Somalia Turkiye Medical Journal (STMJ)
Volume 3, Issue No. 4, 2024
ISSN 2958-2849

RESEARCH ARTICLE

Interplay of Physical Activity and Insomnia: A Cross-Sectional Study of University Students in Somalia

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Received: August 22, 2024
Accepted: October 12, 2024
Published: October 15, 2024

Abstract:

***Objective*:** Physical activity (PA) positively impacts health, enhancing well-being, life satisfaction, and sleep quality. This study examined the associations between PA levels and insomnia in a university student sample in Somalia.

***Methods*:** A total of 268 volunteer students aged 18–30 from the Health Sciences University Mogadishu Somalia Türkiye Recep Tayyip Erdogan School of Health Sciences participated in the study. Exclusion criteria included refusal to participate or contraindications for PA. PA levels were assessed using the International Physical Activity Questionnaire-Short Form (IPAQ-SF), and insomnia severity was evaluated using the Insomnia Severity Index (ISI). Data were analyzed with SPSS version 26.0.

***Results*:** The majority of participants were women (88.1%), non-smokers (99.6%), and coffee consumers (61.6%). PA levels were categorized as inactive/low (44%), moderate (43.3%), and vigorous (12.7%). Insomnia prevalence included subthreshold insomnia (36.2%) and clinically significant insomnia (8.6%). ISI scores were significantly correlated with musculoskeletal pain, pain localization, pain duration, VAS scores, energy drink consumption, economic status, and frequency of stressful situations ($p < 0.05$). However, hierarchical regression analysis revealed that gender, BMI, and IPAQ-SF scores were not significant predictors of ISI scores.

***Conclusions*:** Nearly half of the participants were physically inactive, with a substantial proportion reporting subthreshold or clinically significant insomnia. Insomnia scores were influenced by musculoskeletal pain, stress, and lifestyle factors such as energy drink consumption and economic status, highlighting the multifactorial nature of sleep disturbances in this population.

Keywords: Physical activity, insomnia, sleep disorders, university students, Somalia.

1. INTRODUCTION

Insomnia, a pervasive sleep disorder, affects about 30% of the global adult population and is associated with significant physical, psychological, and societal consequences [1, 2]. It is characterized by persistent difficulties in initiating or maintaining sleep or waking up too early, leading to daytime impairment. Chronic insomnia has been linked to an increased risk of cardiovascular disease, metabolic disorders such as diabetes, and mental health challenges like depression and anxiety [3, 4]. This condition not only diminishes individual well-being but also burdens healthcare systems due to its associated comorbidities and reduced productivity.

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The university years present unique challenges to maintaining healthy sleep patterns, particularly due to academic demands, irregular schedules, and heightened stress levels. Research highlights that students experiencing insomnia often report impaired memory, difficulty concentrating, and reduced academic performance [5, 6]. Additionally, social media use and screen exposure before bedtime exacerbate sleep disturbances by delaying melatonin release and increasing physiological arousal, particularly in younger populations [7, 8].

Physical activity (PA) is widely acknowledged as a key determinant of sleep quality. Regular engagement in moderate-to-vigorous PA enhances sleep by reducing the time required to fall asleep, increasing slow-wave sleep duration, and improving overall sleep efficiency [9, 10]. The physiological mechanisms underpinning this relationship include reduced arousal, improved thermoregulation, and beneficial changes in mood and stress levels [11, 12]. However, the positive impact of PA on sleep is contingent on factors such as exercise timing and intensity. For instance, engaging in vigorous exercise close to bedtime may delay sleep onset due to elevated core body temperature and increased cortisol levels [13, 14].

The bidirectional nature of the relationship between PA and sleep is also noteworthy. While regular PA promotes better sleep, adequate sleep enhances an individual's motivation and ability to engage in physical activity, creating a virtuous cycle of improved health behaviors [15]. However, despite these benefits, sedentary behavior is becoming increasingly prevalent among university students, leading to significant reductions in PA levels [7]. This trend is especially concerning given the concurrent rise in stress and mental health issues during these formative years.

Despite the growing body of evidence on the interplay between PA and sleep, there is a scarcity of research exploring these dynamics in low-resource settings. Students in countries like Somalia face unique sociocultural and environmental challenges that may influence both PA and sleep behaviors. Factors such as limited access to recreational facilities, cultural norms regarding exercise, and economic pressures may significantly impact health outcomes in this population [16, 17]. Furthermore, the lack of public awareness and infrastructure to support healthy lifestyles underscores the need for context-specific research to inform interventions.

This study examined the relationship between physical activity levels and insomnia symptoms among university students in Somalia. By focusing on this understudied population, it aimed to explore potential strategies for improving sleep health and overall well-being in resource-limited settings. This research contributes to a broader understanding of sleep-related challenges in culturally unique and economically constrained environments.

2. METHODS

2.1. Participants

Participants were recruited voluntarily from the Health Sciences University Mogadishu Somalia Türkiye Recep Tayyip Erdogan School of Health Sciences. Eligibility criteria included university students aged 18–30 without contraindications for physical activity. A total of 268 students participated in the study out of 320 eligible students, yielding a response rate of 83.8%. Students who refused to participate or did not meet the inclusion criteria were excluded. The study adhered to ethical standards and was approved by the hospital's ethics review board, with reference number [MSTH/9852, Date: 11/04/2022]. All participants provided informed consent before participating, and their confidentiality was ensured throughout the study. Ethical guidelines outlined in the Declaration of Helsinki were strictly followed. Data collection was carried out using several tools: the International Physical Activity Questionnaire-Short Form (IPAQ-SF) for assessing physical activity levels [18], the Insomnia Severity Index (ISI) to evaluate insomnia symptoms [19], and a custom questionnaire developed after reviewing relevant literature. Demographic data collected included age, gender, body mass index (BMI), and additional lifestyle factors such as marital status, substance use (*e.g.*, smoking, alcohol, khat, and energy drink consumption), as well as the presence of musculoskeletal pain and various lifestyle habits.

2.2. Psychometric Scales

2.2.1. Sociodemographic Data Form

A custom-designed questionnaire was utilized to collect sociodemographic and clinical information relevant to participants' health and lifestyle. This form included items about personal characteristics such as age, gender, education level, marital status, and employment status. In addition, questions were included to capture data on participants' current and previous psychiatric conditions, ongoing treatments, and medication usage. The form also covered substance use behaviors, including cigarette smoking, alcohol consumption, and drug use, alongside inquiries about any psychiatric treatments received in the past or present. These details were aimed at providing a comprehensive understanding of the participants' medical and psychological background.

2.2.2. The International Physical Activity Questionnaire-Short Form (IPAQ-SF)

The IPAQ-SF is a self-reported tool aimed at evaluating physical activity levels in individuals aged 15 to 69. It consists of seven items, focusing on vigorous-intensity activities (such as running or cycling), moderate-intensity activities (*e.g.*, swimming or recreational cycling), and walking. Additionally, it asks participants about sedentary behaviors, specifically the time spent sitting. Physical activity levels are calculated in MET-minutes per week, by multiplying the MET value (vigorous: 8 MET, moderate: 4 MET, walking: 3.3 MET) by the frequency of the activity over the past week. The PA levels were categorized into three groups: high, moderate, and low [18]. The Turkish version of the IPAQ-SF was used, which has been validated for use in the Turkish population [20].

2.2.3. The Insomnia Severity Index (ISI)

The ISI is a self-report measure that evaluates the severity of insomnia. It consists of seven questions, rated on a Likert scale from 0 (not at all) to 4 (very much). The total score ranges from 0 to 28, with higher scores indicating more severe insomnia symptoms [19]. The Turkish version of the ISI was used in this study, which has been psychometrically validated for Turkish-speaking populations [21].

3. STATISTICAL ANALYSIS

Data were analyzed using SPSS version 26.0 (IBM Corp., Armonk, NY). Descriptive statistics summarized categorical variables as frequencies and percentages, while continuous variables were presented as medians and interquartile ranges (P25, P75) due to non-normal data distribution. Spearman's rank-order correlation was used to assess associations between variables. Hierarchical regression analysis was conducted to explore the predictive relationships between gender, BMI, physical activity levels (IPAQ- SF scores), and insomnia severity (ISI scores). Predictors were included in the regression model to provide a holistic understanding of their relationships with insomnia, even if their individual significance levels were limited. For instance, predictors like gender and BMI were retained to allow comparisons with prior literature and to ensure comprehensive data interpretation. Statistical significance was set at $p < 0.05$.

4. RESULTS

A total of 268 participants were involved in the study, with a predominance of female participants (88.1%) and a smaller proportion of males (11.9%). A large majority (95.9%) of the participants were single, and 82.4% reported a moderate-to-fair income level, reflecting a typical socioeconomic distribution in university student populations. The study also found that 30.2% of participants experienced musculoskeletal pain, which aligns with prior studies indicating that physical discomfort is prevalent in student populations [22]. Regarding lifestyle habits, 99.6% of the participants were non-smokers, which is consistent with the health-conscious behavior typically observed in academic settings [23]. Coffee consumption was common, with 61.6% of participants drinking coffee, and 22.8% consumed energy drinks—highlighting the increasing trend of caffeine consumption among young adults, often to combat fatigue associated with academic pressure [24]. Alcohol use was reported by 3% of the participants, and 2.6% used khat, which is a less common substance but is notable in certain regional contexts [25]. Moreover, 42.5% of the participants

reported experiencing stressful situations on a frequent basis, ranging from several times a month to daily, which reflects the stress levels typically experienced by university students due to academic and personal pressures [26]. Sociodemographic characteristics of the study participants are shown in Table **1**.

Table 1. Sociodemographic characteristics of the study participants (n = 268).

-	-	*M*	*SD*
Body mass index (BMI)	-	21.69	3.24
Variable	Category	*n*	%
Gender	Female	236	88.06
	Male	32	11.94
Marital Status	Married	11	4.10
	Single	257	95.90
Economic Status	Low Income	9	3.36
	Moderate Income	148	55.22
	Fair Income	73	27.24
	High Income	38	14.18
Living Place	Village	9	3.36
	City < 100K	44	16.42
	City > 100K	215	80.22
Musculoskeletal Pain	Present	81	30.22
	Absent	187	69.78
Pain Localization	None	185	69.03
	Lower Back	10	3.73
	Neck	19	7.09
	Upper Back	23	8.58
	Shoulder	6	2.24
	Other Areas	25	9.33
Pain Duration	None	186	69.40
	1 Month	29	10.82
	3 Months	7	2.61
	> 3 Months	46	17.16
Coffee Consumption	Present	165	61.57
	Absent	103	38.43
	None	207	77.24
Energy Drink Consumption	Several times a week	38	14.18
	Several times a month	23	8.58
	Present	8	2.99
Alcohol Use		-	-
-	Absent	259	96.64

-	Present	7	2.61
Khat Use		-	-
Frequency of Stressful Situations	Absent	260	97.01
	Rarely	154	57.46
	Several times a month	54	20.15
	Several times a week	46	17.16
	Every day	14	5.22

Regarding physical activity, the results indicated a relatively low level of regular exercise. Approximately 44% (118 participants) reported low or inactive physical activity, while 43.3% (116 participants) were moderately active, and only 12.7% (34 participants) reported engaging in vigorous physical activity. These findings are consistent with studies in other regions that highlight the prevalence of insufficient physical activity among university students [27]. In terms of insomnia, 36.2% (97 participants) exhibited subthreshold insomnia, and 8.6% (23 participants) reported clinically significant insomnia, ranging from moderate to severe, aligning with the rates observed in previous studies focusing on sleep disturbances in university student populations [28].

Table **2** summarizes the significant correlations observed in the study. A positive correlation was found between IPAQ-SF scores and gender ($r_s = 0.234$, $p < 0.01$), indicating that gender differences may influence physical activity levels. However, no significant correlations were found between IPAQ-SF scores and other sociodemographic variables. In contrast, ISI scores, which measure insomnia severity, were positively correlated with stressful situations ($r_s = 0.267$, $p < 0.01$), musculoskeletal pain localization ($r_s = 0.265$, $p < 0.01$), and pain duration ($r_s = 0.309$, $p < 0.01$), suggesting that both stress and physical pain contribute to sleep disturbances. ISI scores were negatively correlated with musculoskeletal pain ($r_s = -0.314$, $p < 0.01$), which may indicate a complex interaction between the subjective experience of pain and sleep quality [22]. Economic status was also negatively correlated with ISI scores ($r_s = -0.159$, $p < 0.01$), suggesting that individuals facing economic stress may be more vulnerable to sleep disorders, a finding consistent with the work of Lund *et al.* [29]. Additionally, energy drink consumption was positively associated with ISI scores ($r_s = 0.133$, $p < 0.05$), which aligns with emerging research indicating that high- caffeine beverages can interfere with sleep quality [24; 30].

Finally, hierarchical regression analysis revealed that variables such as gender ($\beta = -0.160$, $t = -1.224$, $p = 0.222$), BMI ($\beta = 0.014$, $t = 1.112$, $p = 0.267$), and IPAQ-SF scores ($\beta = 0.009$, $t = 0.143$, $p = 0.886$) were not significant predictors of ISI scores, suggesting that while these factors might be correlated with insomnia, they do not provide significant explanatory power when predicting insomnia severity in this sample. Further analysis, possibly with additional variables or longitudinal data, could help clarify these relationships (see Table **3**).

5. DISCUSSION

Insomnia remains a global health issue, affecting diverse populations across varying demographics and cultural contexts. In this study, 36.2% of participants experienced subthreshold insomnia, while 8.6% reported clinically significant insomnia, aligning with findings from other countries. For instance, a study conducted among medical students in India found a 33% prevalence of insomnia [31], and a Polish study reported a similar prevalence of 37% [32]. However, other cultural contexts report higher rates. Studies in Hong Kong and Ethiopia found insomnia prevalence rates of 68.8% and 61.6%, respectively [33, 34]. These discrepancies highlight the influence of cultural, social, and environmental factors, such as academic stress, living conditions, and access to healthcare resources, which may mediate the prevalence and perception of insomnia. The findings underscore the need for culturally tailored strategies to address sleep disturbances in university populations, particularly in low-resource settings like Somalia. Studies in Sub-Saharan Africa and Ethiopia have shown that socio-cultural factors such as social disparities and mental health issues (*e.g.*,

living with HIV/AIDS) exacerbate insomnia, indicating that contextual factors must be considered when addressing sleep disorders in these regions [35].

Table 2. Spearman's Rank-Order Test Correlations (rs) between sleep quality measures and demographics.

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. IPAQ-SF	1													
2. ISI	-.025	1												
3. VAS	-.001	** .317	1											
4. BMI	.061	.062	.101	1										
5. Gender	** .234	-.076	-.004	.048	1-									
6. Economical Status	.067	** -.159	* -.140	-.088	-.014	1								
7. Stresful Situations	-.048	** .267	** .195	.073	-.036	* -.187	1							
8. Musculoskelatal Pain	.003	** -.314	** -.955	-.081	.017	* .152	- ** .173	1						
9. Pain Localization	-.003	** .265	** .949	.101	.009	* -.135	** .160	** -.944	1					
10. Pain Duration	.013	** .309	** .969	.082	-.004	* -.133	** .178	** -.964	** .957	1				
11. Coffee Consumption	-.038	-.028	.020	-.050	-.007	* -.179	-.092	.002	.027	.007	1			
12. Energy Drink Consumption	-.008	* .133	* .150	.017	.088	.003	** .189	* -.151	* .143	* .135	* -.135	1		
13. Alcohol Use	.030	.052	-.010	.018	* -.138	-.067	-.045	-.004	-.028	.031	.113	-.023	1	
14. Khat Use	.067	.013	.058	-.063	* -.154	-.087	-.042	-.038	.047	.057	.058	.011	** .579	1

Abbreviations: IPAQ-SF: International Physical Activity Questionnaire Short Form, ISI: Insomnia Severity Index. VAS: Visual Analog Scale; BMI: Body Mass Index.

The significant correlation observed between insomnia severity and stressful situations ($rs = 0.267$, $p < 0.01$) aligns with prior research demonstrating that stress exacerbates sleep disturbances [35]. Stressors related to academic demands, familial obligations, and personal challenges are particularly prevalent among university students and have been shown to disrupt sleep patterns [37, 38]. This is consistent with evidence that academic settings often foster environments of heightened stress, with limited resources available to manage these pressures effectively. Implementing stress management interventions, such as mindfulness-based practices or counseling services, could mitigate this burden and improve sleep outcomes. Physical discomfort also plays a crucial role in sleep disturbances, as indicated by positive correlations between insomnia severity and musculoskeletal pain localization ($rs = 0.265$, $p < 0.01$) and pain duration ($rs = 0.309$, $p < 0.01$). These findings corroborate previous studies that link chronic pain with disrupted sleep patterns.

McBeth and Jones [39] highlighted that pain not only contributes to difficulty falling and staying asleep but also perpetuates a cycle where inadequate sleep exacerbates the perception of pain. Addressing pain through appropriate management strategies, including physiotherapy or pain- relief interventions, could help improve sleep quality in this population.

Table 3. Hierarchical Regression Analysis for Variables Predicting ISI Score.

Variable	*B*	*SE*	β	*t*	*p*
Step 1	-	-	-	-	-
(Intercept)	1.405	0.310	0.00	4.529	<0.001
Gender	-0.155	0.126	-0.075	-1227	0.221
BMI	0.014	0.013	0.069	1.126	0.261
Step 2	-	-	-	-	-
(Intercept)	1.398	0.315	0.00	4.436	<0.001
Gender	-0.160	0.130	-0.077	-1.224	0.222
BMI	0.014	0.013	0.068	1.112	0.267
IPAQ-SF	0.009	0.062	0.009	0.143	0.886

Abbreviations: IPAQ-SF: International Physical Activity Questionnaire Short Form, ISI: Insomnia Severity Index. BMI: Body Mass Index
Note: Model 1: F (2, 265) = 1.367, p = .257, ΔR^2 = .00; Model 2: F (2, 265) = 0.915, p = .434, ΔR^2 = .00.

Interestingly, our study found a negative correlation between insomnia severity and musculoskeletal pain ($rs = -0.314$, $p < 0.01$), a finding that may initially seem contradictory. However, this can be interpreted through the lens of individual pain tolerance, type of pain, and variability in pain perception. For instance, Chung *et al.* [40] suggest that localized or less intense pain might not significantly disrupt sleep compared to widespread or chronic pain. Future studies should differentiate between acute and chronic pain to better understand its complex relationship with insomnia. The association between insomnia severity and lifestyle factors, such as energy drink consumption ($rs = 0.133$, $p < 0.05$), reflects the growing body of evidence linking stimulants to poor sleep outcomes [41, 42]. Energy drinks, often consumed by students to manage academic demands, contain high levels of caffeine and other stimulants that delay sleep onset and reduce overall sleep quality. Public health initiatives should address the risks associated with excessive energy drink consumption and promote healthier alternatives for maintaining alertness during study periods.

Regarding physical activity (PA), our study found that 44% of participants were physically inactive, 43.3% engaged in moderate PA, and 12.7% reported vigorous PA. These findings align with research conducted in other regions, such as Turkey, where Demirer and Erol [43] reported high rates of inactivity among university students. Additionally, Bloemhoeff *et al.* [44] noted that male students generally engage in higher PA levels than females, a trend also observed in our study, where IPAQ-SF scores correlated positively with gender ($rs = 0.234$, $p < 0.01$). Despite strong evidence linking PA with improved sleep quality, our study found no significant correlation between PA and insomnia severity. This is consistent with Vancampfort *et al.* [45], who suggested that short-term assessments like the seven-day recall used in our study may not reflect habitual activity. Moreover, other factors, such as diet, mental health, and social support, may have a greater influence on sleep quality than PA alone.

Economic status also emerged as a significant factor, with a negative correlation observed between insomnia severity and economic status ($rs = -0.159$, $p < 0.01$). This finding supports prior research linking financial stress to poor sleep quality [45]. In resource-constrained settings, economic hardships often translate into heightened anxiety and stress, exacerbating sleep disturbances. For example, a study conducted in Lebanon found that students from lower socioeconomic backgrounds reported worse sleep quality [47]. Addressing socioeconomic disparities through targeted interventions, such as financial aid programs or stress reduction workshops, could improve sleep outcomes in these populations.

The lack of significant gender differences in insomnia prevalence in our study contrasts with findings from other settings, where women often report poorer sleep quality than men, particularly in academic environments [48]. However, similar to a study conducted in Turkey [49], this discrepancy may reflect cultural norms and variations in reporting behaviors or measurement tools. Future studies should consider gender-specific factors influencing sleep to clarify these inconsistencies.

The relationship between physical activity and insomnia remains complex. While our study did not find a direct correlation, other studies have demonstrated the positive effects of physical activity on sleep quality. Kredlow *et al.* [50] found that regular physical activity significantly improved sleep in individuals with insomnia. Moreover, long-term engagement in physical activity may help to regulate the body's circadian rhythms, thus promoting better sleep [51]. However, further research is needed to explore how different types of physical activity—whether aerobic, strength training, or flexibility exercises—affect sleep patterns in university students.

Several limitations should be acknowledged in this study. First, its single-center design, limited to a university student population in Somalia, restricts the generalizability of findings to broader or more diverse populations. Expanding future research to include multiple centers or diverse demographic groups could enhance representativeness. Second, the lack of validated tools in Somali cultural contexts, such as the IPAQ-SF and ISI, may have introduced measurement biases. Developing culturally adapted instruments would improve reliability. Third, the cross-sectional nature of the study limits causal inferences. Longitudinal research is needed to clarify temporal relationships between variables like physical activity and insomnia. Additionally, reliance on self-reported data for insomnia symptoms, pain levels, and lifestyle factors may be subject to recall and social desirability biases. Employing objective measures such as actigraphy or polysomnography could provide more accurate assessments. Lastly, while confounders were controlled to some extent, unmeasured variables, including genetic predispositions and medical conditions, may have influenced the results. Addressing these limitations in future research could provide a more robust understanding of the factors influencing insomnia.

CONCLUSION

In conclusion, our study contributes to the growing body of literature on insomnia among university students by highlighting the role of lifestyle factors such as stress, musculoskeletal pain, and energy drink consumption in sleep disturbances. It underscores the importance of adopting a holistic approach to managing insomnia, incorporating interventions focused on physical activity, stress management, and lifestyle modifications. Future research should employ longitudinal designs to better understand the long-term effects of these factors on sleep quality across diverse cultural contexts, addressing limitations related to single-center designs and cultural adaptations of measurement tools.

DECLARATIONS

COMPETING INTERESTS

The authors declare that they have no competing interests.

AUTHORS' CONTRIBUTIONS

ZS served as the guarantor for the integrity of the study. ZS and SK contributed equally to the study's concept, design, literature review, and statistical analysis. ZS and SK were also responsible for manuscript preparation. All authors reviewed and approved the final manuscript.

FUNDING

This study did not receive any specific funding from any funding agencies or sectors.

AVAILABILITY OF DATA AND MATERIALS

The datasets and materials used during the current study are available from the corresponding author upon reasonable request.

CONFLICT OF INTEREST

The authors declare that this article's content has no conflict of interest..

ACKNOWLEDGEMENTS

The authors declared none.

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