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Research Article / Araştırma Makalesi

Relationships between smoking and sleep quality, depression, and anxiety among medical students: A cross-sectional study in Türkiye

Tıp fakültesi öğrencileri arasında sigara kullanımı ile uyku kalitesi, depresyon ve anksiyete arasındaki ilişkiler: Türkiye'de bir kesitsel çalışma

Burak Avcu[1], Zehra Ulubaba[2], Umut Emin Ünlü[2], Nazım Ünlü[2], Sevde Türkmenoğlu[2], Münira Nazlı Unal[2], Şevval Üner[2], Ceren Uçar[2], Eylül Vural[2], Adulnur Uçar[2], Numan Ulgen[2], Deniz Türkmen[2]

[1]Department of Public Health, Faculty of Medicine, İnönü University, Malatya, Türkiye
[2]Faculty of Medicine, İnönü University, Malatya, Türkiye

ABSTRACT

Background: Tobacco consumption continues to be a primary contributor to preventable illness and death globally, especially among young adults. Medical students experience high stress levels and inadequate sleep, potentially increasing tobacco consumption, depression, and anxiety.

Methods: This cross-sectional study recruited 273 medical students from a A medical school in Türkiye. Data were collected via a sociodemographic questionnaire, the Pittsburgh Sleep Quality Index (PSQI), the Beck Depression Inventory (BDI), the Beck Anxiety Inventory (BAI), and the Fagerström Test for Nicotine Dependence (FTND). Mann-Whitney U and chi-square tests were employed to compare smokers (n=70) and nonsmokers (n=203). Linear regression analyses examined the impact of smoking status on PSQI, BDI, and BAI scores, whereas logistic regression identified predictors of smoking.

Results: Overall, 53.1% of the students had tried smoking at least once in their lifetime, and 25.6% reported current tobacco use. Smokers exhibited significantly higher median PSQI (9 vs. 6), BDI (17 vs. 10), and BAI (15 vs. 11) scores ($p<0.05$). Chi-square analyses indicated that poor sleep quality and moderate-to-severe depression were more prevalent among smokers. Linear regression revealed that smoking predicted an average increase of 2.36 points in PSQI, 6.01 in BDI, and 3.97 in BAI ($p<0.01$). FTND scores showed a positive correlation with PSQI and BAI, but not with BDI. Logistic regression demonstrated that each 1-point increase in PSQI elevated the odds of current smoking by 26.6% (OR=1.266).

✉ Burak Avcu ▪ burak.avcu@inonu.edu.tr

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Conclusions: Current smoking was associated with reduced sleep quality, elevated depression, and increased anxiety symptoms in medical students. These results highlight the need for integrated interventions focusing on smoking cessation and mental health support to improve the well-being of future physicians.

Keywords: Tobacco use, sleep quality, depression, anxiety, medical students

ÖZ

Arka Plan: Tütün kullanımı, özellikle genç erişkinler arasında, dünya genelinde önlenebilir hastalıklar ve ölümlerin başlıca nedenlerinden biri olmaya devam etmektedir. Tıp öğrencileri yüksek düzeyde stres yaşamakta ve yetersiz uyku süresiyle karşı karşıya kalmaktadır; bu durum tütün kullanımını, depresyonu ve anksiyeteyi artırabilir.

Yöntemler: Bu kesitsel çalışmada, Türkiye'deki tek bir kurumdan 273 tıp fakültesi öğrencisi çalışmaya dahil edilmiştir. Veriler; sosyodemografik anket, Pittsburgh Uyku Kalitesi İndeksi (PUKİ), Beck Depresyon Envanteri (BDE), Beck Anksiyete Envanteri (BAE) ve Fagerström Nikotin Bağımlılığı Testi (FNBT) ile toplanmıştır. Sigara içenler (n=70) ve içmeyenler (n=203) Mann-Whitney U ve ki-kare testleri ile karşılaştırılmıştır. Lineer regresyon analizleri, sigara kullanım durumunun PUKİ, BDE ve BAE puanları üzerindeki etkisini incelemiş; lojistik regresyon ise sigara kullanımının yordayıcılarını belirlemiştir.

Bulgular: Öğrencilerin %53,1'i hayatlarında en az bir kez sigara denemiş, %25,6'sı ise halen tütün kullandıklarını bildirmiştir. Sigara içenler, içmeyenlere kıyasla anlamlı düzeyde daha yüksek medyan PUKİ (9'a karşı 6), BDE (17'ye karşı 10) ve BAE (15'e karşı 11) puanlarına sahipti (p<0,05). Ki-kare analizleri, sigara içenlerde kötü uyku kalitesi ve orta-ileri düzey depresyonun daha yaygın olduğunu göstermiştir. Lineer regresyon analizleri, sigara içmenin PUKİ'de ortalama 2,36 puan, BDE'de 6,01 puan ve BAE'de 3,97 puanlık artış ile ilişkili olduğunu göstermiştir (p<0,01). FNBT puanları, PUKİ ve BAE ile pozitif korelasyon gösterirken, BDE ile anlamlı fark bulunmamıştır. Lojistik regresyon analizinde, PUKİ puanındaki her 1 birimlik artışın sigara içme olasılığını %26,6 artırdığı belirlenmiştir (OR=1,266).

Sonuçlar: Mevcut sigara kullanımı, tıp öğrencilerinde daha düşük uyku kalitesi, daha yüksek depresyon ve anksiyete semptomları ile ilişkilidir. Bu sonuçlar, geleceğin hekimlerinin iyi oluş halini artırmak için sigara bırakma programlarını ve ruh sağlığı desteğini entegre eden müdahalelere ihtiyaç olduğunu vurgulamaktadır.

Anahtar Kelimeler: Tütün kullanımı, uyku kalitesi, depresyon, anksiyete, tıp öğrencileri

Introduction

Tobacco consumption is the primary cause of preventable diseases globally, with cigarettes being the most widely used form of tobacco.[1] Smoking is associated with various serious health complications and accounts for over 8 million deaths each year.[2]

According to 2019 estimates, approximately 155 million individuals aged 15–24 worldwide were current tobacco smokers, with a prevalence of 20.1% among males and 4.95% among females.[3] Most individuals begin regular smoking prior to the age of 20, highlighting the necessity for targeted prevention strategies to decrease morbidity and health-care costs. Approximately 82.6% of smokers indicated that they began smoking between the ages of 14 and 25. In Türkiye, the smoking prevalence in this age group is notably high, 45.6% among males and 22.0% among females. The mean age of smoking onset is 17.3 years for males and 20.0 years for females, signifying that adolescence and early adulthood are important phases for the establishment of nicotine dependence.[4,5] Recent findings further indicate that initiating smoking at age 20 or older is associated with lower nicotine dependence and depressive tendencies, as well as higher cessation

success rates, and that delaying initiation until age 22 confers even greater reductions in nicotine dependence.[6]

The effects of nicotine on neurotransmitter systems, such as dopamine, serotonin, and glutamate in the brain, is essential for understanding addiction and cognitive effects.[7]

Medical school is challenging because of high levels of stress, poor sleep quality and high rates of depression and anxiety.[8,9] Many studies have reported positive associations between smoking and mental health issues such as depression, anxiety, and poor sleep quality, with smoking rates increasing with the severity of the disease.[10-12] Numerous studies have suggested a bidirectional relationship between smoking and depression, wherein each can act as a risk factor for the other.[11] Despite the prevalence of tobacco dependence and psychosocial issues among medical students, comprehensive research concurrently examining smoking, sleep quality, depression and anxiety simultaneously is quite limited. This study will provide evidence for the development of integrated smoking cessation-mental health screening programs on university campuses, as well as the enhancement of tobacco control policies targeted at young adults.

This study aims to determine the relationships between smoking and sleep quality, depression and anxiety levels among medical students and to reveal the interactions between these variables.

Materials and Methods

Study Design, Setting, and Participants

The descriptive cross-sectional study was conducted from February 5 to March 14, 2025, among a Faculty of Medicine students. The research spanned 1741 student participants. A minimum sample size of 273 participants was determined based on a predicted smoking rate of 30.1% among medical students, with a 95% confidence level and ±5% margin of error. The research sample was proportionally stratified by class (1-6) and then randomly sampled for each stratum.

Variables

The data collection included both a standardized questionnaire and Turkish versions of standardized psychometric scales:

Sociodemographics and smoking behaviors: The survey asked about age, gender, residence type, family/individual income, smoking behaviors, initiation age, smoking status, quit attempts, and family/friend smoking. The Fagerström Test for Nicotine Dependence (FTND) assessed nicotine dependence.[13]

Sleep quality: The Pittsburgh Sleep Quality Index (PSQI) evaluated three sleep-related dimensions which included sleep duration, sleep latency and sleep disturbances. Better sleep quality corresponds to lower total scores.[14]

Depression: The Beck Depression Inventory (BDI) contained 21 items rated from 0 to 3 to evaluate depressive symptoms and higher total scores indicated more severe depression.[15]

Anxiety: The Beck Anxiety Inventory (BAI) contained 21 anxiety items which participants rated from 0 to 3 to assess anxiety severity and higher scores indicated more anxiety.[16]

Reliability of the Measures

Reliability analyses were conducted via Cronbach's alpha. The depression measure (BDI) yielded a Cronbach's alpha of 0.910, indicating excellent internal consistency. Similarly, the anxiety measure (BAI) had a Cronbach's alpha of 0.871, also reflecting high reliability. The FTND, a 6-item scale, had a Cronbach's alpha of 0.671. Although this value is slightly below the conventional 0.70 threshold, it may be attributed to the limited

number of items and the inherent variability of the construct.

Data Collection

The participants received an explanation of the study's purpose, scope, and voluntary nature, and provided written informed consent. The questionnaires were administered face-to-face by the research team in settings that preserved participant privacy. No identifying information was collected; all the data were coded anonymously and stored electronically.

Statistical Analysis

All the data were analyzed via the IBM Statistical Package for the Social Sciences (SPSS) version 22.0. For descriptive statistics, categorical variables are presented as frequencies (n) and percentages (%), whereas continuous variables are summarized as the mean ± standard deviation if normally distributed, or as the median (interquartile range) otherwise. Normality was tested via the Shapiro-Wilk test. Independent sample t-tests and Mann-Whitney U tests were used for group comparisons according to normal distribution characteristics. Relationships between categorical variables were examined via Pearson's chi-square test or Fisher's exact test when expected cell frequencies were less than 5. Among participants who smoked, associations between FTND scores and PSQI, BDI, and BAI scores were evaluated via Spearman's correlation coefficient, according to normality assumptions. Multivariate logistic regression analysis was then conducted to identify independent predictors of smoking status. Simple linear regression models examined current smoking status as a predictor of PSQI, BDI, and BAI scores. A p-value <0.05 was considered to indicate statistical significance.

Ethical Approval

This study was approved by the Non-Interventional Clinical Research Ethics Committee of the a Faculty of Medicine (Decision No: 2025/7075), as well as by the Dean's Office of the Faculty of Medicine. The research was conducted in accordance with the principles of the Declaration of Helsinki. The participants were informed about the voluntary nature of the study, and their rights were fully protected.

Results

In this study, 48.0% of the participants were male and 52.0% were female, with a median age of 21 years (IQR: 19-23). The largest proportion of students came from the second year with 23.4%. Among the students, 46.9% lived with family or relatives, 39.9% resided in dormitories, and 13.2% lived independently. The research participants had a median household income of 55.000 TRY (IQR: 40.000-80.000 TRY) while their average individual monthly earnings amounted to 7.500 TRY (IQR: 5.000-12.000 TRY).

A total of 34.8% reported being influenced by health warnings on cigarette packs. Students most commonly quit or avoided smoking because of health risks (85.7%) and the unpleasant odor (61.2%) as well as economic factors (28.9%) and personal values or beliefs (30.4%) and family and social pressure (20.1%) and physician advice (10.6%) and media or public service announcements (10.6%).

Within the last 30 days, 56.0% indicated that smoking had occurred in their home, and 54.9% had at least one regular smoker in the household (most often the father, 37.0%). Also, 36.6% of the students did not have any of their three closest friends who smoked daily.

Overall, 53.1% of the students had tried smoking at least once in their lifetime, and 25.6% reported current tobacco use. Most students tried cigarettes because of curiosity (51.4%) followed by family or peer influence (17.8%) then university stress (13.0%) and major life issues such as death or

illness (7.5%) and social imitation (4.1%) and loneliness (3.4%) and earthquake distress (2.7%).

Manufacturing cigarettes were the most popular tobacco product among smokers (94.2%). Many smokers used multiple tobacco products, including 31.9% hand-rolled cigarettes, 27.5% electronic cigarettes, and 24.6% waterpipes. Students started smoking at 18.0 (17.0-19.5) years old and smoked for 3.0 (2.0-5.0) years. 80.0% of students wanted to quit smoking. Participants who tried to quit smoking had 39.6% stay abstinent for over a year and 23.7% for less than a month.

The median scores obtained by the students on the psychometric scales were compared to established clinical cutoff values. For sleep quality, the median Pittsburgh Sleep Quality Index (PSQI) score was 6.0 (IQR: 5.0–9.0). According to the established 5-point scale, 60.8% of students exhibited poor sleep quality while 39.2% demonstrated good sleep quality. For depression, the median value of Beck Depression Inventory (BDI) score was 11.0 (IQR: 7.0–18.5). When subdivided by standard cutoff ranges, 36.3% of the participants scored in the minimal depression range (0–9), 31.9% in the mild depression range (10–18), 22.3% in the moderate depression range (19–29), and 9.5% in the severe depression range (30–63). The Beck Anxiet Inventory (BAI) produced a median score of 12.0 (IQR: 7.5–20.0). According to the BAI cutoff values, 24.9% had minimal anxiety (0–7), 38.1% had mild anxiety (8–15), 25.3% had moderate anxiety (16–25), and 11.7% had severe anxiety (30–63). The last score represented the median Fagerström Test for Nicotine Dependence (FTND) score among current smokers which indicated a low overall level of nicotine dependence in this study sample. (Table 1).

Median PSQI scores were significantly higher in current smokers (median=9.0, IQR=6.0-11.0) than in nonsmokers (median=6.0, IQR=4.0-8.0; p<0.001). Categorical analysis showed that 22.9% of smokers (n=16) versus 44.8% of nonsmokers (n=91) achieved good sleep quality (PSQI≤5), and these groups constituted 15.0% and 85.0%, respectively, of all participants with good sleep quality. Conversely, poor sleep quality was reported by 77.1% of smokers and 55.2% of nonsmokers, representing 32.5% and 67.5% of the total poor-sleep quality group (p=0.001).

BDI scores were also elevated among smokers (median=17.0, IQR=10.0-26.0) compared with nonsmokers (median=10.0, IQR=7.0-17.0; p<0.001). When stratified by severity, minimal depression affected 18.6% of smokers and 42.4% of nonsmokers—smokers comprising 13.1% and nonsmokers 86.9% of the minimal-depression group. Mild depression was observed in 30.0% of smokers versus 32.5% of nonsmokers (24.1% and 75.9% of the mild-depression group), moderate depression in 32.9% versus 18.7% (37.7% and 62.3% of that subgroup), and severe depression equally in both groups (18.6% each, representing 50.0% of the severe-depression category; p<0.001).

BAI scores were higher among smokers (median=15.0, IQR=10.0-23.0) than nonsmokers (median=11.0, IQR=7.0-18.0; p=0.003); however, anxiety severity distributions did not differ significantly (p=0.132). Minimal anxiety was present in 17.1% of smokers and 27.6% of nonsmokers-corresponding to 17.6% and 82.4% of the minimal-anxiety group. Mild anxiety occurred in 35.7% versus 38.9% (24.0% and 76.0% of the mild group), moderate anxiety in 30.0% versus 23.6% (30.4% and 69.6% of the moderate subgroup), and severe anxiety in 17.1% versus 9.9% (37.5% and 62.5% of the severe-anxiety category).

The study found that 37.4% of male students smoked, compared to 14.8% of female students (p<0.001). The median income of current smokers was 10.000 TRY (IQR: 6.000-15.000 TRY), while that of nonsmokers was 7.000 TRY (IQR: 5.000-10.000 TRY). The difference was statistically significant (p=0.005).

Table 1. Sociodemographic, Smoking, and Psychometric Scale Characteristics of Medical Students

		n, (%) – Median, (IQR)
Gender	Male	131 (48.0%)
	Female	142 (52.0%)
Age		21.0 (19.0-23.0%)
Place of Residence	Dormitory	109 (39.9%)
	At home with family/relatives	128 (46.9%)
	At home, separate from the family	36 (13.2%)
Monthly family income		55.000 TRY (40.000-80.000 TRY)
Monthly personal income		7.500 TRY (5.000-12.000 TRY)
Influenced by warnings on cigarette packs (Yes)		95 (34.8%)
Household smoking in the last 30 days (Yes)		153 (56.0%)
Regular smoker in the family (Yes)		150 (54.9%)
Reasons Influencing the Decision to Quit Smoking or Never Start*	Harmful to health	234 (85.7%)
	Unpleasant odor	167 (61.2%)
	Personal values or beliefs	83 (30.4%)
Number of closest 3 friends who smoke daily	0	100 (36.6%)
	1	78 (28.6%)
	2	50 (18.3%)
	3	45 (16.5%)
Ever tried cigarettes		145 (53.1%)
Reasons for initially trying cigarettes (n=145)	Curiosity	75 (51.4%)
	Peer/family influence	26 (17.8%)
	University-related stress	19 (13.0%)
Currently smokes		70 (25.6%)
Tobacco products used (n=70)*	Manufactured cigarettes	65 (94.2%)
	Hand-rolled cigarettes	22 (31.9%)
	Electronic cigarettes	19 (27.5%)
	Waterpipe	17 (24.6%)
Intention to quit smoking (Yes, n=70)		56 (80.0%)
Age at smoking initiation (n=70)		18.0 (17.0-19.5)
Duration of smoking (years, n=70)		3.0 (2.0-5.0)
Pittsburgh Sleep Quality Index (PSQI) Score		6.0 (5.0-9.0)
PSQI Groups	Good Sleep Quality	107 (39.2%)
	Bad Sleep Quality	166 (60.8%)
Beck Depression Inventory (BDI) Score		11.0 (7.0-18.5)
BDI Groups	Minimal Depression (0-9)	99 (36.3%)
	Mild Depression (10-18)	87 (31.9%)
	Moderate Depression (19-29)	61 (22.3%)
	Severe Depression (30-63)	26 (9.5%)
Beck Anxiety Inventory (BAI) Score		12.0 (7.5-20.0)
BAI Groups	Minimal Anxiety (0-7)	68 (24.9%)
	Mild Anxiety (8-15)	104 (38.1%)
	Moderate Anxiety (16-25)	69 (25.3%)
	Severe Anxiety (30-63)	32 (11.7%)
Fagerström Test for Nicotine Dependence (FTND)		2.0 (1.0-5.0)

*: Multiple responses were allowed

A significant difference (p<0.001) was found between smoking behavior and the number of close friends who smoked regularly. With more smoking peers, smoking rates rose. Students whose three closest friends smoked smoked 64.4%, compared to 5.0% whose friends did not. Smokers were more likely to have been exposed to cigarette smoke at home in the past 30 days (36.6%) than nonsmokers (11.7%) (p<0.001). Only 5.3% of current smokers cited health warnings as influencing their behavior, compared to 36.5% of non-influenced individuals (p<0.001).

The nonsmokers mentioned 'Harmful to health' and 'Unpleasant odor' more often when quitting or not starting smoking (p=0.002 and p=0.001). Additionally, nonsmokers cited 'Personal values or beliefs' more frequently (p<0.001). No significant differences were found in 'Financial reasons' (p=0.079), 'Social or family pressure' (p=0.178), or 'Doctor's advice' (p=0.518) (Table 2).

The Fagerström Test for Nicotine Dependence (FTND) scores were used to examine individual differences in cigarette smoking through correlation analyses with other scale scores in the study.

FTND scores (n=70) showed a moderately positive significant correlation with Pittsburgh Sleep Quality Index (PSQI) scores (r=0.383; p=0.001). FTND scores demonstrated a positive significant correlation with Beck Anxiety Inventory (BAI) scores (r=0.316; p=0.008). The research indicates that stronger nicotine dependence is linked to worse sleep quality and more severe anxiety symptoms. The analysis between FTND scores and Beck Depression Inventory (BDI) scores yielded no statistically meaningful relationship (r=0.090; p=0.458).

The entire student sample (n=273) revealed significant correlations between the PSQI and BDI and BAI scores during data examination. The PSQI scores demonstrated significant positively correlated with both the BDI (r=0.591; p<0.001) and the BAI (r=0.464; p<0.001). The BDI and BAI scores showed a strong positive correlation (r=0.636; p<0.001). The analysis shows that poorer sleep quality tends to result in more severe depressive and anxiety symptoms. (Table 3).

The final logistic regression model contained psychosocial, demographic and environmental variables which were found to be statistically significant in preliminary univariate analyses and a one-point increase in the Pittsburgh Sleep Quality Index (PSQI) score was associated with a 26.6% greater likelihood of current smoking (OR=1.266, p=0.001, 95% CI=1.097–1.461). In contrast, the Beck Depression Inventory (BDI) and Beck Anxiety Inventory (BAI) scores were not significant predictors (OR=1.003, p=0.907 and OR=1.025, p=0.337).

From a demographic perspective, being male was linked to a 3.55-fold increase in the odds of smoking compared with being female (p=0.001, 95% CI=1.638-7.688). Moreover, exposure to smoking within the home (OR=5.100, p<0.001, 95% CI=2.295-11.335) and having at least one smoker in the household (OR=8.744, p<0.001, 95% CI=3.030-25.240) emerged as particularly strong predictors of current smoking. Finally, unpleasant odor was also found to be a significant risk factor (OR=2.216, p=0.032, 95% CI=1.072-4.581), indicating that participants who reported distress from cigarette odor were more than twice as likely to smoke (Table 4).

Our analyses reveal compelling evidence that current smoking affects major mental health aspects and sleep quality significantly. Current smoking status proved to be a statistically significant predictor in separate regression models for all outcome measures. The Pittsburgh Sleep Quality Index (PSQI) scores of current smokers exceeded those of nonsmokers by 2.36 points on average which shows severe sleep quality impairment (B=2.36, SE=0.40, β=0.34,

Table 2. Comparison of Psychometric Scale Scores and Smoking-related Factors by Current Smoking Status Among Students

Variable		Current Smoker (n=70)	Nonsmoker (n=203)	p value
Psychometric Scales				
Pittsburgh Sleep Quality Index (PSQI)	PSQI Score (Median, IQR)**	9.0 (6.0-11.0)	6.0 (4.0-8.0)	**<0.001**
	Good Sleep Quality*	16 (15.0%)	91 (85.0%)	**0.001**
	Bad Sleep Quality*	54 (32.5%)	112 (67.5%)	
Beck Depression Inventory (BDI)	BDI Score (Median, IQR)**	17.0 (10.0-26.0)	10.0 (7.0-17.0)	**<0.001**
	Minimal Depression*	13 (13.1%)	86 (86.9%)	**<0.001**
	Mild Depression*	21 (24.1%)	66 (75.9%)	
	Moderate Depression*	23 (37.7%)	38 (62.3%)	
	Severe Depression*	13 (50.0%)	13 (50.0%)	
Beck Anxiety Inventory (BAI)	BAI Score (Median, IQR)**	15.0 (10.0-23.0)	11.0 (7.0-18.0)	**0.003**
	Minimal Anxiety*	12 (17.6%)	56 (82.4%)	0.132
	Mild Anxiety*	25 (24.0%)	79 (76.0%)	
	Moderate Anxiety*	21 (30.4%)	48 (69.6%)	
	Severe Anxiety*	12 (37.5%)	20 (62.5%)	
Sociodemographic characteristics (n, %)				
Gender*	Male	49 (37.4%)	82 (62.6%)	**<0.001**
	Female	21 (14.8%)	121 (85.2%)	
Individual income, median (IQR)**		10.000 (6.000-15.000)	7.000 (5.000-10.000)	**0.005**
Smoking-related factors (n, %)				
Number of daily smokers among 3 closest friends*	0	5 (5.0%)	95 (95.0%)	**<0.001**
	1	13 (16.7%)	65 (83.3%)	
	2	23 (46.0%)	27 (54.0%)	
	3	29 (64.4%)	16 (35.6%)	
Exposure to smoking at home in the last 30 days*	Yes	56 (36.6%)	97 (63.4%)	**<0.001**
	No	14 (11.7%)	106 (88.3%)	
Impact of health warnings on smoking behavior/attitude*	Yes	5 (5.3%)	90 (94.7%)	**<0.001**
	No	65 (36.5%)	113 (63.5%)	
Factors influencing the decision to quit smoking or never start smoking*	Harmful to health	52 (22.2%)	182 (77.8%)	**0.002**
	Financial reasons	26 (32.9%)	53 (67.1%)	0.079
	Social or family pressure	18 (32.7%)	37 (67.3%)	0.178
	Doctor's advice	6 (20.7%)	23 (79.3%)	0.518
	Unpleasant odor	31 (18.6%)	136 (81.4%)	**0.001**
	Personal values or beliefs	4 (4.8%)	79 (95.2%)	**<0.001**

* Pearson chi-square test was applied.
** Mann Whitney-U test was used.

p<0.001, 95% CI: 1.58-3.14). The large effect size accounts for 11.6% of PSQI score variance thus demonstrating the clinical relevance of smoking status in predicting sleep disturbances.

The analysis showed that current smoking led to significant growth of depressive symptoms. The Beck Depression Inventory (BDI) model showed that smokers showed 6.01 more points on average compared to nonsmokers (B=6.01, SE=1.31, β=0.27, p<0.001, 95% CI: 3.43-8.60) which explained 7.2% of the variance. The research reveals that smoking acts as a significant factor which worsens depressive symptoms.

Table 3. Correlations between nicotine dependence (FTND), sleep quality (PSQI), depression (BDI), and anxiety (BAI) scores among medical students

	Fagerström Test for Nicotine Dependence (FTND)	Pittsburgh Sleep Quality Index (PSQI)	Beck Depression Inventory (BDI)
Pittsburgh Sleep Quality Index (PSQI)	0.383** (**p=0.001**, n=70)		
Beck Depression Inventory (BDI)	0.090 (p=0.458, n=70)	0.591** (**p<0.001**, n=273)	
Beck Anxiety Inventory (BAI)	0.316** (**p=0.008**, n=70)	0.464** (**p<0.001**, n=273)	0.636** (**p<0.001**, n=273)

Spearman correlation coefficients are presented.

Table 4. Multivariable logistic regression of psychosocial (PSQI, BDI, BAI), demographic (gender), and environmental exposures (household smoking, unpleasant odor) predicting current smoking status among medical students

Variable	B	SE	p value	OR (Exp(B))	95% CI
PSQI	0.236	0.073	**0.001**	1.266	1.097 – 1.461
BDI	0.003	0.025	0.907	1.003	0.955 – 1.053
BAI	0.025	0.026	0.337	1.025	0.975 – 1.078
Male (vs. Female)	1.267	0.394	**0.001**	3.549	1.638 – 7.688
Smoking exposure at home	1.629	0.407	**<0.001**	5.100	2.295 – 11.335
Unpleasant odor	0.796	0.370	**0.032**	2.216	1.072 – 4.581
Household smoking	2.168	0.541	**<0.001**	8.744	3.030 – 25.240

The model explained 48.8% of the variance in current smoking status (Nagelkerke $R^2 = 0.488$), with a statistically significant overall fit ($\chi^2(9) = 108.82$, $p<0.001$).

Table 5. Simple linear regression analyses examining the effects of current smoking on sleep quality, depression, and anxiety

Predictor	PSQI	BDI	BAI
Constant	6.24 (0.20)* [5.85, 6.64]	12.65 (0.66)* [11.34, 13.95]	13.09 (0.63)* [11.84, 14.34]
Current Smokers	2.36 (0.40)* β = 0.34 t(271) = 5.96 **p<0.001** [1.58, 3.14]	6.01 (1.31)* β = 0.27 t(271) = 4.58 **p<0.001** [3.43, 8.60]	3.97 (1.25)* β = 0.19 t(271) = 3.17 **p=0.002** [1.50, 6.43]
Model Summary	$R^2 = 0.116$; F = 35.54, p<0.001	$R^2 = 0.072$; F = 20.997, p<0.001	$R^2 = 0.036$; F = 10.05, p=0.002

Independent variable= Current smoking status
Dependent variables: PSQI, BDI, and BAI scores
The values in parentheses denote standard errors; 95% confidence intervals are provided in brackets. *p<0.005.

The Beck Anxiety Inventory (BAI) results showed that current smokers had 3.97 higher points than nonsmokers (B=3.97, SE=1.25, β=0.19, p=0.002, 95% CI: 1.50-6.43) which explained 3.6% of the outcome variance. The effect size is small but it reaches statistical significance and holds clinical importance (Table 5).

Discussion

This cross-sectional study was conducted among Turkish medical students to determine the correlation between smoking habits and mental health consequences such as sleep, depression, and anxiety. Results show that current smokers had poorer sleep quality and higher depression and anxiety symptoms when compared to their nonsmoker counterparts.

Smoking

Stress, depression, and anxiety can increase smoking and their intensity. Many studies have found a bidirectional relationship between smoking and stress, depression, and anxiety.[11,17] Those who smoke daily have the highest risk of depression, but quitting smoking reduces the risk, with longer cessation periods lowering risk.[18] We found that 53.1% of students have tried smoking and 25.6% smoke. Globally, 12.5%-46.7% of university students smoke.[19-22] In Türkiye, 27.9%-42.5% of university students smoke.[23-26]

Sleep Quality

Our findings suggest that the medical faculty students have very low quality of sleep. As shown by the Pittsburgh Sleep Quality Index, 60.8% of the students had poor sleep quality. This result means that the majority of medical students do not get enough sleep to get proper rest, and the quality of sleep is also not optimal. The hypothesis is that demanding schedules, night duties, and examination stress are some of the factors that can interfere with the quality of sleep. Several meta-analyses have also revealed that the incidence of poor sleep quality among medical students ranges between 52.7% and 64%.[9,27,28] Several studies carried out in Türkiye have also shown that 52.4% to 79.62% of the medical students have poor sleep quality, which is in agreement with our results.[29-32]

Our results show that the median PSQI score was significantly higher in the current smokers (9) as compared to the nonsmokers (6), hence the sleep quality was poorer in the smoking group. The present study findings are in agreement with the study that was done among medical students where it was observed that PSQI scores were higher (worse) for smokers than for nonsmokers (median PSQI score: 7 vs. 4).[33]

Depression

Our study identified a significant difference between depression levels and smoking among medical students. Beck Depression Inventory (BDI) scores were significantly elevated in smokers compared to nonsmokers, and the prevalence of smoking escalated with increasing levels of depression. Longitudinal studies demonstrate a bidirectional relationship between smoking and depression, wherein smoking predicts depression and depression predicts smoking. Depression's capacity to predict smoking is frequently more pronounced.[34] Current smokers are more prone to experiencing depression compared to never smokers and former smokers.[35] Quitting smoking correlates with enhancements in mental health, including decreases in depression, anxiety, and stress, as well as improvements in quality of life.[36] A meta-analysis involving over 129,000 students across 43 countries indicated that the average prevalence of depression or depressive symptoms among medical students was 27.2%. The review indicated that depressive symptoms escalated during medical education, with merely 15.7% of students seeking professional assistance. This highlights the psychological strain associated with medical education and the insufficiency of students' help-seeking behaviors.[37]

Research suggests that smoking may contribute to elevated levels of depression. A meta-analysis of 19 studies, including seven prospective studies,

indicated that smokers exhibited greater odds of developing depression compared to non-smokers within 1–6 years (OR=1.62).[38] A meta-analysis involving adolescents indicated that smoking correlated with a increased risk of depression over a 1–6-year duration (OR=1.73).[34]

This study revealed that 56.0% of students experienced household smoking exposure, signifying a substantial prevalence of secondhand smoke exposure. The presence of at least one smoker in the household is a significant predictor of current smoking (OR=8.744). Passive smoking exposure elevated the risk of depressive symptoms (OR=1.51) in two cohort studies.[39]

Anxiety

Our study revealed a significant link between medical students' smoking and anxiety. Current smokers had significantly higher Beck Anxiety Inventory (BAI) scores than nonsmokers, and nicotine dependence (FTND) correlated positively with anxiety (BAI). Early-life smoking may increase the risk of anxiety symptoms and disorders.[40] There is strong evidence linking smoking to anxiety.[41] A meta-analysis of fifteen studies found a significant association between anxiety disorders and regular smoking (OR=1.41) and nicotine dependence (OR=1.58).[42]

The cross-sectional design of this study limits causal conclusions about smoking and mental health. Self-reported measures may also cause recall or social desirability biases. One institution obtained the data, limiting generalizability to other regions or educational settings. Finally, academic workload, sleep hygiene, and coping mechanisms were not fully assessed, potentially ignoring factors that affect smoking and mental health.

Our findings highlight that smoking is significantly associated with diminished sleep quality, elevated depression levels, and increased anxiety among medical students. The findings emphasize the interplay of these factors, suggesting early, integrated interventions to diminish tobacco use, enhance mental health support, and eventually improve the overall well-being of future physicians.

Ethical approval

This study was approved by the Non-Interventional Clinical Research Ethics Committee of İnönü University Faculty of Medicine (Date: 21.02.2025, Decision No: 2025/7075). Informed consent was obtained from all participants.

Author contribution

Study conception and design: BA, ZU; Data collection: ZU, UEÜ, NÜ, ST, MNÜ, ŞÜ, CU, EV, AU, NÜ, DT; Analysis and interpretation of results: BA, ZU, UEÜ; Draft manuscript preparation: BA, ZU, UEÜ. All authors reviewed the results and approved the final version of the manuscript.

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Conflict of interest

The authors declare that there is no conflict of interest.

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