating the transition to university, poor but not moderate sleep satisfaction was associated with lower academic self-efficacy. This association persisted after adjustment for socioeconomic status, depression, and living status, although attenuation of the estimate suggests that psychological and contextual factors may partly contribute to the relationship. By focusing on students' overall subjective appraisal of sleep, this study extends prior evidence based mainly on

multidimensional sleep-quality measures and shows that clearly negative sleep perceptions may be relevant to students' confidence in managing academic demands.

Brief assessment of sleep satisfaction, interpreted alongside mental health and living circumstances, may support early identification of students who need further academic or well-being support. Longitudinal analyses of the TUMS cohort and multicenter studies using both subjective and objective sleep measures should clarify temporal direction and broader applicability. Overall, sleep satisfaction may provide a simple but meaningful window into academic adjustment during the first year of university.

Declarations

Competing interests

The authors declare no competing interests.

Author Contribution

S.N.T. led the preparation of the manuscript and wrote the original draft. P.Z. performed the statistical analyses. Y.A. and H.A.G. critically reviewed and revised the manuscript. Z.J. supervised the work, critically reviewed the manuscript, and served as the corresponding author. All authors reviewed and approved the final manuscript.

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Data Availability

The datasets analysed during the current study are not publicly available due to ethical and confidentiality considerations related to participant data but are available from the corresponding author on reasonable request, subject to approval by the relevant institutional authorities.

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Tables

Table 1. Distribution of Sleep satisfaction by Demographic and Socioeconomic characteristics

Variables		Sleep Satisfaction (N%)			
		Total N= 392	Good N= 198	Moderate N= 117	Poor N=77
Sex	Female	211 (53.83)	108 (54.55)	67 (57.26)	36 (46.75)
	Male	181 (46.17)	90 (45.45)	50 (42.74)	41 (53.25)
Living status	Dormitory	174 (44.39)	79 (39.90)	56 (47.86)	39 (50.65)
	Home	218 (55.61)	119 (60.10)	61 (52.14)	38 (49.35)
Socioeconomic status	Low	55 (14.03)	34 (17.17)	13 (11.11)	8 (10.39)
	Middle	229 (58.42)	110 (55.56)	73 (62.39)	46 (59.74)
	High	108 (27.55)	54 (27.27)	31 (26.50)	23 (29.87)
Tobacco Use	No	381 (97.19)	194 (97.98)	111 (94.87)	76 (98.70)
	Yes	11 (2.81)	4 (2.02)	6 (5.13)	1 (1.30)
Alcohol Consumption	No	374 (95.41)	191 (96.46)	109 (93.16)	74 (96.10)
	Yes	18 (4.59)	7 (3.54)	8 (6.84)	3 (3.90)
Physical Activity	Insufficient	176 (44.90)	88 (44.44)	56 (47.86)	32 (41.56)
	Sufficient	216 (55.10)	110 (55.56)	61 (52.14)	45 (58.44)
Depression	No	126 (32.14)	93 (46.97)	21 (17.95)	12 (15.58)
	Mild	174 (44.39)	81 (40.91)	64 (54.70)	29 (37.66)
	Moderate-to-severe	92 (23.47)	24 (12.12)	32 (27.35)	36 (46.75)
Anxiety	No	153 (39.03)	95 (47.98)	36 (30.77)	22 (28.57)
	Mild	167 (42.60)	79 (39.90)	58 (49.57)	30 (38.96)

Variables		Sleep Satisfaction (N%)			
		Total	Good	Moderate	Poor
		N= 392	N= 198	N= 117	N=77
	Moderate-to-severe	72 (18.37)	24 (12.12)	23 (19.66)	25 (32.47)
Values are presented as column percentages. Insufficient physical activity: <600 MET-min/week (equivalent to <150 min/week). Depression: PHQ-9 score 0–4 (none), 5–9 (mild), and 10–27 (moderate-to-severe). Anxiety: GAD-7 score 0–4 (none), 5–9 (mild), and 10–21 (moderate-to-severe). Severe depression and anxiety were not observed in the study population.					

Table 2. Distribution of sleep satisfaction across levels of academic self-efficacy

Variable		Levels of Academic Self-Efficacy		
		Low, N (%)	Moderate, N (%)	High, N (%)
Sleep satisfaction	Good	59 (40.41)	78 (56.93)	61 (55.96)
	Moderate	48 (32.88)	39 (28.47)	30 (27.52)
	Poor	39 (26.71)	20 (14.60)	18 (16.51)
Sleep satisfaction was presented across levels of academic self-efficacy using column percentages.				

Table 3. Linear regression analysis of the association between sleep satisfaction and academic self-efficacy scores

Academic self-efficacy scores				
Sleep satisfaction	Crude Model		Adjusted Model	
β (95% CI)	p-value	$A\beta$ (95% CI)	p-value	
Good	Ref			
Moderate	-3.97 (-8.03, 0.09)	0.056	-1.50 (-5.65, 2.64)	0.477
Poor	-8.90 (-13.57, -4.22)	<0.001	-5.43 (-10.29, -0.57)	0.029
A β : adjusted for: SES, Depression, living status; CI: Confidence Interval				