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Associations between sedentary behavior, mental well-being, and sleep dysregulation: cross-sectional evidence from student populations

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Abstract

This study investigates the prevalence of sedentary behavior and examines its association with mental well-being and sleep patterns. This cross-sectional study included 649 medical students. Participants completed a structured, closed-ended survey assessing demographic characteristics, mental well-being, and sleep-related variables. A high prevalence of sedentary behavior was identified among students (60.1%). Sedentary behavior was significantly associated with mental well-being (p=0.04), sleep patterns (p=0.01), and screen time (p<0.001). Multinomial regression analyses demonstrated that sedentary behavior significantly predicted poor mental health [odds ratio (OR)=1.66; 95% confidence interval (CI): 1.11-2.48; p=0.01] and screen time of 4 to 6 hours per day (OR=2.24; 95% CI: 1.19-4.21; p=0.01). The likelihood of exceeding 6 hours of screen time was even higher (OR=6.0; 95% CI: 3.23-11.12; p<0.001). Additionally, sedentary behavior was associated with a significantly increased odds of irregular sleep (OR=1.63; 95% CI: 1.16-2.29; p=0.005). The high prevalence of sedentary behavior and its strong association with sleep dysregulation highlight the urgent need for targeted interventions. Implementing strategies to reduce prolonged sitting and promote healthier sleep and mental health practices may provide significant benefits. Additional research utilizing longitudinal or experimental designs across diverse institutions is necessary to clarify causal mechanisms and inform the development of effective prevention strategies.

Key words: sedentary behavior, sleep dysregulation, mental well-being, screen time, college students.

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Introduction

Sedentary behavior refers to activities that involve low energy expenditure while sitting, reclining, or lying down during waking hours.[1] Common examples include extended screen time, studying, reading, and other passive leisure activities. Unlike physical inactivity, which denotes insufficient engagement in moderate-to-vigorous exercise, sedentary behavior is considered a distinct construct and an important determinant of health outcomes.[2] The widespread adoption of digital technologies and heightened academic demands have contributed to the increasing prevalence of sedentary lifestyles among university students.[3]

Recent studies indicate that sedentary behavior is linked to negative physical and psychological outcomes, including obesity, elevated cardiovascular risk, musculoskeletal discomfort, and diminished mental well-being.[4] University students, who often spend extended periods attending lectures, studying, and engaging in screen-based activities, are particularly vulnerable. Mental well-being, encompassing emotional stability, life satisfaction, and resilience, is especially influenced by lifestyle factors.[5] Excessive sedentary time is associated with increased stress, anxiety, depressive symptoms, and reduced quality of life, highlighting the importance of investigating this relationship within academic settings.[6]

Despite growing recognition of sedentary behavior as a public health concern, research on its association with mental well-being among university students remains limited, especially in non-Western contexts.[7] The majority of existing studies emphasize physical health outcomes, with comparatively less attention to psychological dimensions. Furthermore, many investigations focus on general adult populations, overlooking the unique academic pressures, social transitions, and digital engagement patterns characteristic of university students.[8] This gap highlights the need for context-specific evidence to inform interventions tailored to student populations.

This study examines the prevalence of sedentary behavior among medical students at the University of Duhok. It also explores the association between sedentary behavior and mental well-being, along with related psychobehavioral variables such as sleep patterns, screen time, and academic performance. The findings are expected to inform evidence-based health promotion strategies within academic institutions, thereby supporting students' physical and mental resilience.

Materials and Methods

Study design and setting

A cross-sectional design was used to assess the prevalence of sedentary behavior and its association with psychobehavioral indicators, including mental health status, sleep patterns, sleep duration, and academic performance, among medical students. The study was conducted at the College of Medicine, University of Duhok, from April to November 2025. Full-time students who provided informed consent were eligible for inclusion. Students who declined participation or withdrew at any stage of recruitment were excluded from the analysis. Additionally, students with documented psychological disorders who were currently receiving psychotherapy, regardless of type, were excluded.

Survey instrument

A closed-ended, self-designed questionnaire in English, the official language of instruction, was used for this study. The instrument comprised two main sections. The first section collected demographic information, including age, gender, and academic year. The second section addressed variables such as physical activity, mental health status, screen time, sleep patterns and duration, and academic performance. Students were categorized as sedentary (sitting for more than 6 hours per day) or active (sitting for less than 6 hours per day) based on their physical activity. Sleep patterns were classified as regular (going to bed at the same time each night) or irregular (varying bedtimes).[9] For daily screen time and sleep duration, students were grouped into three categories: less than 4 hours per day, 4-6 hours per day, and more than 6 hours per day. Mental health status was assessed using the World Health Organization-5 (WHO-5) Well-being Self-reported Questionnaire.[10] Scores of 50 or higher indicated good well-being, scores between 29 and 50 indicated average well-being, and scores of 28 or below indicated poor mental health.

The instrument was reviewed by a subject-matter expert to ensure reliability. It was subsequently pilot-tested with a small group of students who were not included in the final analysis to assess feasibility.

Determination of sedentary behavior

Sedentary behavior was measured using self-reported daily sitting time, adapted from the International Physical Activity Questionnaire. Participants estimated their average daily sitting hours, including both screen-based activities (such as television viewing, computer use, and smartphone use) and non-screen sedentary activities (such as reading and studying while seated). Individuals reporting more than 6 hours of sitting per day were classified as sedentary, while those reporting 6 hours or less were classified as active. This threshold was selected to align with established cut-offs in the literature and to capture prolonged sitting that may negatively impact mental health outcomes.

Measurement of sleep patterns

Sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI), a validated instrument widely used in both clinical and student populations. The PSQI measures sleep duration, latency, disturbances, and overall subjective quality over the preceding month. Scores were calculated according to the standardized protocol, with higher scores reflecting poorer sleep quality. Participants self-reported their bedtimes and were classified as having regular sleep patterns if they reported consistent bedtimes each night, or as having irregular sleep patterns if their bedtimes varied.

Assessment of mental well-being

Mental well-being was measured using the WHO-5 Well-Being Index, a brief and psychometrically robust scale validated across diverse populations. The WHO-5 comprises 5 positively worded items that assess mood, vitality, and general interest in daily activities over the previous 2 weeks. Responses were recorded on a 6-point Likert scale, and total scores were converted to a percentage scale ranging from 0 to 100, with higher scores indicating greater well-being. The WHO-5 has also been validated as a sensitive screening tool for psychological distress.

Data collection and handling

Participants were instructed to complete the survey independently, and adequate time was provided to minimize response bias. Ambiguous or unclear questions were clarified by the researcher as needed. This approach enabled the efficient collection of a large number of samples within a limited time. The recruitment process was preceded by official announcements in the student common areas. Following students' initial willingness to participate, the researcher approached interested students and explained the study objectives. After final approval for participation, students were given the previously explained survey instrument and a sufficient time (2 weeks) to provide their feedback. All collected instruments were then reviewed for completeness, and the incomplete responses were excluded from the final analysis. For variables with sporadic missing values, statistical techniques such as multiple imputations were applied. Overall, the sampling process lasted 3 months, during which 800 surveys were administered, but only 649 complete responses were included in the final statistical analysis.

Data analysis

Following data collection, all responses were coded and recorded in an Excel sheet (Microsoft, Redmond, WA, USA), and the Statistical Package for the Social Sciences (SPSS) version 26 (IBM, Armonk, NY, USA) was used for statistical analysis. Descriptive statistics, including frequencies and percentages, were used to demonstrate the prevalence of sedentary behavior among the student population. Chi-square tests were applied to assess associations among sedentary behavior, mental well-being, sleep patterns, screen time, and academic performance. Multinomial regression analyses were conducted to evaluate whether sedentary behavior predicted mental well-being and related variables and to confirm associations identified by chi-square tests. Physical activity was treated as a binary independent variable (sedentary *vs.* active). Interpretation of the findings was based on β coefficients, odds ratios (ORs), and 95% confidence intervals (95% CIs). Statistical significance was defined as p-values less than 0.05, with p-values less than 0.01 considered highly significant.

Results

A total of 649 university students participated in the study, comprising 52.9% male and 47.1% female respondents. The age distribution included 47.6% aged 18-20 years, 49.3% aged 21-24 years, and 3.1% aged 25 years or older. In terms of academic year, 27.4% were first-year students, 21.1% were in their second year, 19.3%

were in their third year, 14.6% were in their fourth year, 7.9% were in their fifth year, and 9.7% were in their sixth year (Table 1).

Psychobehavioral parameters were evaluated. Daily sitting time was less than 4 hours for 18.3% of participants, 4-6 hours for 21.6%, and more than 6 hours for 60.1%. Regarding daily screen time, 12.9% of students reported less than 4 hours, 41.3% reported 4-6 hours, and 45.8% reported more than 6 hours. Sleep duration was less than 4 hours for 6% of participants, 4-6 hours for 20.3%, and more than 6 hours for 73.7%. Regular sleep patterns were observed in 34.6% of students, whereas 65.4% reported irregular sleep patterns. In terms of academic performance in the last year, 16.5% of students rated themselves as poor, 38.2% as average, and 45.3% as good. With respect to mental health status, 22.3% of participants reported poor mental health, 27.9% reported average mental health, and 49.8% reported good mental health.

The association between sedentary behavior and psychobehavioral parameters was examined by categorizing the study population into students with sedentary behavior, defined as sitting more than 6 hours per day (n=390, 60.1%), and active students, defined as sitting less than 6 hours per day (n=259, 39.9%) (Table 2). The proportion of students with poor or average mental health status was significantly higher in the sedentary group compared to the active group (p=0.04). Similarly, irregular sleep patterns were more prevalent among sedentary students (p=0.01). Prolonged screen time was also significantly more common in the sedentary group (p<0.001). No significant differences were found for sleep duration, age, or academic performance (p>0.05). The chi-square test assessed associations between sedentary behavior and other variables, while Cramér's V measured the strength of these associations. Only mental health status, sleep patterns, and screen time demonstrated significant associations with sedentary behavior (Cramér's V=0.099, 0.112, and 0.289, respectively).

After confirming the association between sedentary behavior and the parameters listed in Table 2, a multinomial regression analysis was performed to determine whether sedentary behavior predicts mental health status, sleep patterns, and screen time (Table 3). The analysis identified sedentary behavior as a significant predictor of poor mental health status, with a β coefficient of 0.511, an OR of 1.66, and a 95% CI of 1.11 to 2.48 (p=0.01). These results indicate that individuals with higher levels of sedentary behavior are 66% more likely to report poor mental health status compared to those with lower levels.

Additionally, sedentary behavior was a significant predictor of average mental health status (β=0.152; OR=1.16; 95% CI=0.8-1.69), and the model was statistically significant (p=0.05).

Sedentary behavior significantly predicts screen time of 4 to 6 hours per day (β=0.808; OR=2.24; 95% CI=1.19-4.21; p=0.01). The likelihood of exceeding 6 hours of screen time increases further (β=1.79; OR=6.0; 95% CI=3.23-11.12; p<0.001). Furthermore, sedentary behavior is associated with significantly higher odds of irregular sleep (β=0.490; OR=1.63; 95% CI: 1.16-2.29; p=0.005).

In the logistic regression analysis, potential confounders such as age, gender, and academic performance (self-reported grade point average) were included in the model due to their theoretical relevance. Although these covariates were not statistically significant, their inclusion did not materially alter the associations between sedentary behavior and the primary variables.

Table 1. Distribution of the demographic and psych-behavioral features of the study population.

Variables	Groups	Frequency (n= 649)	Percent (%)
Gender	Male	343	52.9
	Female	306	47.1
Age	18-20	309	47.6
	21-24	320	49.3
	>24	20	3.1
Academic year	1st	178	27.4
	2nd	137	21.1
	3rd	125	19.3
	4th	95	14.6
	5th	51	7.9
	6th	63	9.7
Daily sitting time	≤4 h	119	18.3
	4-6 h	140	21.6
	>6 h	390	60.1
Daily screen time	≤4 h	84	12.9
	4-6 h	268	41.3
	>6 h	297	45.8
Sleep duration	≤4 h	39	6.0
	4-6 h	132	20.3
	>6 h	478	73.7
Sleep patterns	Regular	225	34.6
	Irregular	424	65.4
Academic performance	Poor	107	16.5
	Average	248	38.2
	Good	294	45.3
Mental health status	Poor	145	22.3
	Average	181	27.9
	Good	323	49.8

Table 2. Crosstabulation of psychobehavioral parameters by sitting duration.

Variables	Groups	Sitting time		χ value	Cramer's V	p
		Sedentary (n=390, 60.1%)	Active (n=259, 39.9%)			
Academic performance	Poor	67	40			
	Average	147	101	0.360	0.024	>0.05
	Good	176	118			
Mental health status	Poor	73	69			
	Average	109	72	6.339	0.099	0.04
	Good	208	118			
Sleep patterns	Regular	152	73	8.139	0.112	0.01
	Irregular	238	186			
Daily screen time	≤4 h	70	14			
	4-6 h	185	83	54.383	0.289	<0.001
	>6 h	135	162			
Sleep duration	≤4 h	18	21			
	4-6 h	80	52	3.372	0.072	>0.05
	>6 h	292	186			
Age	18-20	190	119			
	21-24	187	133	0.818	0.035	>0.05
	>24	13	7			

Table 3. Regression analyses of sedentary behavior with study variables.

Variables	Sedentary behavior			
	β coefficient	Odds ratio	95% confidence interval	P
Poor mental health status	0.511	1.66	1.11-2.48	0.01
Average mental health status	0.152	1.16	0.8-1.69	0.05
Screen time (4-6 h)	0.808	2.24	1.19-4.21	0.01
Prolonged screen time (>6 h)	1.79	6.0	3.23-11.12	<0.001
Irregular sleep	0.490	1.63	1.16-2.29	0.005

Discussion

Different types of sedentary behavior exhibit distinct causal relationships with health outcomes. Leisure television viewing is associated with increased risks of myocardial infarction, coronary artery disease, ischemic stroke, and type 2 diabetes. In contrast, leisure computer use is linked to protective effects against rheumatoid arthritis, Alzheimer's disease, and gastroesophageal reflux disease. These findings suggest that sedentary time is not uniformly detrimental; the specific nature of the sedentary activity is important. Consequently, public health interventions should address both reducing total sedentary time and promoting healthier sedentary activities.[11] Recent evidence indicates that sedentary behaviors are associated with neuropsychiatric disorders (NPDs), highlighting a potential modifiable target for prevention. However, the directionality of this relationship remains uncertain: sedentary behaviors may influence NPD risk, and NPDs may also affect the extent of sedentary behavior.[12] The present study investigated the prevalence of sedentary behavior among medical students and examined its association with psychobehavioral parameters, including mental well-being, sleep patterns, screen time, and academic performance.

This study included full-time medical students of both genders, spanning various age groups and academic years. The findings indicated that most students engaged in sedentary behavior, characterized by prolonged sitting and screen time exceeding 6 hours per day. Most students also reported irregular sleep patterns, marked by short duration and insufficient rest. Approximately one-third of participants exhibited poor mental health status. Chi-square tests revealed significant associations among sedentary behavior, screen time, sleep patterns, and mental health status. Regression analyses further demonstrated that sedentary behavior significantly predicts poor mental health, irregular sleep, and extended screen time. These findings are consistent with previous research demonstrating that sedentary behavior, including excessive screen time, is strongly associated with poorer mental health in adolescents, with notable gender differences.[13] Additional studies have indicated that mentally passive sedentary behaviors, such as watching television, may increase the risk of depression.[14] Although promoting physical activity and reducing sedentary behavior can improve mental health among adolescents, further research is necessary to clarify these effects in preschool-aged children.[15] Among Korean university students, increased sitting hours were significantly associated with higher levels of stress, anxiety, and depression, even after adjusting for sex, economic status, body mass index, underlying disease, and health self-management.[16] Similarly, research involving college students in China found that sedentary behavior was positively associated with anxiety, depression, and suicidal behavior in a dose-response rela-

tionship. An independent dose-response association between sedentary behavior and mental well-being was also observed among Chinese college students, which may be partially attributable to impaired sleep quality.[17] Despite substantial evidence linking sedentary behavior to mental health outcomes, some studies have reported no consistent associations between sitting time and psychological distress. Given the increasing prevalence of psychological distress in recent years, particularly among younger adults, it is essential to investigate effective countermeasures through large-scale interventions or prospective study designs.[18]

Extensive studies and systematic reviews consistently demonstrate that increased sedentary time is associated with poorer self-reported sleep quality and a higher incidence of sleep problems in adults.[19-24] Prolonged sedentary behavior is linked to reduced sleep quality in both men and women.[19] A meta-analysis reported that sedentary behavior increases the risk of insomnia and sleep disturbances, although no association was found with daytime sleepiness or poor sleep quality.[20] Research involving desktop workers identified a high prevalence of disturbed sleep, with evidence indicating a relationship among sleep deprivation, physical activity, and sedentary behavior.[21] Further studies show that exercise effectively improves symptoms of sleep disturbance in individuals with high sedentary behavior.[22] In a cohort of middle-aged adults in Japan, substituting 60 minutes of sedentary behavior with moderate-to-vigorous physical activity was associated with improved sleep quality.[23] Additional evidence indicates that limiting sedentary time to 300 minutes per day and maintaining a sleep duration of 7-8 hours may reduce the risk of sleep disorders and improve sleep quality.[24]

The mechanisms underlying the health outcomes associated with sedentary behavior, particularly its effects on mental health and sleep patterns, require thorough investigation. Prolonged sedentary behavior has been linked to insulin resistance, vascular dysfunction, increased carbohydrate oxidation, a transition in muscle fiber composition from oxidative to glycolytic types, reduced cardiorespiratory fitness, decreased muscle and bone mass and strength, increased total and visceral body fat, elevated blood lipid concentrations, and elevated levels of inflammation.[25] Circadian and hormonal disruptions are also significant contributors. Evidence shows that sedentary, screen-based activities at night can disrupt circadian rhythms and melatonin secretion, leading to sleep displacement or delay. Furthermore, physical inactivity may alter the onset of nocturnal melatonin.[26]

Several limitations should be acknowledged when interpreting these findings. First, reliance on self-reported measures introduces the potential for recall and social desirability biases, which may compromise the accuracy of reported sedentary time, sleep quality, and mental well-being. Second, the sample was drawn from a single academic institution, which may restrict the generalizability of the findings to student populations in other cultural or educational contexts. Third, the cross-sectional design prevents conclusions regarding causality or temporal directionality, limiting interpretation to associative relationships. Therefore, these results should be interpreted as associative, highlighting the need for longitudinal or experimental studies to clarify temporal directionality and identify potential causal mechanisms. The mental health assessment relied solely on the WHO-5 validated questionnaire; future research should incorporate additional assessment instruments and examine other relevant variables to provide a more comprehensive analysis. Although the sample size was adequate for the present analysis, larger samples are recommended in future studies to enhance robustness and external validity.

Despite these limitations, the findings emphasize the importance of addressing sedentary behavior among students. Interventions designed to reduce prolonged sitting and promote healthier sleep and mental health practices may offer significant benefits. Future research utilizing longitudinal or experimental designs across diverse institutions is necessary to clarify causal pathways and inform targeted prevention strategies.

Conclusions

This study demonstrates a significant association between sedentary behavior, mental well-being, and related psychobehavioral factors among medical students in the region. The increasing prevalence of sedentary habits and sleep dysregulation highlights the urgent need for targeted interventions. Educational institutions should implement proactive measures that provide students with practical strategies to promote both mental health and healthy sleep patterns. Prioritizing these initiatives is expected to enhance academic performance and support overall student well-being.

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Informed consent: written informed consent was obtained from all participants. Written informed consent was obtained from all participants before data collection.

Participant consent for publication: participants were informed that their data would be published anonymously and consented to the publication of the results.

Availability of data and materials: the datasets generated and analyzed during this study are available from the corresponding author upon reasonable request.

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