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Smoking Prevalence, Knowledge, and Attitude among College Students of Riyadh Elm University: A Cross- Sectional Study

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Abstract

Introduction: This quantitative, non-experimental, cross-sectional survey investigated the prevalence of smoking, health risk knowledge, and attitudes towards smoking among 400 undergraduate students at Riyadh Elm University. The study aimed to provide a comprehensive understanding of these factors within this specific student population.

Methods: A self-administered structured survey, validated by six experts (Cronbach's alpha = 0.732; test-retest r = 0.778), was used. Ethical approval was obtained from the Institutional Review Board, and written informed consent ensured voluntary, anonymous, and confidential participation.

Results: Findings revealed 17.75% of students were current smokers, with 83.10% initiating before age 18 and 55% consuming 6-10 cigarettes daily. Students showed high knowledge of major risks like lung cancer (91.75% correct) and pregnancy harm (94.25% correct). However, significant misconceptions persisted, notably that shisha/waterpipe is less harmful (49.50% incorrect) and secondhand smoke is not harmful (50.75% incorrect). Attitudes were neutral on smoking as a social behavior, yet strongly positive towards complete campus bans (mean=3.578), increased tobacco taxes (mean=3.340), and advertising prohibition (mean=3.570). Students also expressed high demand for university-provided cessation support (mean=3.688). Conversely, a negative attitude was observed towards a complete public smoking ban in Riyadh (mean=2.088). A statistically significant positive correlation existed between knowledge and attitude towards smoking (r = 0.443, $P < 0.05$), supporting the Knowledge-Attitude-Practice model. Knowledge levels varied significantly by age, gender, and current residence, but not by year level.

Conclusion: This study highlights a notable smoking prevalence and critical knowledge gaps among Riyadh Elm University students, despite general awareness of major risks. The findings underscore the urgent need for targeted, comprehensive tobacco control interventions within this population, focusing on correcting specific misconceptions, enhancing self-efficacy for quitting, and expanding accessible cessation support services on campus to foster healthier behavior.

Keywords: Smoking, Undergraduate Students, Knowledge, Attitude, Prevalence, Riyadh, Saudi Arabia

1. Introduction

Tobacco use remains a significant global public health crisis, contributing to millions of preventable deaths annually and imposing substantial burdens on healthcare systems worldwide (WHO, 2019). This pervasive issue is particularly concerning among young adults, with college students representing a vulnerable demographic susceptible to initiating and sustaining smoking habits. The transition to university often brings new social environments, increased autonomy, and academic pressures, which can act as triggers for smoking initiation or escalation (Almogbel *et al*., 2021; Bin Abdulrahman *et al*., 2022). Understanding the dynamics of smoking within this population is crucial for developing targeted and effective prevention and cessation interventions.

In the Kingdom of Saudi Arabia (KSA), the escalating prevalence of tobacco smoking has emerged as a major public health concern, particularly affecting adolescents and college students (AlSwuailem *et al*., 2014; Alqahtani *et al*., 2023). Recent meta-analyses indicate a pooled prevalence of smoking among college students in KSA to be around 24.5% (Alqahtani *et al*., 2023). This figure, though varying across studies (ranging from 7.9% to 59.57% depending on the specific student group and methodology), highlights the widespread nature of the problem within the university demographic (Alqahtani *et al*., 2023). Factors such as peer influence, family smoking status, stress, and academic tenure have been identified as significant predictors of smoking behavior among Saudi college students (Alqahtani *et al*., 2023; Alqahtani *et al*., 2023).

Despite the established health risks associated with smoking, a gap often exists between an individual's knowledge of these risks and their actual smoking behavior. While general awareness campaigns have been implemented, a deeper understanding of the specific knowledge gaps and prevailing attitudes towards smoking among college students is essential. Attitudes, shaped by beliefs, values, and social norms, play a crucial role in influencing health behaviors, including tobacco use (Ansari & Farooqi, 2017). Therefore, investigating students' knowledge about the harmful effects of smoking and their attitudes towards it can provide valuable insights into the underlying psychological and social determinants of smoking prevalence.

Riyadh Elm University, as a prominent educational institution in the capital city, houses a diverse student body that warrants specific investigation regarding smoking patterns. While national and regional data on college student smoking exist, specific insights into the prevalence, knowledge, and attitudes within a particular university like Riyadh Elm University are often lacking. Such localized data are vital for tailoring effective university-specific health promotion programs and policies. This cross-sectional study, therefore, aims to determine the smoking prevalence, assess the level of knowledge regarding smoking's harms, and explore the attitudes towards smoking among college students at Riyadh Elm University. The findings of this research will contribute to a more comprehensive understanding of the tobacco epidemic within Saudi Arabian higher education institutions, ultimately informing the development of targeted intervention strategies to promote a smoke-free campus environment and foster healthier lifestyles among the student population.

Research Objectives

This study aims to determine smoking prevalence, knowledge and attitude of undergraduate students at Riyadh Elm University. Specifically, it sought to answer the following objectives:

1. Determine the demographic profile of the students as to
   1.1 age
   1.2 gender
   1.3 year level
   1.4 current residence
2. Determine the prevalence of smoking among undergraduate college students
3. Assess the level of knowledge regarding the health risks and consequences of smoking among undergraduate students.
4. Examine the attitudes toward smoking among undergraduate student.

Hypotheses

H₁: There is no significant relationship between knowledge on smoking and attitude towards smoking.

H₂: There is no significant difference on knowledge level regarding smoking across demographic profile.

2. Material and Methods

Study Design

This study utilized a quantitative, non-experimental, cross-sectional survey approach. This means that researchers gathered data from a group of undergraduate students at Riyadh Elm University at a single point in time. The primary aim of this design is to describe the current levels of prevalence, knowledge, and attitudes within this student body and to simultaneously investigate the relationships among these factors.

Data Collection Process

For this study, participants completed a self-administered, structured survey composed of four distinct parts. The initial section collected basic demographic data, such as age, gender, academic year, and current living situation. Following that, the second section explored the prevalence of smoking among undergraduate students, covering details like smoker profiles, how often they smoke, how many cigarettes they consume daily, and when they started. The third section aimed to evaluate students' understanding of the health dangers and effects of smoking through 10 statements, where respondents could choose "correct," "incorrect," or "don't know." The final section assessed the participants' attitudes, ranging from very negative to positive, using a 4-point Likert scale with options like Strongly Agree, Agree, Disagree, and Strongly Disagree.

Validity and Reliability of Tools

The research tools were validated and refined by a panel of six experts from the medical and nursing fields, ensuring their accuracy and consistency. After their review, all necessary adjustments were made. The questionnaire demonstrated good internal consistency, indicated by a Cronbach's alpha of 0.732. Furthermore, the test-retest reliability of the subscales was assessed over one month, revealing a mean correlation of 0.778, suggesting stability over time. It's important to note that the 10 participants in the pilot testing were excluded from the final study.

Sample Characteristics

The study's participants were undergraduate students currently enrolled at Riyadh Elm University during the academic 2024 – 2025. The researchers followed an eligibility criterion. Inclusion criteria: To be included in the study, participants had to meet the following conditions: Be an undergraduate student at Riyadh Elm University; be from any academic year/level; be of either male or female sex; be currently enrolled in the academic semester when the study was conducted. However, students were excluded from the study if they chose not to participate in the research survey. This indicates that participation was voluntary.

Sampling Technique

A convenience sampling technique was utilized on this study. A total of 400 students represent the total sample of this study. This suggests that the researchers selected participants based on their easy accessibility and willingness to participate, rather than employing a random selection method. On this study, the researchers approached students on campus and send the Google link to social media and group chats e.g. whatsapp and those who were present and willing to complete the survey during the data collection period.

Survey Administration

The survey administration method was self-administered, meaning participants completed the structured questionnaire independently, without direct researcher intervention during the completion process. This approach facilitated the collection of data while potentially enhancing participant comfort and honesty in responses, particularly concerning sensitive topics. The structured nature of the survey ensured uniformity in question presentation and response collection across all participants. The researchers used tool distribution method (e.g., in-person group administration, online platform, take-home) in order to allow students to complete the survey at their convenience.

Study Preparation

The preparation for this study was meticulously conducted to ensure the validity and reliability of the research instruments and to adhere to ethical principles. Crucially, institutional review board (IRB) approval was secured at Riyadh Elm University, Research Ethics Committee prior to any data collection, confirming compliance with ethical guidelines for research involving human subjects.

Ethical Considerations

Before starting the study, approval was secured from Riyadh Elm University's Institutional Review Board (IRB). Every participant provided written informed consent after receiving a full explanation of the study's purpose, objectives, and potential benefits. Investigators stressed that participation was completely voluntary, and students were informed of their right to decline participation or withdraw at any point without any negative repercussions. Throughout the study, anonymity, privacy, safety, and confidentiality were guaranteed for all participants.

Statistical Analysis

The collected data were meticulously coded, analyzed, and tabulated using Statistical Package for the Social Sciences (SPSS), version 23.0. Prior to any calculations, the data underwent a crucial check for normality of distribution, which was confirmed. Continuous data are presented as the mean ± standard deviation, while categorical data are expressed through numbers and percentages. For identifying relationships, Pearson's r was utilized to determine correlations between continuous variables. Comparisons between variables with categorical data were made using Analysis of Variance (ANOVA) and independent t-tests. The significance of the results was interpreted based on a *P*-value of less than 0.05 ($P < 0.05$), indicating a statistically significant difference.

3. Results and Discussion

Table 1: Demographic characteristics of the college students (n=400)

Variable/s	Category	Frequency	Percentage
Age	18 – 20 years old	36	9%
	21 – 23 years old	128	32%
	24 – 26 years old	113	28.25%
	27 – 29 years old	60	15%
	30 years old & above	62	15.5%
Gender	Male	112	28%
	Female	288	72%
Year Level	First year	94	23.5%
	Second year	136	34%
	Third year	87	21.75%
	Fourth year	82	20.5%
Current residence	With family	236	59%
	Dormitory	32	8%
	Rented apartment	131	32.75%

The Table 1 presents frequency distribution of the demographic characteristics of the undergraduate students. The table shows the demographic breakdown of 400 college students across several variables such as age, gender, year level, and current residence. In terms of age distribution, it can be seen that the largest proportion of students (32%) falls within the 21-23 years old category, followed closely by 24-26 years old at 28.25%. Students aged 18-20 years old represent a smaller segment at 9%, suggesting that while some students enroll immediately after high school, a significant portion might be slightly older or have taken a gap year. The 27-29 years old and 30 years old & above categories also contribute a notable percentage (15% and 15.5% respectively), indicating the presence of non-traditional students or those pursuing higher education later in life. This diverse age profile is common in modern higher education, as universities cater to a broader range of learners beyond the typical 18-22 year old demographic (Kim, 2023).

The presence of a significant proportion of students aged 21 and above, including those 30 and older, aligns with the growing trend of non-traditional students in higher education. Non-traditional students are typically defined by characteristics such as delayed enrollment, part-time attendance, financial independence, having dependents, or working full-time while studying (Modern Campus, 2025 [36]; However, studies suggest that while early college graduates may have greater immediate wage benefits, later-in-life graduates also receive a substantial college premium, especially for historically disadvantaged populations (Brookings Institution, 2024) [15].

For gender, it indicates a significant disparity, with females constituting 72% (288 students) of the student population, while males account for 28% (112 students). This imbalance is a notable characteristic, suggesting a higher female enrollment in this particular college. Such a pattern is observed in many educational institutions globally, where women increasingly outnumber men in higher education enrollment, reflecting societal shifts and increased access to educational opportunities for women (UNESCO, 2024) [57]. The observed gender disparity, with a higher proportion of female students, reflects a long-standing and increasingly pronounced trend in global higher education. Women have consistently outpaced men in college enrollment and degree attainment for over four decades (American Institute for Boys and Men, 2024; Top Tier Admissions, 2025) [9, 55]. This gap is evident across various institutional types and racial groups, with women being more likely to enroll immediately after high school and to complete their degrees within a standard timeframe (American Institute for Boys and Men, 2024) [9].

With regards to year level, it shows that second-year students form the largest group at 34%, followed by first-year students at 23.5%. This could imply effective student retention from the first to the second year. Third-year students (21.75%) and fourth-year students (20.5%) represent progressively smaller proportions. This gradual decrease in student numbers from the second to the fourth year might suggest various factors such as transfers, dropouts, or students completing their degrees within three years if applicable (Tinto & Pusser, 2006) [52]. However, the relatively even distribution across the upper years indicates consistent progression for a significant portion of the student body. For instance, research has shown that LMS usage tends to increase with year-level progression, with final-year students demonstrating higher engagement due to their reliance on these systems for advanced academic tasks (Anhwere *et al*., 2025) [10]. Understanding these progression patterns is crucial for designing targeted interventions and support programs to improve student success at different stages of their academic journey (Raji *et al*., 2017) [44].

Regarding current residence, the majority of students (59%, or 236 students) reside with family. This is a substantial proportion and suggests that a large number of students attend a local institution, commute from home, or live in close proximity to their families. This means that the strong preference for living with family amongst the student population suggests a commuter-heavy institution or a student body with strong local ties. This demonstrate higher retention rates, increased social integration, and greater engagement in academic and co-curricular activities (Acuho-I, 2021) [2]. A smaller percentage (8%, or 32 students) live in dormitories, which might indicate limited on-campus housing availability or a preference among students for off-campus living arrangements. The remaining 32.75% (131 students) live in rented apartments, highlighting a significant segment of independent student living. The prevalence of students living with family could impact their university experience, social engagement, and financial independence differently compared to those living in dormitories or rented apartments (Astin, 1993; Pike & Kuh, 2005) [11, 43].

Table 2: The prevalence of smoking among undergraduate college students (n-400)

Characteristic	Category	Frequency (n)	Percentage (%)
Current smoker	Yes	71	17.75%
	No	329	82.25%
Smoking Frequency*	Daily	68	97.77%
	Occasionally	3	4.23%
Number of Cigarettes/Day*	1-5	21	29.58%
	6-10	39	54.93%
	>10	11	15.49%
Age Start Smoking*	<18 years	59	83.10%
	≥18 years	12	16.90%

*Percentage from the 71 active smokers

The table above shows the prevalence of smoking among undergraduate college students. These are the active smokers from the population of 400 students. Based on the results, there are 71 students (17.75%) who are currently smokers out of the total 400 which signifies an 18% of active smokers. This indicates that a significant minority of undergraduate college students in this sample are current smokers. Similarly, a meta-analysis conducted by Alshehri *et al*., (2025) [6] found a 24.5% prevalence on cigarette smoking among undergraduate students in Saudi Arabia. For Tingke & Bauri (2025) [51], their study revealed 31% prevalence on smoking of the participants taking MBBS course at University of Papua New Guinea. Contrastingly, data from the 2024 National Youth Tobacco Survey (NYTS) in the United States shows a significant decline in overall youth tobacco product use, with cigarette smoking reaching its lowest recorded level at 1.4% among middle and high school students in 2024 (CDC, 2024) [19]. However, it also noted that e-cigarettes remain the most commonly used tobacco product among youth (CDC, 2024) [19]. A study by Topal *et al*., (2025) [54] examined students' opinions on a smoke-free campus initiative reported that 28.5% of university students were active smokers.

Meanwhile, a significant portion of current smokers (approximately 55%) consume 6-10 cigarettes daily, indicating a moderate to heavy smoking habit within this group. The present study found that approximately 55% of these current smokers consume 6-10 cigarettes daily, indicating a moderate to heavy smoking habit within this subgroup. This level of consumption is particularly concerning. While sometimes labeled as "light" or "social" smoking, even low levels of daily cigarette consumption carry significant health risks. A meta-analysis conducted by Hackshaw *et al*., (2018) [30] demonstrated that smoking only one cigarette per day carries a risk of developing coronary heart disease and stroke much greater than expected—around half that for people who smoke 20 per day. This non-linear relationship for cardiovascular disease suggests that the initial few cigarettes per day impose a disproportionately high risk. The result of the present study also agreed with the study of Tobacco in Australia (2020) which found that mortality risks were only slightly lower among those who smoked 3-10 cigarettes per day compared to those smoking 11-20 cigarettes per day, and even daily smokers of just one cigarette per day had substantially higher mortality risks than never-smokers. This highlights that consuming 6-10 cigarettes daily, as observed in a majority of the smokers in the present study, represents a significant health hazard.

It can also be seen in the table above that 83.10% of current college student smokers initiated tobacco use before the age of 18 aligns robustly with decades of public health research on the epidemiology of smoking. This strongly suggests that smoking is primarily an adolescent behavior that extends into early adulthood rather than a habit largely formed during college years. This finding underscores the critical period of adolescence as the primary window for tobacco experimentation and the establishment of regular smoking habits (USDHHS, 2012; CDC, 2020) [58, 17]. Numerous studies have consistently demonstrated that nearly all adult smokers began smoking during their youth, often before reaching the legal age for purchasing tobacco products (Gilman & Abrams, 2017) [28]. The Surgeon General's Reports on smoking have repeatedly highlighted adolescence as a vulnerable period, characterized by increased susceptibility to peer influence, risk-taking behaviors, and the deceptive marketing tactics of the tobacco industry (USDHHS, 2012) [58]. Early initiation is a powerful predictor of long-term nicotine dependence, greater difficulty in quitting, and higher risks of smoking-related diseases later in life (Kendler *et al*., 1999; Chen & Millar, 1998) [32, 22].

Lastly, the findings in the present study pointed out that 71 out of 400 undergraduate college students (17.75%) are active smokers. This aligns that a significant minority of college students engage in smoking. This percentage falls within the range observed in various international and national studies in recent years, particularly given the focus on traditional cigarette smoking. While lower than some reported figures (e.g., 24.5% in Saudi Arabia, 31% in Papua New Guinea), it is notably higher than the very low rates reported for U.S. high school students' traditional cigarette use, suggesting distinct regional and demographic trends. This highlights the continued need for targeted interventions within the specific context of Saudi undergraduate college students.

Table 3: Knowledge regarding the health risks and consequences of smoking among undergraduate students

Statement	Correct	Incorrect	Don't Know	Total (N)	% Correct	% Incorrect	% Don't Know
1. Smoking cigarettes causes lung cancer.	367	28	5	400	91.75%	7.00%	1.25%
2. Smoking causes heart disease and stroke.	298	76	26	400	74.50%	19.00%	6.50%
3. Smoking during pregnancy can harm the baby.	377	21	2	400	94.25%	5.25%	0.50%
4. Shisha/waterpipe smoking is less harmful than cigarette smoking.	117	198	85	400	29.25%	49.50%	21.25%
5. Electronic cigarettes (vapes) are completely safe and harmless.	384	5	11	400	96.00%	1.25%	2.75%
6. Exposure to secondhand smoke (passive smoking) is harmful to non-smokers.	68	203	129	400	17.00%	50.75%	32.25%
7. Smoking can lead to addiction.	247	101	52	400	61.75%	25.25%	13.00%
8. Smoking can cause dental problems and bad breath.	278	24	98	400	69.50%	6.00%	24.50%
9. Quitting smoking can reverse some of the damage caused by smoking.	211	167	22	400	52.75%	41.75%	5.50%
10. There are health benefits to smoking.	22	364	14	400	5.50%	91.00%	3.50%

The Table 3 explained that knowledge regarding the health risks and consequences of smoking among undergraduate students. The results of the survey provide insights into the knowledge levels of 400 undergraduate students regarding various aspects of smoking. It can be seen that majority of the students is highly knowledgeable of the major risks the smoking posed. A vast majority of students correctly identified that smoking causes lung cancer (91.75%) and that smoking during pregnancy can harm the baby (94.25%). Awareness of heart disease and stroke as consequences was also high (74.50%). The results of the present study relates with the previous study that shows general awareness of the harmful effects of smoking is widespread across various demographics, including college students (Al-Naggar *et al*., 2017; World Health Organization, 2023) [5, 61]. Studies in diverse global contexts reported a high level of knowledge regarding the established dangers of smoking, such as cancer, respiratory diseases, and cardiovascular problems (El-Setouhy *et al*., 2019; Park & Kim, 2021) [23, 40]. This high level of awareness is often attributed to comprehensive public health strategies, including graphic warning labels on cigarette packs, media campaigns, and educational curricula (Centers for Disease Control and Prevention, 2023) [18]. Furthermore, eventhough significant diseases are widely recognized as smoking-related, a deeper grasp of its more gradual or intricate detrimental effects, or the underlying biological mechanisms, might be lacking (Osman *et al*., 2019) [38]. The finding that 74.50% are aware of heart disease and stroke, while still high, is slightly lower than the awareness for lung cancer and pregnancy risks, which could point to areas where educational efforts could be further strengthened. Yet, the strong recognition of "smoking during pregnancy can harm the baby" (94.25%) is particularly encouraging, reflecting successful targeted campaigns on maternal and child health. This specific awareness is vital given the severe implications of prenatal tobacco exposure on fetal development and lifelong health outcomes (American College of Obstetricians and Gynecologists, 2021; Salmasi *et al*., 2023) [8, 46].

On the other hand, a significant portion (49.50%) incorrectly believed that shisha/waterpipe smoking is less harmful than cigarette smoking, with only 29.25% knowing the correct information. The finding about the misconception is not isolated to the current study's population but is a prevalent issue among youth and young adults globally, despite growing scientific evidence to the contrary (WHO, 2017; Al-Naggar & Al-Naggar, 2017 [5]). Numerous studies have revealed that a significant number of individuals, particularly in cultures where waterpipe smoking is ingrained or on the rise, incorrectly view it as a harmless substitute for cigarettes. This misconception is often fueled by several factors: the belief that the water filters out harmful substances, the typically smoother and flavored smoke, and the social context of waterpipe use (Aboaziza & Eissenberg, 2015; Griffiths *et al*., 2023) [1, 29]. Similarly, Kalan *et al*. (2023) [31] systematic review have found that despite increasing awareness of some health risks, a substantial proportion of waterpipe users still believe it is less addictive or harmful than cigarettes. Also, research in various university settings often reveals that while students are aware of the general harms of smoking, specific knowledge about waterpipe risks remains low, contributing to its sustained popularity (Akl *et al*., 2019; Chaaya *et al*., 2019) [3, 20]. The discrepancy between perceived and actual harm necessitates targeted educational interventions that specifically address the false sense of security associated with waterpipe smoking, emphasizing its distinct, and often greater, health risks. Despite this high awareness of general risks, some literature indicates that college students might still underestimate the personal risk associated with smoking, or be less informed about the dangers of newer tobacco products like e-cigarettes (Truth Initiative, 2024; Levy *et al*., 2019) [56, 33]. Overall, the survey's findings of high knowledge about smoking risks among young adults suggest that general public health campaigns have been effective. Future initiatives should focus on converting this awareness into actual behavior change and on clarifying misconceptions about newer tobacco products and immediate health impacts, not just long-term ones.

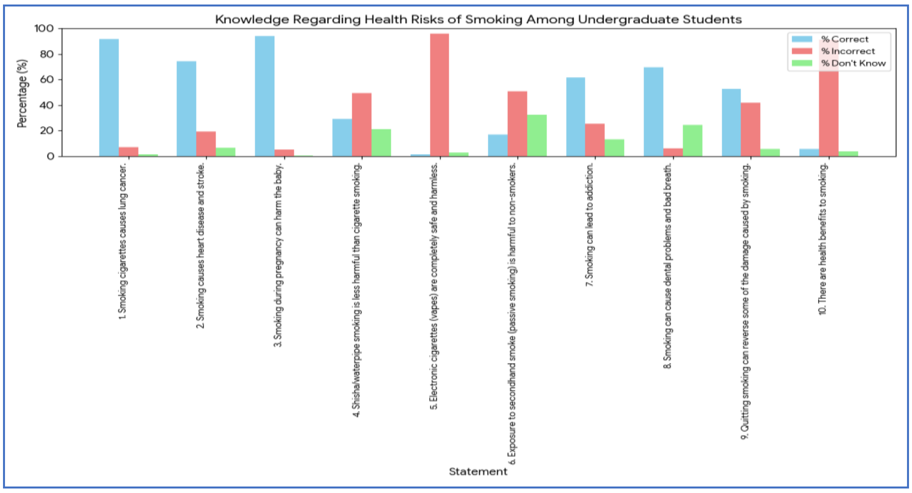


Fig 1: Knowledge levels of the undergraduate students about smoking health risks

The figure above illustrate a mixed but generally strong understanding of fundamental smoking risks among undergraduate students, alongside some significant misconceptions, particularly concerning newer forms of tobacco and quitting. The fact that harm from secondhand smoke isn't universally understood points to a continued necessity for educating individuals on its risks to non-smokers (Ong & Glantz, 2004) [37]; the subtle dangers of passive smoking may be underappreciated. Concurrently, insufficient knowledge about the potential for recovery after quitting smoking is a critical oversight in promoting cessation. By underscoring both immediate and lasting health advantages of quitting, including better cardiovascular function, reduced cancer incidence, and extended lifespan, greater numbers of individuals might be inspired to stop smoking (USDHHS, 2020) [59].

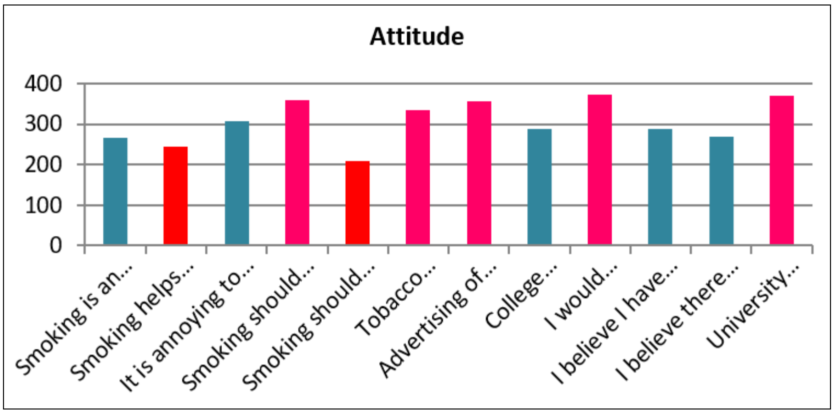
Table 4: Attitudes towards cigarette smoking among undergraduate students

Statement	SA	A	D	SD	Average Mean	Description
Smoking is an acceptable social behavior among college students.	16	237	143	4	2.663	Neutral
Smoking helps relieve stress and anxiety.	77	215	12	6	2.458	Negative
It is annoying to be near a person who is smoking.	51	323	24	2	3. 058	Neutral
Smoking should be completely banned on university campuses.	274	86	37	3	3.578	Positive
Smoking should be completely banned in all public places in Riyadh.	12	232	43	5	2. 088	Negative
Tobacco products should be made more expensive (e.g., through taxes).	149	239	11	1	3.340	Positive
Advertising of tobacco products should be completely prohibited.	237	155	7	1	3.570	Positive
College students who smoke are less responsible than those who don't.	64	223	112	1	2.875	Neutral
I would encourage my friends who smoke to quit.	323	54	17	6	3.735	Positive
I believe I have the ability to quit smoking if I wanted to. (For smokers only)	37	289	68	6	2.893	Neutral
I believe there are effective ways for smokers to quit.	22	234	142	2	2.690	Neutral
University should provide more support for students who want to quit smoking.	278	119	3	0	3.688	Positive
Total Average Mean	1540	2406	619	37	3.053	Neutral

Legend: 1.0-1.75=Very Negative attitude; 1.76-2.50 Negative attitude; 2.51-3.25 neutral; 3.26-4.0 Positive

The Table 4 presents the attitudes towards cigarette smoking among undergraduate students. The results present the attitude towards social acceptability and annoyance, perceived benefits and harm reduction misconceptions, support for tobacco control policies, and quitting and support. It can be seen on the table that undergraduate students were neutral (mean: 2.663) in smoking as acceptable social behavior among students. A substantial number (143 strongly disagree, 4 disagree) indicate that social acceptability is mixed or not universally embraced. The "Neutral" description suggests a division in opinion regarding smoking's social role on campus. While smoking was once widely accepted, increased awareness of secondhand smoke harms and social stigma have reduced its social currency (Bell *et al*., 2010; Borland *et al*., 2010 [14]). Meanwhile, the majority of them were neutral (mean: 3:058) showing proximity to smokers annoying making points to a prevailing desire for smoke-free environments among students. Many college students, particularly non-smokers, advocate for smoke-free environments due to annoyance and health concerns (Merianos *et al*., 2020) [34]. This shift indicates a growing preference for personal space free from tobacco smoke, which aligns with the global trend towards smoke-free policies.

Correspondingly, the students have positive attitude towards smoking completely banned on university campus garnering an average mean: 3.578 making majority supports a complete ban on campus indicating a desire for smoke-free educational environment. While they desire for a completely ban in the university, it is interesting that they have negative attitude (mean=2.088) on completely public banned as it may affects their personal freedoms or feasibility. Yet, the robust advocacy for smoke-free university campuses (Statement 5) and the proscription of tobacco advertising (Statement 7) observed in this context are congruent with overarching public health endeavors advocating for the implementation of smoke-free policies and the regulation of tobacco marketing practices. Smoke-free campus policies are increasingly prevalent and widely supported by both students and faculty, leading to documented reductions in smoking rates and secondhand smoke exposure (Lee *et al*., 2014; Siqueira & Di Benedetto, 2016 [48]). Likewise, research confirms that prohibiting tobacco advertising significantly lowers consumption, particularly among young people, by limiting their exposure to promotional content (Blecher, 2008; Gendall *et al*., 2017) [13, 27]. The endorsement of increased tobacco taxes (Statement 6) is consistent with studies demonstrating that higher prices are a potent tobacco control strategy, effective in deterring youth from starting and encouraging current smokers to quit (Chaloupka & Warner, 2000; Shang *et al*., 2022) [21, 47]. The observed difference in support for a full public smoking ban in Riyadh (Statement 6) versus campus-specific prohibitions could stem from a distinction between private institutional rules and general public regulations, or be influenced by regional cultural norms concerning public smoking (Al-Zalabani *et al*., 2015) [7].



Legend: yellow-very negative; red-negative; blue-neutral; pink-positive

Fig 2: Attitude toward cigarette smoking among undergraduate students

The Fig 2 represents the students' attitude toward cigarette smoking. Based on the results, it can be seen that on the perceived benefits and harm reduction misconceptions that students have negative attitude (average mean: 2.458) believing smoking helps with stress/anxiety indicating a common misconception that often serves as a motivator for smoking. Also, students were divided whether smoking indicates irresponsibility, reflecting a neutral (average mean: 2.875) stance from the collective. The conviction that smoking contributes to stress and anxiety amelioration (Statement 2) constitutes a prevalent misapprehension. While nicotine may confer transient alleviation of withdrawal-induced distress, thereby generating a perception of stress reduction, it does not authentically mitigate psychological stress and may, in fact, exacerbate it through the perpetuation of the addiction cycle (Parrott, 1999; Picciotto *et al*., 2021) [39, 42]. This particular misconception is disproportionately observed among emerging adults and tertiary education students navigating academic rigors and social transitions, frequently leading to the initiation or perpetuation of smoking as a purported coping mechanism (Patterson *et al*., 2010; Vangeli *et al*., 2010) [41, 60]. Lastly, the significant student demand for university-provided quitting support (Statement 12) highlights the necessity of accessible, customized cessation services on campuses. Universities are increasingly vital sites for tobacco control and offering young adults quitting resources, given the prevalence of smoking and vaping in this age group (Berg *et al*., 2018; Cardenas *et al*., 2021) [12, 16]. Furthermore, varying personal confidence in quitting (Statement 10) and mixed beliefs about effective methods (Statement 11) among smokers indicate a need for self-efficacy enhancement and education on evidence-based cessation approaches like NRT and counseling (Fiore *et al*., 2008; Sussman *et al*., 2017) [26, 50].

Table 5: Significant relationship between knowledge in smoking and attitude towards cigarette smoking

Variables	N	Pearson *r*	*p*-value	Significance level	Results	Interpretation
Knowledge vs Attitude	400	0.443	0.001	0.05	Reject the null hypothesis (H_1)	Statistically significant

The correlation coefficient (*r*) is 0.443. This is a positive value, indicating a positive correlation between knowledge in smoking and attitude towards cigarette smoking. In the context of public health, "attitude towards cigarette smoking" usually implies a stance against smoking (e.g., negative attitudes towards smoking itself, positive attitudes towards quitting or smoke-free policies). Assuming this common interpretation, a positive correlation (r=0.443) means that as students' knowledge about smoking increases, their attitude towards cigarette smoking tends to become more negative or unfavorable (i.e., they have a stronger anti-smoking stance).

A statistically significant, moderate positive correlation was identified between knowledge concerning smoking and attitudes toward cigarette use among the undergraduate student cohort. This indicates that heightened awareness of the adverse health implications and sequelae of smoking (as delineated in Table 3) is associated with a propensity for more negative or unfavorable dispositions toward cigarette consumption.

The observed correlation strongly supports the Knowledge-Attitude-Practice (KAP) model, a widely used framework in health education. This model posits that an increase in knowledge (K) leads to a change in attitudes (A), which, in turn, influences practices or behaviors (P) (Launiala, 2009; Sharma & Romas, 2011). In the context of smoking, the present finding suggests that efforts to educate students about the risks of tobacco effectively cultivate more negative and protective attitudes towards smoking. For example, increased awareness of severe health consequences like lung cancer, heart disease, and addiction (as previously shown in the knowledge graph) directly fosters unfavorable attitudes toward initiating or continuing smoking among students. Recent research continues to affirm the KAP model's utility in explaining health behaviors, including tobacco use among youth (Al-Naggar *et al*., 2017; WHO, 2023) [5, 61].

Table 6: Significant difference on the level of knowledge when grouped according to demographic profile

Variables	N	Statistics	*p*-value	Significance level	Results	Interpretation
Age	400	One Way ANOVA	0.001	0.05	Reject the null hypothesis (H_2)	Statistically significant
Gender	400	Independent t -test	0.032	0.05	Reject the null hypothesis (H_2)	Statistically significant
Year Level	400	One Way ANOVA	0.165	0.05	Accept the null hypothesis (H_2)	Not statistically significant
Current residence	400	One Way ANOVA	0.049	0.05	Reject the null hypothesis (H_2)	Statistically significant

Table 6 shows that undergraduate students' knowledge about smoking's health risks varies significantly by age, gender, and current residence. However, their year level doesn't seem to affect their understanding. These results align with existing research on health knowledge and its demographic ties. Based on the results, undergraduate students' knowledge about the health risks of smoking varies significantly with age (p=0.001). This could mean that older students understand these risks better than younger ones, or vice-versa, so we need more research to figure out the exact relationship. It's possible that older university students have had more exposure to health campaigns, personal experiences with smoking, either themselves or through family and friends, or generally have a greater awareness of public health issues (El-Zaemey *et al*., 2013) [24]. In terms of gender, this study revealed a statistically significant difference in the level of knowledge about smoking risks between male and female undergraduate students. This agreed with Al-Dubai *et al*., (2013) [4] which found females to generally report higher health-related knowledge and attitudes, possibly due to higher engagement with health information or greater health-seeking behaviors.

On the other hand, it was found that the undergraduate students' year level doesn't significantly impact their knowledge of smoking risks. This means that simply progressing through their university studies doesn't seem to change how much they know about this topic. The results are in contrast with expectations that increased exposure to academic environments and potentially specialized courses might lead to improved health knowledge (Stepanek *et al*., 2020) [49]. Finally, where students live can significantly affect their health knowledge and behaviors. This is because different residential areas offer varying amounts of health information, social norms, and available resources. Therefore, it's crucial to consider students' living environments when developing health programs to ensure they're effective.

4. Conclusion

This study concluded that while undergraduate students at Riyadh Elm University generally possess a strong awareness of the major health risks associated with smoking, significant gaps and misconceptions persist, particularly regarding tobacco products like shisha/waterpipe and e-cigarettes, and the nuances of secondhand smoke and quitting benefits. There is a moderate positive correlation between knowledge and attitudes towards smoking, suggesting that increased knowledge leads to more unfavorable attitudes towards smoking behavior. Despite a high overall knowledge, the study found significant variations in knowledge levels based on age, gender, and current residence, but notably, not by year level. The prevalence of current smokers among the students is 17.75%, with a majority of smokers initiating tobacco use before the age of 18 and consuming 6-10 cigarettes daily, highlighting a concerning moderate to heavy smoking habit. These findings underscore the continued need for targeted interventions specifically designed for Saudi undergraduate college students, focusing on correcting misconceptions, enhancing self-efficacy for quitting, and providing accessible cessation support.

5. Recommendations

Based on the findings of this study, the following recommendations are proposed to address deficiencies

1. Develop and implement educational programs specifically designed for students that focus on correcting misconceptions about shisha/waterpipe and e-cigarette harms, as well as the dangers of secondhand smoke and the benefits of quitting.
2. Provide resources and interventions that aim to enhance students' confidence in their ability to quit smoking, addressing varying personal beliefs about effective cessation methods.
3. Continue to reinforce educational efforts about the risks

of tobacco, as the study shows that increased knowledge leads to more unfavorable attitudes towards smoking behavior. This supports the utility of the KAP model in health education.
4. Support policies for increased tobacco taxes and the prohibition of tobacco product advertising, aligning with the positive student attitudes towards these measures as effective tobacco control strategies.

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7. Competing interests
The authors declare that there are no competing interests related to the authorship or publication of this article. This includes the absence of any financial support from, or personal/professional ties to, tobacco companies, e-cigarette/vaping companies, or pharmaceutical companies that produce smoking cessation aids, which might directly or indirectly benefit from the study's outcomes.

8. Authors' Contributions
All authors contributed to the study conception and design. Material reparation, data gathering and analysis were performed by all authors. All authors read and approved the final manuscript.

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