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RESEARCH ARTICLE

Smoking Behavior, Nicotine Dependence, and Awareness of Cessation Methods Among Pharmacy Students: A Cross-Sectional Analysis

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SUMMARY

Determining the smoking behaviors of pharmacy students and the factors that influence these behaviors is important for public health, as they are future healthcare professionals. This study assessed the prevalence of nicotine dependence among pharmacy students, evaluated perceptions of smoking-cessation methods, and identified correlates of dependence. This cross-sectional survey was conducted at a Faculty of Pharmacy in eastern Türkiye between June and July 2022. An online 25-item questionnaire, developed based on the literature and expert input, was administered to the students. Students' nicotine dependence was assessed using the Fagerström Test for Nicotine Dependence (FTND). The primary outcome was nicotine dependence severity. Secondary outcomes were the prevalence of current smoking, FTND distributions by demographics, and perceived effectiveness of cessation methods. Data from 232 students were analyzed (median age 23 years; ~70% female). Of these, 121 (52.2%) had never smoked; 54 (23.3%) had tried once; 11(4.7%) were former smokers; 13 (5.6%) smoked occasionally; and 33 (14.2%) smoked daily. The median (IQR) value of the FTND score of active smokers was 3(4). Among 46 current smokers, the distribution of nicotine-dependence levels was: very low: 22 (47.8%), low: 10 (21.7%), moderate: 3 (6.5%), high: 4(8.7%), and very high: 7 (15.2%). The presence of a family member who smoked led to an increase in the FTND Score (p=0.006). Face-to-face counseling and smoking cessation clinic interventions were rated significantly more effective than both mobile applications and posters and printed educational materials (p <0.05). In conclusion, students had low nicotine dependence and limited awareness of smoking-cessation methods.

Keywords: *Nicotine dependence, pharmacy students, smoking cessation methods, smoking prevalence.*

Eczacılık Fakültesi Öğrencilerinde Sigara Kullanım Davranışı, Nikotin Bağımlılığı ve Sigarayı Bırakma Yöntemlerine İlişkin Farkındalık: Kesitsel Bir Analiz

ÖZ

Geleceğin sağlık profesyonelleri olacak eczacılık öğrencilerinin sigara içme davranışlarını ve bu davranışları etkileyen faktörleri belirlemek halk sağlığı açısından önemlidir. Bu çalışmada eczacılık öğrencileri arasında nikotin bağımlılığının yaygınlığı ve sigara bırakma yöntemlerine ilişkin algıları değerlendirilmiş ve bağımlılığın ilişkili olduğu faktörler belirlenmiştir. Bu kesitsel anket, Haziran-Temmuz 2022 tarihleri arasında Türkiye'nin doğusundaki bir eczacılık fakültesinde gerçekleştirilmiştir. Literatür ve uzman görüşlerine dayanarak geliştirilen 25 soruluk çevrimiçi bir anket öğrencilere uygulanmıştır. Öğrencilerin nikotin bağımlılığı Fagerström Nikotin Bağımlılığı Testi (FTND) kullanılarak değerlendirilmiştir. Birincil çıktı nikotin bağımlılığı şiddetidir. İkincil çıktılar mevcut sigara içme yaygınlığı, demografik özelliklere göre FTND dağılımları ve sigara bırakma yöntemlerinin algılanan etkinliğidir. 232 öğrenciden alınan veriler analiz edilmiştir (ortanca yaş 23 yıl; ~%70 kadın). Bunlardan 121'i (%52,2) hiç sigara içmemişti; 54'ü (%23,3) bir kez denemişti; 11'i (%4,7) eskiden sigara içmiş ve bırakmıştı; 13'ü (%5,6) ara sıra sigara içiyordu ve 33'ü (%14,2) ise günlük sigara içiyordu. Aktif sigara içicilerinin FTND skorunun ortanca (IQR) değeri 3(4) idi. 46 mevcut sigara içicisinde nikotin bağımlılığı düzeylerinin dağılımı sırasıyla çok düşük: 22 (%47,8), düşük: 10 (%21,7), orta: 3 (%6,5), yüksek: 4 (%8,7) ve çok yüksek: 7 (%15,2) idi. Sigara içen aile üyesinin varlığı FTND Skorunda artışla ilişkilendirildi (p=0,006). Yüz yüze danışmanlık ve sigara bırakma kliniği müdahaleleri hem mobil uygulama hem de poster ve basılı eğitim materyallerinden önemli ölçüde daha etkili olarak derecelendirildi (p <0,05). Sonuç olarak, öğrencilerin nikotin bağımlılığı düşüktü ve sigara bırakma yöntemleri konusundaki farkındalıkları da sınırlıydı.

Anahtar Kelimeler: *Eczacılık öğrencileri, nikotin bağımlılığı, sigara bırakma yöntemleri, sigara içme yaygınlığı.*

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INTRODUCTION

Tobacco use remains a leading cause of preventable morbidity and mortality worldwide and continues to pose a major public-health challenge in Türkiye (West, 2017). Based on global estimates for 2020–2022, the prevalence of smoking was 13.3% among individuals aged 15–24 years and 21.7% among those aged ≥15 years (WHO, 2024). According to nationally reported data for Türkiye, cigarette-smoking prevalence was 28.7 % among individuals aged ≥15 years, and %19.3 among individuals aged 15-24 years in 2022 (TÜİK, 2023). Compared with global estimates, Türkiye shows a higher prevalence of tobacco smoking across all age groups.

The onset and consolidation of tobacco use occur predominantly during adolescence and young adulthood; nearly nine in ten adult daily cigarette smokers report initiating use by age 18 (Tidey, 2020; CDC, 2024). Young people are more vulnerable to smoking because they develop addiction more quickly than adults (Goriounova & Mansvelder, 2012). Consequently, the rapidly developing addiction often persists into later life, placing individuals at increased risk for smoking-related diseases, including lung cancer, chronic obstructive pulmonary disease, and ischemic heart disease (Dai et al., 2022). Therefore, identifying smoking behavior and its causes among the young population and developing preventive strategies against them remains an important issue.

University students are a key population among whom smoking initiation and consolidation frequently occur. Multiple cross-sectional studies conducted in Türkiye among students from different disciplines have reported smoking rates ranging from 10.8% to 45.4% (Çapık et al., 2007; Tunçdemir, 2009; Ulukoca et al., 2013; Tarı-Selçuk et al., 2018; Çelik & Demirel, 2022). Although most Turkish studies sample students across multiple disciplines, only two have specifically examined smoking among pharmacy students (Yegenoglu et al., 2006; Kop et al., 2015). One used a mixed-methods design with first- and fifth-year cohorts at a state university (Yegenoğlu et al., 2006), and the other surveyed a private pharmacy school (Kop et al., 2015). Both were limited to describing smoking prevalence and patterns, without assessing nicotine dependence or its correlates. Beyond these pharmacy-specific investigations, the broader Turkish literature has largely focused on mixed groups of healthcare students, reporting overall nicotine use or dependence estimates without providing subgroup-specific analyses for pharmacy students (Çapık et al., 2007; Tunçdemir, 2009; Ulukoca et al., 2013; Tarı-Selçuk et al., 2018; Çelik & Demirel, 2022). However, as demonstrated in international research, smoking behaviors, levels of nicotine dependence, and attitudes toward tobacco use can vary considerably across different health-professional student groups (Rahman et al., 2022). These differences highlight the importance of examining pharmacy students as a distinct population in order to obtain discipline-specific data and to inform targeted educational and preventive strategies.

This distinction is particularly relevant in the context of pharmacists' professional responsibilities in smoking cessation. Smoking cessation is a key component of preventive health counseling provided by pharmacists, and pharmacist-led interventions have been shown to support behavioral change (Carson-Chahhoud et al., 2019). Pharmacists who perceive themselves as sufficiently trained in smoking cessation interventions demonstrate greater willingness to provide smoking cessation counseling to patients (Odukoya et al., 2016). Although limited evidence exists regarding the impact of pharmacists' own smoking status, a study reported no significant difference in willingness to counsel, while non-smoking pharmacists demonstrated higher counseling scores, suggesting that personal smoking behaviors may still influence engagement in smoking cessation counseling (Alzahrani et al., 2023).

Given this professional context, and recognizing that smoking behaviors and attitudes may differ across health-professional student groups, it is important to identify cigarette addiction among pharmacy students and to evaluate their perceptions of smoking

cessation approaches. Accordingly, this study aimed to determine the prevalence of smoking addiction among pharmacy students, to examine the perception of smoking cessation methods, and to identify factors associated with nicotine dependence. The findings are intended to raise awareness and inform the development of targeted strategies to encourage smoking cessation in this cohort.

MATERIALS AND METHODS

This cross-sectional survey was conducted at a Faculty of Pharmacy in Türkiye between June and July 2022. The study population comprised all pharmacy students enrolled at the faculty. Because a census approach was adopted (the intention was to reach the entire population, 484 students), no a priori sample-size calculation was performed. Eligibility was restricted to pharmacy students who consented to participate.

The questionnaire was developed based on a literature review and expert opinions, and administered online via Google Forms (Ergin et al. 2016; Karadag et al., 2021). Distribution occurred through students' class WhatsApp groups and institutional email lists. The questionnaire consisted of two sections with a total of 25 items: a demographics section (19 items) and the Fagerström Nicotine Dependence Test (6 items). Perceived effectiveness of smoking-cessation methods among smokers was evaluated using a four-point Likert-type ordinal scale comprising slightly effective (1), moderately effective (2), highly effective (3), and no opinion (0).

To assess the understandability of the questionnaire questions, a pilot study was conducted with 20 individuals with similar characteristics to the study population, and the language and clarity of the questionnaire were adjusted based on the obtained data. The questionnaire was revised and sent to the study population. Before participation, students were presented with an online information and consent page explaining the purpose of the study, the voluntary nature of participation, and their right to withdraw at any time. Electronic informed consent was obtained before access to the questionnaire was granted. The survey was conducted anonymously, and no personally identifiable information was collected.

Following the initial invitation, two reminder messages/emails were sent at two-week intervals. The questionnaire closed two weeks after the final reminder. All data were stored on a secure, password-protected system accessible only to the research team and were used solely for research purposes.

Fagerström test for nicotine dependence (FTND)

Nicotine dependence was assessed using the FTND, which was studied for validity and reliability in Turkish by Uysal et al. and showed moderate internal consistency (Cronbach's $\alpha = 0.56$) (Uysal et al., 2025). This test is a six-item instrument for cigarette smokers. The items cover: time to first cigarette after waking, difficulty refraining in restricted areas, the cigarette most difficult to give up, number of cigarettes per day, smoking more in the morning, and smoking during illness. Item scores are summed to yield a total score from 0 to 10, with higher scores indicating greater dependence. Scores of 0–2 indicate very low dependence, 3–4 low, 5 moderate, 6–7 high, and 8–10 very high dependence. Internal consistency in our sample was evaluated using Cronbach's alpha.

The primary outcome was nicotine-dependence severity, measured by the FTND total score. Secondary outcomes included the prevalence of current cigarette smoking among pharmacy students, the distribution of FTND scores across demographic subgroups (e.g., sex, year of study), and the perceived effectiveness of smoking-cessation methods.

This study was conducted in accordance with the ethical standards set out in the Declaration of Helsinki. The study was approved by the Inonu University Health Sciences Scientific Research Ethics Committee-Nonclinical Trials Ethics Committee (approval number: 2022/3642, date: 07.06.2022).

Statistical analysis

Data were summarized using descriptive statistics (numbers and percentages). For variables that were not normally distributed, medians and interquartile ranges (IQRs) were reported. Comparisons of demographic characteristics across the groups were performed using the Kruskal–Wallis test for continuous variables and the chi-square test for categorical variables. Smoking status was categorized as never smokers, experimenters (tried smoking once), current smokers (occasional or daily), and former smokers. Inclusion of variables in the analyses was guided by their conceptual relevance to the research questions and the availability of corresponding outcome measures. The items assessing perceived effectiveness were designed to obtain independent ordinal ratings of different smoking cessation methods rather than to constitute a unified psychometric scale or generate a composite score. Each item was therefore analyzed independently as an ordinal variable, and no total or summary score was calculated. Because the response options represented ordered categories rather than continuous measurements and did not meet normality assumptions, medians were used as measures of central tendency, and non-parametric tests were applied for comparisons.

The Friedman test was employed to examine differences in perceived effectiveness scores across the nine smoking cessation methods, as the data were ordinal and measured repeatedly for the same participants. Following a significant Friedman test result, post-hoc pairwise comparisons were conducted to identify specific differences between smoking cessation methods. These comparisons were performed using the Wilcoxon signed-rank test, and p-values were adjusted for multiple testing using the Bonferroni correction. Associations between FTND scores and categorical variables were examined with the Mann–Whitney U test for two-group comparisons and the Kruskal–Wallis H test for variables with three or more categories. Results are reported as median (IQR). Two-sided $p < 0.05$ was considered statistically significant.

Because the study targeted all accessible students, an a priori sample size calculation was not performed. However, a post hoc power analysis was performed using G*Power (version 3.1) for the primary outcome, which compared perceived effectiveness scores across multiple smoking cessation methods rated by the same participants (n=18). An equivalent repeated-measures model was applied. Assuming a moderate effect size ($f = 0.25$), $\alpha = 0.05$, nine repeated measurements, and a correlation of 0.5 among measures, the achieved power was 0.90, indicating that the sample size was sufficient to detect group differences. Effect size measures for FTND scores were calculated to evaluate the magnitude of subgroup differences and to support the interpretation of findings in the context of limited subgroup sample sizes. Effect sizes were interpreted according to established guidelines reported in the statistical literature (small ≈ 0.10, medium ≈ 0.30, large ≥ 0.50 for r; small ≈ 0.01, medium ≈ 0.06, large ≥ 0.14 for η^2) (Alpar, 2022).

RESULTS

The survey was completed by 234 of the 484 students enrolled in the Faculty of Pharmacy, corresponding to a response rate of 48.3%. Two students were excluded from the study due to incomplete answers to the survey questions, and data from 232 students were analyzed.

Approximately 70% of the participants were female, and the median age was 23 years. Of the 232 students, 111 (47.8%) were classified as ever smokers, including those who had tried smoking once, former smokers, and current smokers. Among the total sample, 46 students (19.8%) were current smokers (13 occasional and 33 daily smokers), and 11 students (4.7%) were former smokers. The remaining 121 students (52.2%) were never smokers. Demographic characteristics of the students are given in Table 1.

Significant differences were observed across smoking-status groups in terms of age, gender, place

of residence, income status, and presence of smokers in the family ($p < 0.05$). Current/former smokers were older and predominantly male. Experimenters were more likely to live with their families, while current/former smokers were less likely to do so. Lower income was more frequent among experimenters and current/former smokers than among never smokers. Moreover, having a family member who smokes increased progressively from never smokers to experimenters and current/former smokers. No significant differences were found for class level or presence of chronic disease.

Table 1. Demographic characteristics of the students (n=232)

	All students (n=232) n (%)	**Never smoker (n=121) n (%)**	**Experimenters (tried smoking once) (n=54) n (%)**	**Current and Former smokers (n=57) n (%)**	**p value**
Age [median(IQR)]	23 (2)	22 (2)	22 (2)	23 (3)	**<0.001***
Gender					**<0.001****
Female	161 (69.4)	101 (83.5)	37 (68.5)	23 (40.4)	
Male	71 (30.6)	20 (16.5)	17 (31.5)	34 (59.6)	
Class					0.867**
1st year student	24 (10.3)	12.5 (9.9)	5 (9.3)	7 (12.3)	
2nd year student	28 (12.1)	18 (14.9)	6 (11.1	4 (7.0)	
3rd year student	77 (33.2)	39 (32.2)	16 (29.6)	22 (38.6)	
4th year student	33 (14.2)	18 (14.9)	8 (14.8)	7(12.3)	
5th year student	70 (30.2)	34 (28.1)	19 (35.2)	17(29.8)	
Place of residence during university education					**0.001****
Shared student apartment	29 (12.5)	5 (4.1)	11 (20.4)	13(22.8)	
Living with family	62 (26.7)	42 (34.7)	34 (63.0	11(19.3)	
Dormitory	141 (60.8)	74 (61.2)	9(16.6)	33(57.9)	
Income status					0.005**
Good	32 (13.8)	18 (14.9)	10 (18.5)	4(7.0)	
Moderate	175 (75.4)	98 (81.0)	34 (63.0)	43(75.4)	
Poor	25 (10.8)	5 (4.1)	10 (18.5)	10(17.6)	
Presence of chronic disease					0.787**
Yes	16 (6.9)	8 (6.6)	3 (5.6)	5(8.8)	
No	216 (93.1)	113 (93.4)	51 (94.4)	52(91.2)	
Presence of smokers in the family					**0.016****
Yes	127 (54.7)	56 (46.3)	32 (59.3)	39(68.4)	
No	105 (45.3)	65 (53.7)	22 (40.7)	18(31.6)	

* Kruskal Wallis, **Chi-square Test,

Among ever smokers (n=111), the median (IQR) age at first smoking experience was 15 (6) years. Among current smokers (n=46), 43.5% smoked fewer than 10 cigarettes per day, 34.8% smoked 10–20 cigarettes per day, 13.0% smoked 21–30 cigarettes per day, and 8.7% smoked more than 31 cigarettes per day.

Among current and former smokers, 66.7% reported experiencing at least one health problem after starting to smoke. Among the reported problems, oral and dental health issues ranked highest (55.3%) in frequency, whereas skin problems ranked lowest (13.2%). Reported health problems in current and former smokers after starting to smoke are given in Figure 1.

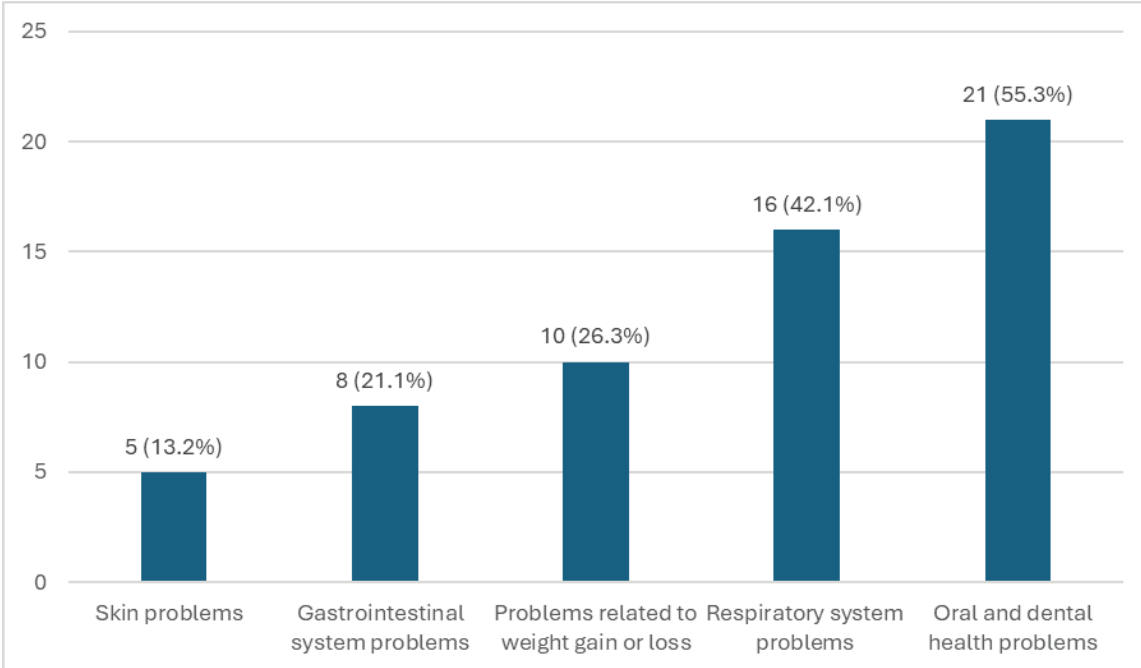

Figure 1. Reported problems in current and former smokers after starting to smoke (n=57).

The distribution of reasons for smoking among ever smokers is given in Figure 2. According to students' statements, the top three factors that lead to smoking are curiosity, influence from friends, and stress, respectively.

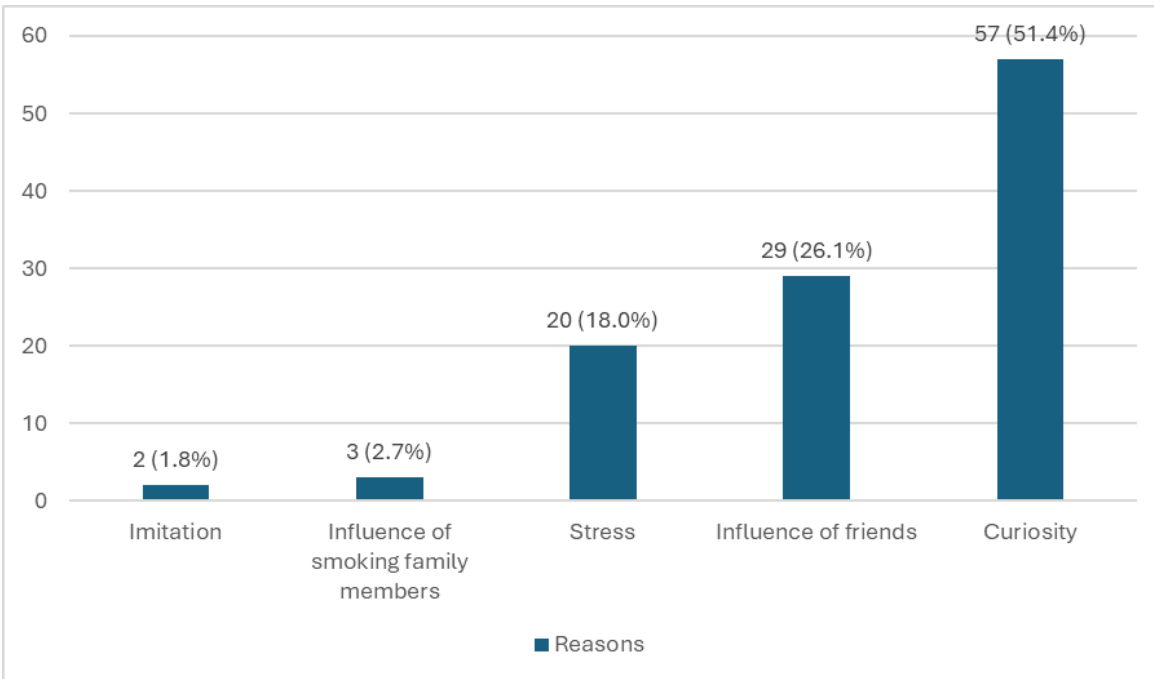

Figure 2. Distribution of reasons for smoking among ever smokers (n=111)

Behaviors and intentions related to smoking cessation among current-smoking students are given in Table 2. Three-quarters of current smokers reported at least one smoking cessation attempt. The most common pattern was four attempts. Only 17.1% of current smokers had tried at least one smoking cessation method. When students were questioned about their intentions for smoking cessation, only 28.2% expressed a desire to quit, and 26.1% wanted to seek counseling for smoking cessation.

Table 2. Smoking cessation behaviors and intentions of current-smoking students (n=46)

	n (%)
Attempted smoking cessation (n=46)	
Yes	35 (76.1)
No	11 (23.9)
Total	46 (100)
The number of smoking cessation attempts (n=35)	
1 time	8 (22.9)
2 times	7 (20.0)
3 times	7 (20.0)
>4 times	13 (37.1)
Total	46 (100)
Use of Smoking Cessation Methods (n=35)	
Yes	6 (17.1)
No	29 (82.9)
Total	35 (100)
Types of Smoking Cessation Methods Used (n=6)	
Smoking cessation clinic	1 (16.7)
Nicotine replacement therapy	1 (16.7)
Prescription medication therapy	1 (16.7)
Mobile smoking cessation application	3 (50.0)
Intention for Smoking Cessation (n=46)	
Yes	13 (28.2)
Undecided	16 (34.8)
No	17 (37.0)
Total	46 (100)
Willingness to Receive Counseling for Smoking Cessation (n=46)	
Yes	12 (26.1)
No	34 (73.9)
Total	46 (100)

Perceived effectiveness of smoking cessation methods among current and former smokers is given in Table 3. According to the results, the methods most frequently rated as "highly effective" were face-to-face counseling, smoking cessation clinics, and prescription medication therapy (each 21.2%). The method most frequently rated as "slightly effective" was posters and printed educational materials (70.2%).

Table 3. Perceived effectiveness of smoking cessation methods among current and former smokers (n=57)

	Slightly effective (1) n (%)	Moderately effective (2) n (%)	Highly effective (3) n (%)	No opinion (0) n (%)
Public service announcements	32 (56.1)	7 (12.3)	2 (3.5)	16 (28.1)
Posters and printed educational materials	40 (70.2)	4 (7.0)	2 (3.5)	11 (19.3)
Face-to-face counseling	8 (14.0)	24 (42.0)	12 (21.2)	13 (22.8)
Smoking cessation clinics	12 (21.2)	19 (33.3)	12 (21.2)	14 (24.3)
Nicotine replacement therapy (NRT)	5 (8.8)	21 (36.8)	10 (17.6)	21 (36.8)
Prescription medication therapy (e.g., varenicline, bupropion)	6 (10.5)	19 (33.3)	12 (21.2)	20 (35.0)
Acupuncture	11 (19.3)	16 (28.1)	2 (3.5)	28 (49.1)
Hypnosis	15 (26.3)	10 (17.6)	2 (3.5)	30 (52.6)
Mobile applications for smoking cessation	26 (45.6)	6 (10.5)	0 (0)	25 (43.9)

The Friedman test revealed a statistically significant difference in perceived effectiveness across the nine methods, $\chi^2(8) = 55.553$, $p<0.001$, Kendall's W=0.386 (Table 4.).

Table 4. Comparison of perceived effectiveness of smoking cessation methods among complete cases (n = 18)

	Mean Rank*	p- value*
Public service announcements	4.11	**<0.001**
Posters and printed educational materials	3.33	
Face-to-face counseling	7.03	
Smoking cessation clinics	6.44	
Nicotine replacement therapy (NRT)	5.75	
Prescription medication therapy (e.g., varenicline, bupropion)	5.89	
Acupuncture	4.69	
Hypnosis	4.44	
Mobile applications for smoking cessation	3.31	

* Mean ranks and p-values were calculated using the Friedman test among participants who provided valid ratings for all nine methods.

Post-hoc pairwise comparisons with Bonferroni adjustment indicated that face-to-face counseling and smoking cessation clinic interventions were rated significantly more effective than both mobile application and posters and printed educational materials ($p<0.05$). No other pairwise differences reached statistical significance after adjustment. Pairwise comparisons of perceived effectiveness between smoking cessation methods are given in Table 5.

Table 5. Pairwise comparisons of perceived effectiveness between smoking cessation methods (n=18)

Comparison pairs	Test statistics	p-value*
Public service announcements- Posters and printed educational materials	0.778	>0.05
Public service announcements- Face-to-face counseling	-2.917	0.05
Public service announcements- Smoking cessation clinics	-2.333	>0.05
Public service announcements- Nicotine replacement therapy	-1.639	>0.05
Public service announcements- Prescription medication therapy	-1.778	>0.05
Public service announcements- Acupuncture	-0.583	>0.05
Public service announcements- Hypnosis	-0.333	>0.05
Public service announcements- Mobile applications for smoking cessation	0.806	>0.05
Posters and printed educational materials- Face-to-face counseling	-3.694	**0.02**
Posters and printed educational materials- Smoking cessation clinics	-3.111	**0.02**
Posters and printed educational materials- Nicotine replacement therapy	-2.417	>0.05
Posters and printed educational materials- Prescription medication therapy	-2.556	>0.05
Posters and printed educational materials- Acupuncture	-1.361	>0.05
Posters and printed educational materials- Hypnosis	-1.111	>0.05
Posters and printed educational materials- Mobile applications for smoking cessation	0.028	>0.05
Face-to-face counseling- Smoking cessation clinics	0.583	>0.05
Face-to-face counseling- Nicotine replacement therapy	1.278	>0.05
Face-to-face counseling- Prescription medication therapy	1.139	>0.05
Face-to-face counseling- Acupuncture	2.333	>0.05
Face-to-face counseling- Hypnosis	2.583	>0.05
Face-to-face counseling- Mobile applications for smoking cessation	3.722	**0.02**
Smoking cessation clinics- Nicotine replacement therapy	0.694	>0.05
Smoking cessation clinics- Prescription medication therapy	0.556	>0.05
Smoking cessation clinics- Acupuncture	1.750	>0.05
Smoking cessation clinics- Hypnosis	2.000	>0.05
Smoking cessation clinics- Mobile applications for smoking cessation	3.139	**0.021**
Nicotine replacement therapy- Prescription medication therapy	-0.139	>0.05
Nicotine replacement therapy- Acupuncture	1.056	>0.05
Nicotine replacement therapy- Hypnosis	1.306	>0.05
Nicotine replacement therapy- Mobile applications for smoking cessation	2.444	0.267
Prescription medication therapy- Acupuncture	1.194	>0.05
Prescription medication therapy- Hypnosis	1.444	>0.05
Prescription medication therapy- Mobile applications for smoking cessation	2.583	>0.05
Acupuncture- Hypnosis	0.250	>0.05
Acupuncture- Mobile applications for smoking cessation	1.389	>0.05
Hypnosis- Mobile applications for smoking cessation	1.139	>0.05
* Wilcoxon signed-rank test		

Fagerström test for nicotine dependence (FTND)

The Cronbach alpha value of the FTND was found to be 0.759. The median (IQR) value of the FTND score of active smokers was 3 (4). Among 46 current smokers, the distribution of nicotine-dependence (FTND) levels was: very low, 22 (47.8%), low, 10 (21.7%), moderate, 3 (6.5%), high, 4 (8.7%), and very high, 7 (15.2%).

When the FTND score was evaluated to determine whether students' demographic characteristics differed, only the presence of a family member who smoked showed a statistically significant difference (p=0.006). The presence of a family member who smoked led to an increase in the FTND Score (Table 6.). Effect size analyses showed that the presence of smokers in the family had a moderate association with FTND scores (r = 0.40), whereas chronic disease status showed a small-to-moderate effect (r = 0.24). Gender demonstrated a negligible effect (r = 0.009). For Kruskal–Wallis comparisons, class level (η^2<0.001) and place of residence (η^2 = 0.007) showed negligible effects, while income status demonstrated a small effect (η^2 = 0.069).

Table 6. Comparison of FTND scores according to demographic characteristics.

	FTND Score [median(IQR)]	**p value**
Age [median(IQR)]	Correlation coefficient= 1.000	0.960*
Gender		
Female	3.5 (6)	0.952**
Male	2.5 (4)	
Class		
1st year student	5 (6)	0.407***
2nd year student	3 (0)	
3rd year student	4 (5)	
4th year student	1 (8)	
5th year student	2 (4)	
Place of residence during university education		
Shared student apartment	2.5 (3)	0.315***
Living with family	1 (4)	
Dormitory	4 (5)	
Income status		
Good	-	0.084***
Moderate	3.5 (4)	
Poor	3 (5)	
Presence of chronic disease		
Yes	7 (7)	0.099**
No	2.5 (4)	
Presence of smokers in the family		
Yes	4 (6)	**0.006****
No	1.5 (2)	
*Spearman correlation, **Mann-Whitney U Test, ***Kruskal Wallis		

DISCUSSION

In this cross-sectional study of pharmacy students, nicotine dependence among current smokers was generally low, and the presence of a smoker in the family was significantly associated with higher FTND scores. Although quit attempts were common, uptake of evidence-based cessation support was minimal. Participants rated face-to-face counseling and smoking-cessation clinics as more effective than mobile applications or printed educational materials.

In this study, nearly half of the students had tried, previously used, or were currently smoking cigarettes. About one-quarter of the students were active smokers. In a study conducted among university students, 38.4% were identified as current smokers, and the mean age at smoking initiation was 16.5 ± 2.78 years (Karadag et al., 2021). In a study, which included medical, pharmacy, and dentistry students, the smoking rate was found to be 20.3% (Alwhaibi et al., 2022). In a study conducted among medical and pharmacy students, the overall prevalence of smoking was 1.6% (n = 4) and was significantly higher among medical students (4.3%, n = 4) than among pharmacy students (0%, n = 0; p = 0.009) (Rahman et al., 2022). To date, the prevalence of cigarette smoking among pharmacy students in Türkiye has been documented in only two studies, with Kop et al. reporting 28.1% and Yegenoğlu et al. reporting 22.2% (Yeğenoğlu et al., 2006; Kop et al., 2015). In the present study, the percentage of students who smoke is higher than the smoking prevalence among individuals aged 15-24, both in Türkiye and worldwide (TÜİK, 2023; WHO, 2024). Relative to the 2015 study by Kop et al., the current prevalence among pharmacy students in Türkiye shows a slight decline, whereas relative to the 2006 study by Yegenoğlu et al., it reflects an increase; moreover, when benchmarked against international studies in student populations, smoking rates remain comparatively high. These findings indicate that awareness regarding smoking as a harmful behavior is low among pharmacy students in Türkiye.

Our findings indicate that smoking behavior among students is closely linked to several sociodemographic and familial characteristics. In particular, students who currently smoke or have smoked in the past tended to be slightly older and were more often male compared with the other groups. Living arrangements also differed across groups: those who had only experimented with smoking were more likely to reside with their families, whereas current/former smokers were less likely to do so. In addition, indicators of lower socioeconomic status were more common among students with any smoking experience than among those who had never smoked. A clear gradient was also observed for family smoking exposure, with higher proportions among experimenters and current/former smokers than among never smokers. In contrast, academic year and chronic disease status did not appear to influence smoking status. In a study of university students, the proportion of smokers was slightly higher among women than men (31.2% vs. 29.5%); however, this gender difference was not statistically significant (Milošević-Georgiev et al., 2019). In a study conducted among medical students, the probability of a student currently smoking increased significantly if there was a family member who smoked (Taher et al., 2014). The same study further reported a higher smoking prevalence among male than female students, while no statistically significant differences were observed across academic years. On the other hand, Ilic et al. reported that final-year pharmacy students were significantly more likely to smoke than younger cohorts (Ilic et al., 2020). In a study of university students, it was reported that smoking prevalence was significantly higher among individuals with lower income levels (Yurt-Öncel et al., 2011). Comparisons with the extant literature reveal heterogeneity in the associations between demographic characteristics and smoking behavior. This variation likely reflects differences in study populations (e.g., composition of student cohorts) and methodological features such as sampling frames and sample size.

The health harms of smoking rise with each additional cigarette per day and with more years of smoking (Inoue-Choi et al., 2018; 2019). And, it is well known that there is no safe level of smoking. In our study, students typically initiated cigarette use at approximately 15 years of age. Among current smokers, nearly half reported consuming more than 10 cigarettes per day, with some smoking as many as 30 per day. Considering the cumulative harms of smoking, this pattern points to moderate-to-heavy use among many pharmacy student smokers and underscores the need for targeted cessation support.

In our study, nearly 70% of current and former smokers reported at least one smoking-related health problem. The most frequently cited were oral/dental issues, respiratory symptoms, and weight-related problems. Prior studies indicate that smoking approximately doubles the risk of infectious respiratory illnesses, is associated with an 85% higher risk of periodontitis, contributes to oral mucosal lesions and tooth loss, has bidirectional effects on body weight (both gain and loss), is linked to inflammatory bowel disease, and increases the risk of peptic-ulcer recurrence (Chiolero et al., 2008; Berkowitz et al., 2018; McGeoch et al., 2023). Moreover, continued smoking is associated with the progression of these conditions over time and with an elevated long-term risk of cancer (Berkowitz et al., 2018; Leite et al., 2018; Chen, 2023; McGeoch et al., 2023). In a university-aged population, cumulative exposure is still limited; however, if smoking persists, the relatively mild problems observed are likely to progress to more serious disease over time.

Evaluations of smoking determinants among university students indicate that stress and unhappiness, peer influence, and curiosity are the most frequently cited reasons for initiation (Oğuz et al., 2018). Consistent with prior reports, students in our study most commonly cited curiosity, peer influence, and stress as reasons for smoking initiation. Addressing these modifiable determinants can change smoking trajectories. A life-course approach—improving family and environmental conditions from childhood—may prevent initiation; at the university stage, however, efforts should prioritize identifying and targeting the factors that sustain smoking (e.g., stress coping, social pressure, habit/dependence), which is crucial for effective tobacco control on campus.

Approximately three-quarters of current smokers reported at least one prior cessation attempt, and the greatest proportion had made four or more attempts in our study. Among students with prior cessation attempts, use of evidence-based cessation methods was rare. Cessation intent was likewise limited, with only one in four expressing willingness to seek cessation counseling. Across studies of university students in Türkiye, reported rates of at least one prior cessation attempt range from 45% to 77%, whereas cessation intent ranges from 27% to 60.4% (Kop et al., 2015; Ergin et al., 2016; Tarı-Selçuk et al., 2018). The smoking cessation attempts and intentions observed in our cohort are broadly similar to those reported in previous studies. Smoking cessation behavior and intention are multifactorial. In adults, key predictors include age, sex, education, health-insurance status, place of residence, and nicotine dependence (Suen et al., 2022; Al-Dahshan et al., 2023). Among adolescents and young adults, smoking behavior is significantly associated with male sex, increasing age, exposure to second-hand smoke, and favorable beliefs about smoking, such as perceiving it as socially prestigious, attractive, or difficult to quit (El Dalatony et al., 2025). Considering these age-specific determinants, cessation attempts and intentions differ between adults and young people. In our university sample, a substantial proportion had made at least one cessation attempt, yet intention to undertake further attempts was low. The limited uptake of evidence-based cessation approaches further suggests insufficient awareness of effective support options among students.

While motivation for smoking cessation is foundational, employing evidence-based cessation methods

is a key determinant of successful smoking cessation. Accordingly, smokers should possess high levels of knowledge and awareness regarding evidence-based strategies for smoking cessation.

Evidence-based approaches comprise behavioral, pharmacological, and combined modalities. Pharmacotherapies include nicotine replacement therapy (NRT), bupropion, and varenicline; behavioral interventions include cognitive-behavioral therapy, motivational interviewing, and contingency/incentive-based strategies to motivate and reinforce behavior change (Onwuzo et al., 2024). When students' perceptions of evidence-based methods were assessed, face-to-face counselling, smoking-cessation clinics, and pharmacological therapy were rated as the most effective. In a pairwise comparison of smoking cessation methods, face-to-face counseling and smoking cessation clinic interventions were rated significantly more effective than both mobile applications, posters, and printed educational materials. These results are partially consistent with previous studies. In the study conducted by Alwhaibi et al., it was determined that one-third of pharmacy faculty students found smoking cessation clinics effective (Alwhaibi et al., 2022). In a study involving university students studying health in Türkiye, an on-campus smoking cessation clinic and the idea of peer-assisted smoking cessation were evaluated as useful by more than half of the students (Ergin et al., 2016). In a meta-analysis of university students assessing the effectiveness of smoking-cessation interventions, technology-based approaches and motivational interviewing showed statistically significant effects, whereas reinforcement/reward interventions were comparatively less effective (Setchoduk et al., 2023). Students' approaches to smoking cessation methods and the real-life effectiveness of these methods appear to differ. In our study, similar to other studies, motivational interviews, such as face-to-face counseling and smoking cessation clinics, were found to be more effective than technological applications alone. These findings suggest insufficient knowledge and awareness of evidence-based smoking-cessation methods among students. If such gaps exist in health-sciences cohorts, they are likely even greater in non–health-sciences populations. These findings underscore the need to integrate structured instruction on smoking-cessation strategies into pharmacy curricula, particularly as a component of preventive health coursework.

The internal consistency of the FTND in our sample (Cronbach's $\alpha = 0.759$) was higher than that reported in the Turkish validation study ($\alpha = 0.56$). This difference may be related to the more homogeneous structure of our sample, which consisted of health sciences university students. Greater sample homogeneity is known to increase reliability coefficients.

In our study, among 46 current smokers, the median FTND score was 3, indicating low nicotine dependence. Approximately 30% of students exhibited moderate to very high nicotine dependence. In a study conducted among university students, 10.2% of the participants showed medium nicotine dependence, 15.1% exhibited high dependence, and 7.5% demonstrated very high dependence according to FTND scores (Karadag et al., 2021). In another study assessing university students' nicotine dependence, 31.4% were classified as moderately dependent and 13.4% as highly dependent (Terzi et al., 2019). In another study, the mean FTND score (± SD) among male university smokers was 4.37 ± 2.3, whereas among female smokers it was 3.90 ± 2.4 (Yurt-Öncel et al., 2011). Compared with prior studies, active smokers in our pharmacy-student sample appear to exhibit lower nicotine dependence. This disparity may reflect shorter smoking duration and fewer cigarettes per day, and could also be influenced by students' health-related training and greater awareness of tobacco harms relative to non–health sciences cohorts.

When FTND scores were compared across demographic subgroups, only having a family member who smokes was associated with a statistically significant increase in dependence scores. In contrast, gender, age, year of study, income level, and presence of a

chronic condition showed no significant associations with FTND score. In the study by Terzi et al., both the father's and the close friend's smoking levels were found to be higher in students with high nicotine addiction (Terzi et al., 2019). Öncel and colleagues reported that among university students, FTND scores increased with higher daily cigarette consumption and decreased with older age at smoking initiation (Yurt-Öncel et al., 2011). Previous studies show that FTND scores vary across populations and contexts. Even so, a clear dose-response relationship is evident: greater daily cigarette consumption is associated with higher nicotine dependence. In addition, smoking within the household remains an important risk factor, promoting initiation and increasing progression to dependence.

A key strength of this study is the combined assessment of pharmacy students' smoking behaviors with the FTND, alongside an evaluation of their perceptions of cessation methods. However, several limitations should be noted. First, the single-institution design limits the generalizability of the findings. Second, the data are based on self-reported survey responses rather than objective measurements, which may introduce reporting and recall bias. Although a census-based sampling strategy was planned, the response rate was 48.3%, which may introduce non-response bias and limit the representativeness of the findings. Moreover, subgroup analyses, particularly those involving FTND categories, should be interpreted with caution due to reduced sample sizes. The lack of multivariable regression analysis should be considered a limitation, as potential confounding and interaction effects could not be examined. Finally, the data were collected in 2022, and although the main patterns of smoking behavior remain informative, rapid developments in nicotine products and digital cessation tools may limit the direct applicability of our findings to current student populations.

CONCLUSION

In this cross-sectional sample of pharmacy students, nicotine dependence among current smokers was generally low, yet exposure to family members who smoke was associated with higher FTND scores. Although most smokers had attempted to quit at least once, engagement with evidence-based supports was limited; students perceived face-to-face counselling and smoking-cessation clinics as more effective than stand-alone technology or printed materials. Curriculum and campus initiatives that expand access to counseling and approved pharmacotherapies and strengthen students' awareness of smoking cessation methods appear to be needed.

AUTHOR CONTRIBUTION STATEMENT

Concept: N.Ö.A, N.A., Z.Ü.G.; Design: N.Ö.A, N.A., Z.Ü.G.; Supervision: Z.Ü.G.; Resources: N.A., N.Ö.A; Data Collection and/ or Processing: N.A.; Analysis and/or Interpretation: N.Ö.A., N.A., Z.Ü.G.; Literature Review: N.Ö.A.; Writing the Article: N.Ö.A; Critical Review: Z.Ü.G.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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