

CASE STUDY

Knowledge, attitudes, behaviors and some factors affecting the behaviors of using electronic cigarettes among students in four high schools in Viet Tri city, Phu Tho province, 2024

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ABSTRACT

Objective: This study aimed to investigate the knowledge, attitudes, behaviors, and factors influencing e-cigarette use among high school students in Viet Tri City, Phu Tho Province, Vietnam, in 2024.

Methods: A cross-sectional study was conducted using a mixed-methods approach, combining a quantitative survey with qualitative interviews. A total of 1,002 students from four high schools participated in the survey. Additionally, eight in-depth interviews were conducted with school administrators and Youth Union representatives, along with two focus group discussions with students. Multivariate logistic regression analysis was employed using the enter method to identify factors associated with e-cigarette use.

Results: Among the surveyed students, 57.1% demonstrated satisfactory knowledge, and 76.5% of students had appropriate attitudes towards e-cigarettes. The prevalence of students currently using e-cigarettes was 2.5%, with higher usage rates observed among males (3.6%) compared to females (1.6%). The percentage of students who have ever used e-cigarettes was 5.7% (6.6% for males and 5.0% for females). Multivariate analysis revealed that students with peers who used e-cigarettes, had a history of using traditional cigarettes, drink alcohol, and had exposure to cigarette advertising were 2.2, 2.1, and 2.7 times more likely to use e-cigarettes than other groups, respectively ($p < 0.05$). Conversely, students with a positive attitude toward resisting e-cigarette use were less likely to engage in this behavior ($OR = 0.4$) ($p < 0.05$).

Conclusions: Knowledge and attitudes of students toward e-cigarette use was still limited and a concerning proportion have experimented with or currently use e-cigarettes. Schools play a pivotal role in strengthening educational interventions to correct misconceptions, enhance awareness, and equip students with the necessary skills to resist peer pressure and marketing influences associated with e-cigarette use.

Keywords: Knowledge, attitudes, behaviors, e-cigarettes, students, influencing factors.

INTRODUCTION

Adolescence is an important stage of development because this is a sensitive age group that is highly susceptible to temptation and the development of unhealthy behaviors. Nicotine use in adolescence can increase the risk of addiction to other addictive substances (such as drugs) (1). However, e-cigarette use is

becoming increasingly popular among students. According to the World Health Organization (WHO), e-cigarette use is addictive and causes many harmful effects on human health (6). Furthermore, e-cigarette use among young people also increases the likelihood of future tobacco use (2). In the United States, according to 2021 survey data, e-cigarettes were the most commonly used tobacco products among middle



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and high school students, with usage rates of 11.3% and 2.8%, respectively (3). In Vietnam, the rate of e-cigarette use among adults has increased 18 times from 0.2% (2015) to 3.6% (2020), of which the rate of e-cigarette use among students aged 13-15 was 3.5%, (4). The 2019 Global Student Health Survey (GSHS) showed that 2.6% of students aged 13-17 used e-cigarettes (5). The results of the survey in 11 provinces and cities conducted in 2023-2024 showed that the rate of students aged 13-18 currently using e-cigarettes has increased to 7%. Recently, the number of cases of poisoning among students due to e-cigarette use has also been recorded in a number of provinces and cities in Vietnam (7).

Meanwhile, knowledge and appropriate attitudes about e-cigarettes among high school students were limited. The results of a study of high school students in 4 provinces/cities (Hanoi, Hai Phong, Quang Ninh and Can Tho) showed that only 27% of students had adequate knowledge about e-cigarettes (8). Factors such as family, friends, use of electronic cigarettes; access to e-cigarettes; advertising of e-cigarettes, knowledge, attitudes... were related to e-cigarette use among students (9).

In Phu Tho province, there have been a number of cases of illegal trading and storage of e-cigarettes, mainly used by students. Although some activities to prevent tobacco harm have been implemented in schools, the situation of students using e-cigarettes seemed to be increasingly more common. Students can easily access them through social networks, but there is not much research information on this issue. Therefore, describing the current situation and analyzing the factors affecting the behavior of e-cigarette use of students in schools in Phu Tho province plays an important role in developing activities to prevent e-cigarette use among students. The research results provided scientific evidence

to propose intervention measures to raise awareness and reduce the rate of students using e-cigarettes in the community.

METHODS

Research design: This was a mix-method study, combining both quantitative and qualitative methods. The qualitative component was conducted after the quantitative component to explore additional information that explains and supplements the quantitative findings.

Research subjects: Grade 10 and 11 students; school representatives, and Youth Union Secretaries who presented at the time of the study and agreed to participate in the study. The study did not investigate grade 12 students because the data collection time was close to the time when students were busy preparing for their graduation exams.

Study site and time: At four high schools in Viet Tri city, Phu Tho province, including Viet Tri Industry School, Viet Tri Technology School, Vu The Lang School, and Tran Phu School. Study period was from January 2024 to September 2024. Data collection was conducted in May 2024.

Sample size and sampling method: The sample size was calculated using the following formula:

$$n = Z^2_{(1 - \alpha/2)} \frac{p(1-p)}{d^2} \times DE$$

In which: $\alpha = 0.05$; $Z = 1.96$; $DE = 2$ (the study applied 2-stage cluster sampling); $p = 0.035$ (Proportion of students using e-cigarettes in 2022 according to the National Survey on Youth Tobacco in Vietnam) (3); $d = 0.018$ (The acceptable absolute error level was based on the resources available for the study and on the p-value ($p < 0.1$ $d = p/2$) (10). The sample included 10% reserve for invalid

questionnaires or refusals by the research subjects and was rounded to 1000 students. In fact, 1010 students participated in the survey, 1,002 out of 1,010 students have completed the survey.

Study variables and qualitative research topics

General information: Year of birth, gender, ethnicity, grade level, academic performance, monthly allowance, people living with, history of traditional tobacco use, history of alcohol use; Being family members with traditional tobacco users, family with e-cigarette users, being friends with traditional tobacco users, friends with e-cigarette users; Receiving information on tobacco harm prevention activities in schools, exposure to e-cigarette advertising, places of exposure to e-cigarette advertising, frequency e-cigarette advertising exposure, e-cigarette availability, e-cigarette use, and social media.

Knowledge about e-cigarettes: Ever heard about e-cigarettes, knowledge of ingredients of e-cigarettes, harmful effects of e-cigarettes, addictive properties of e-cigarettes, diseases related to e-cigarettes, e-cigarettes replacing traditional cigarettes.

Attitudes about e-cigarettes: Attitude toward the harmfulness of e-cigarettes, acceptance of e-cigarettes, views on e-cigarettes replacing traditional cigarettes, regulations on use and sale of e-cigarettes.

E-cigarette use behaviors: E-cigarette usage status, current use status, commonly used e-cigarette flavors, reasons for using e-cigarettes, place of purchase.

Qualitative research topics: Knowledge and understanding of e-cigarettes; Students' attitudes about e-cigarettes; Personal factors affecting behavior of using e-cigarettes; Family and friends' factors affecting behavior of using e-cigarettes; Environmental and social factors behavior of using e-cigarettes;

Reasons for using e-cigarettes; Time and area of using e-cigarettes; Sources of electronic cigarette purchased.

Evaluation criteria: Criteria for knowledge, attitude assessment: The general knowledge about e-cigarettes of students was assessed using 14 questions. Each correct answer corresponds to 1 point, while an incorrect answer or the response "Don't know" corresponds to 0 points. The total knowledge score is 14 points if all answers are correct. The general attitude toward e-cigarettes was assessed using 13 questions, based on a Likert scale. Each response is rated on a Likert scale from 1 to 5, giving a total attitude score of up to 65 points. The knowledge and attitude scores were dichotomized using a 75% cutoff. A student is considered to have "achieved" knowledge about e-cigarettes if they score $\geq 75\%$ of the total knowledge points (≥ 11 points). A student is considered to have a "correct" attitude toward e-cigarettes if they score $\geq 75\%$ of the total attitude points (≥ 49 points). In the knowledge section, a key question is "E-cigarettes do not harm human health." If a participant answers incorrectly or chooses "Don't know," they are considered to have inadequate knowledge about e-cigarettes.

Processing and analyzing data

Quantitative data were entered using Epidata 3.1 software and analyzed using SPSS 20.0 software. Descriptive statistics (Frequency (n) and proportion (%)) were used to describe quantitative variables. Univariate analysis was conducted using the Chi-square test with a statistical significance level of $p < 0.05$, odds ratio (OR), 95% confidence interval (CI) to find out the relationship between variables. Multivariate logistic regression analysis was performed using the enter method for selected some factors affecting students' e-cigarette use behavior included personal factors, family factors, friends, social environment factors, knowledge and attitude. The independent

variables included in the multivariate model were tested for correlation and met the criteria for inclusion in the model, with a correlation coefficient (R) of less than 0.2.

For qualitative data, in-depth interview/group discussion tapes were transcribed. The collected information was coded and analyzed by topics using Mindjet software. Qualitative information was cited for content that was consistent with the research objectives.

Research ethics: The study was approved by the Ethics Committee of the Hanoi University of Public Health according to the Decision No. 89/2024/YTCC-HD3 dated April 19, 2024.

RESULTS

The study subjects had an average age of 16.5 years (SD 0.3 year), 56.1% were females and 43.9% were males. 11th graders accounted for 49.2% and 10th graders accounted for 50.8%. The percentage of students with good, excellent and average academic performance was 53%, 31.4%, and 15.6%, respectively. Students participating in the study mainly lived with their parents (86.1%). 93.9% of students did not receive a monthly allowance.

In the study, the majority of students (96.5%) said they had never used traditional cigarettes and 3.5% had used them (5.5% for males and 2.0% for females). 31.8% of students had ever drunk alcohol, of which 35.1% were males and 28.5% were females. 43.1% of students said that someone in their families used traditional cigarettes and 3.4% said that someone in their families used e-cigarettes. In the study subjects' group of friends, 22.1% of students said that they had friends who used traditional cigarettes and up to 36.1% said that they had friends who used e-cigarettes.

Knowledge and attitudes of students about e-cigarettes

General knowledge of students about e-cigarettes are presented in Figure 1, which showing that more than half of students (57.1%) had adequate knowledge, 42.9% of students had inadequate knowledge. The percentage of students with adequate knowledge in the e-cigarette use group was lower compared to the non-smoking group (45.1% and 45.2%). In our study, 84.9% of students believed that e-cigarettes were harmful to human health; 87.3% of students knew that e-cigarettes were addictive and 9.9% knew that e-cigarettes can replace traditional cigarettes.

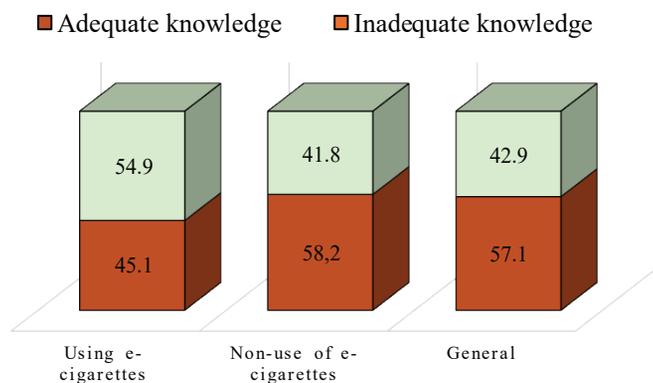


Figure 1. General knowledge of students about e-cigarettes (%)

General attitudes of students about e-cigarettes are presented in Figure 2, which showing

that 76.5% of students had appropriate attitudes, 23.5% of students had inappropriate

attitudes about e-cigarettes. Students who used e-cigarettes had a lower percentage of

appropriate attitudes compared to students who did not use e-cigarettes (52.4% and 78.7%).

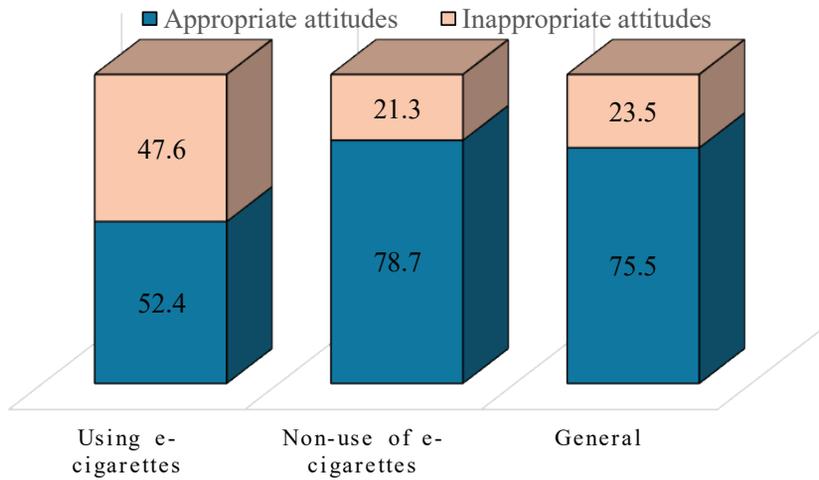


Figure 2. General attitudes of students about e-cigarettes

In our study, 82.7% of students agreed that long-term e-cigarette use could lead to e-cigarette dependence. Up to 74.4% of students disagreed that e-cigarette use was a method to quit traditional cigarettes. 83.4% of students supported the ban on the production, sale and advertising of e-cigarettes and 77.2% agreed to ban the use of e-cigarettes in Vietnam. The research subjects participating in in-depth interviews and group discussions all supported the ban on the production, sale and advertising of e-cigarettes. *“I think e-cigarettes are popular because Vietnam Tobacco Control Law has not banned them yet, and smokers are not fined. Therefore, I think there should be clear measures, regulations in the Law and penalties, which will be more deterrent”* (Group discussion 01). *“The current problem of e-cigarettes is quite painful, there are even types of e-cigarettes containing drugs, so it is necessary to soon include regulations on the use of e-cigarettes in the Law and have specific guidelines for penalties”* (Interview 01- Teacher).

Behaviors of using e-cigarettes

Regarding the behaviors of using e-cigarettes, the research results showed that the percentage

of students currently using e-cigarettes was 2.5% (males were 3.6% and females were 1.6%). The percentage of students who have used e-cigarettes was 5.7%. The three most chosen reasons for using e-cigarettes were having friends or relatives use them (57.3%); curiosity, wanting to experience (57.3%) and because of the attractive flavor (15.9%). The results of in-depth interviews and group discussions showed that e-cigarettes are becoming more and more popular, not only among boys, but also among girls. *“In my group of friends, there are about 7-8 friends who use e-cigarettes. They use them anytime, anywhere, smoking before going to school, at home or going out. They also often share them with each other”* (Group discussion 01).

Some factors affecting the behaviors of using electronic cigarettes among students

The multivariate regression results in Table 1 showed that students who had friends who used e-cigarettes were 2.23 times more likely to use e-cigarettes (95% CI: 1.15-4.35). Students with a history of drinking alcohol and using traditional cigarettes were two times and 13 times more likely to use e-cigarettes than

students with no history of using these drugs. Students exposed to tobacco advertising were 2.67 times more likely to use e-cigarettes than students not exposed to tobacco advertising (95% CI: 1.44-4.95). Students with appropriate attitudes were less likely to use e-cigarettes than students with inappropriate attitudes (OR = 0.4, 95% CI: 0.21-0.67). Student interviews

particularly emphasized the influence of friends using e-cigarettes on students' e-cigarette use behavior: "My friends brought e-cigarettes to school and let their friends try them. Many of them did not have money to buy them so they often used them, like only taking 1 or 2 puffs to try the taste of e-cigarettes. They often used them in groups" (Interview 07- students).

Table 1. Multivariate regression model identifying some factors related to e-cigarette use behaviors of high school students

Related factor	Frequency (n=1002)	Percentage (%)	Coefficient Regression (B)	Standard error (SE)	Crude OR (KTC 95%)	P	Adjusted OR (KTC 95%)	P
Gender								
Male	440	43.9	-	-			1	-
Female	562	56.1	-0.06	0.28	0.62 (0.39-0.97)	0.03	0.93 (0.53-1.63)	0.81
Academic performance								
Good - Excellent	846	84.4	-	-			1	-
Weak - Average	156	15.6	0.07	0.35	2.15 (1.27-3.62)	0.004	1.07 (0.53-2.16)	0.83
School group								
Public	478	47.7	-	-			1	-
Private	524	52.3	0.54	0.3	2.35 (1.43-3.85)	0.001	1.72 (0.95-3.11)	0.07
Monthly allowance								
Not provided	941	93.9	-	-			1	-
<500.000 VND	42	4.2	0.60	0.56	1.61 (0.61-4.21)	0.33	1.83 (0.60-5.59)	0.28
≥500.000 VND	19	1.9	0.78	0.71	3.17 (1.02-9.80)	0.04	2.20 (0.54-8.91)	0.26
Ever used traditional cigarettes								
No*	967	96.5	-	-			1	-
Yes	35	3.5	2.57	0.44	25.58 (12.28-53.28)	<0,001	13.0 (5.46-31.35)	<0.001
Ever drank alcohol								
No*	683	68.2	-	-			1	-
Yes	319	31.8	0.69	0.27	3.78 (2.37-6.06)	<0,001	2.0 (1.17-3.42)	0.011
Relatives use traditional cigarettes								
No*	570	58.9	-	-			1	-
Yes	432	43.1	-0.01	0.27	1.59 (1.0-2.49)	0.04	0.98 (0.57-1.68)	0.94

Related factor	Frequency (n=1002)	Percentage (%)	Coefficient Regression (B)	Standard error (SE)	Crude OR (KTC 95%)	P	Adjusted OR (KTC 95%)	P
Relatives use e-cigarettes								
No*	968	96.6	-	-			1	-
Yes	34	3.4	0.63	0.57	5.18 (2.38-11.26)	< 0.001	1.88 (0.61-5.76)	0.27
Friends use traditional cigarettes								
No*	781	77.9	-	-			1	-
Yes	221	22.1	-0.09	0.33	3.1 (1.95-4.95)	< 0.001	0.90 (0.47-1.75)	0.77
Friends use e-cigarettes								
No*	640	63.9	-	-			1	-
Yes	362	36.1	0.80	0.33	4.06 (2.51-6.57)	< 0.001	2.23 (1.15-4.35)	0.01
Advertising exposure								
No*	494	49,3	-	-			1	-
Yes	508	50,7	0.98	0.31	3.07 (1.84-5.13)	< 0.001	2.67 (1.44-4.95)	0.002
E-cigarettes are easy to access								
Easy to buy			-0.008	0.29	2.06 (1.28-3.31)	0.003	0.99 (0.55-1,78)	0.97
Difficult to buy			0.18	0.54	1.2 (0.44-3.17)	0.72	1,19 (0.40-3.51)	0.74
Don't know/ unsure*			-	-			1	-
Knowledge								
Inadequate*	572	57.1	-	-			1	-
Adequate	430	42.9	-0.11	0.28	0.6 (0.37-0.93)	0.02	0.89 (0.50-1.56)	0.68
General attitudes								
Inappropriate*	767	76.5	-	-			1	-
Appropriate	235	23.5	-0.96	0.29	0.3 (0.18-0.47)	< 0.001	0.38 (0.21-0.67)	0.001

*: Comparison group; -: Not applicable

Hosmer and Lemeshow statistical model fit test $p > 0.05$

DISCUSSION

Knowledge and attitudes of students about e-cigarettes

The percentage of students with adequate knowledge about e-cigarettes in the study was not high (57.1%). This research result was

higher than the research result of Hoang The Ky and colleagues (26.7%) on the same group of high school students in four provinces and cities in Vietnam (8) and Aghar H (36.7%) (11) and is similar to the research result of Nguyen Thi Lan Phuong (54.1%) (9). In our study, 84.9% of students knew that e-cigarettes were harmful to

human health. However, 11.8% of students still believed that using e-cigarettes was not harmful to human health. This result was higher than the research result of Hoang Van Minh in 39 high schools in 11 provinces and cities (10.6%). The results were lower than the study in the US (17.9%) (3). In addition, students still had gaps in knowledge about e-cigarettes when 35.6% of students answered that they did not know to whether e-cigarettes can replace traditional cigarettes, 38.6% of students did not know whether e-cigarettes are licensed in Vietnam or not, and 22.5% of students did not know that nicotine is the main ingredient of e-cigarettes. The reason why students had incorrect knowledge about e-cigarettes could be explained by the fact that e-cigarettes are not licensed for use in Vietnam, e-cigarettes are advertised on social channels e.g. Facebook, Instagrams as non-addictive and can replace traditional cigarettes.

The percentage of students with appropriate attitudes about e-cigarettes was 76.5% and only 23.5% of students had an attitude in support of e-cigarettes. 95.5% of students agreed that e-cigarettes were harmful to human health. 83.4% of students had attitudes in favor of banning advertising, buying, selling and promoting e-cigarettes in Vietnam. These results were higher than those reported in the study of Hoang The Ky et al. (8). The fact that students and people had attitudes in favor of banning advertising, buying, selling, promoting and using e-cigarettes would contribute to promoting the promulgation of policies related to limiting the harmful effects of e-cigarettes.

Behaviors of using e-cigarettes

The rate of students currently using e-cigarettes was 2.5% (3.6% for males and 1.6% females). The rate of students who have ever used e-cigarettes was 5.7%. The rate of students currently using e-cigarettes was similar to the national survey on school health (GSHS 2019) (2.6%), lower than that of Hoang The Ky's study (4.2%) and the 2021 GYTS survey (3.5%),

much lower than the results of Hoang Van Minh's study at 39 high schools in 11 provinces and cities (7%). Although the rate of current e-cigarette use was lower, the rate of students who have ever used e-cigarettes was almost equivalent to the results of the 2021 GYTS survey with the rate of students aged 13-15 who have ever used e-cigarettes being 7.8%. Notably, when asked about their friends' e-cigarette use, up to 36.1% of students participating in the study said that they had friends who used e-cigarettes. Compared to other Southeast Asian countries, the proportion of students who were currently using and had ever used e-cigarettes was lower than the that among adolescents in Indonesia (11%), Thailand (3.5%), and Laos (4.9%). This difference may be explained by the prevalence of e-cigarettes in the countries and e-cigarette control policies. The three most frequently cited reasons for using e-cigarettes were having friends or relatives use them (57.3%); being curiosity, wanting to experience (57.3%) and because of attractive flavors for e-cigarettes (15.9%). Our qualitative research results also indicated that the reasons students use e-cigarettes include: curiosity, wanting to express themselves, friends smoking and letting them use them, and attractive flavors. This may affect tobacco harm prevention efforts and the goal of reducing the number of smokers and reducing the burden of disease caused by tobacco use.

Some factors affecting the behaviors of using electronic cigarettes among students

Through multivariate analysis, factors having a statistically significant relationship with students' e-cigarette use behaviors included: having friends using e-cigarettes, history of using traditional cigarettes, history of drinking alcohol, exposure to tobacco advertising, attitudes related to students' e-cigarette use behavior. The influence of having friends using e-cigarettes on students' e-cigarette use behaviors has also been recorded in the study of Yusof et al. in Malaysia (12) and

the study of Cao Minh Dat (13). The results of our qualitative research also showed similar results, when the participants all confirmed that the strong influence of friends on students' e-cigarette use. Having a history of traditional cigarette use and alcohol consumption were risk factors that increased the likelihood of e-cigarette use by 13 times and 2 times, respectively. Previous studies have also found a significant association between traditional cigarette use, alcohol consumption, and e-cigarette use, with odds ratios ranging from 3.97 to 17.5 (14). Once students became accustomed to using alcohol or traditional cigarettes, they were more likely to transition to or supplement e-cigarette use as an alternative. Students who used alcohol or traditional cigarettes often did not have significant concerns about the health consequences of using e-cigarettes. Additionally, students who used traditional cigarettes also had easier access to e-cigarette supplies, which facilitated experimentation and use.

Exposure to e-cigarette advertising, particularly on social media platforms, significantly influenced usage behaviors. Students frequently encountered advertisements portraying e-cigarettes as modern and fashionable, sparking curiosity and experimentation. This finding mirrors earlier research indicating the powerful impact of digital marketing on adolescent substance use (15-16). Given these findings, it is imperative to implement targeted educational interventions that address misconceptions, build resilience against peer pressure, and regulate online advertising of e-cigarettes to protect adolescent health.

Limitations of the study: This study presents several limitations that should be acknowledged. Given the prohibition of e-cigarette use in schools, some participants may have been reluctant to provide accurate information due to concerns about potential repercussions on their academic records. Consequently, this hesitation could have

resulted in underreporting or misrepresentation of actual behaviors. Moreover, the use of self-administered questionnaires introduced the potential for information bias. Participants might not have fully completed the survey, misunderstood certain questions, or responded inaccurately, thereby impacting the reliability of the findings. As a cross-sectional study, this research provided a snapshot of students' knowledge, attitudes, and behaviors at a single point in time and cannot capture changes or trends over an extended period. Future research should consider longitudinal designs to track these dynamics over time and expand the study population to include both middle and high school students. Such approaches would provide a more comprehensive understanding of e-cigarette use patterns and inform more effective prevention and intervention strategies.

CONCLUSIONS

The research results showed that 57.1% of students had adequate knowledge about e-cigarettes, while 76.5% of students exhibited appropriate attitudes about e-cigarettes. The percentage of students currently using e-cigarettes was 2.5%, with a higher prevalence among males (3.6%) compared to females (1.6%). Additionally, 5.7% of students reported having tried e-cigarettes at least once. Key factors influencing e-cigarette use among students included a history of traditional cigarette smoking, alcohol consumption, peer influence from friends who use e-cigarettes, and exposure to tobacco advertising. These findings highlight the necessity of targeted interventions to address misconceptions and promote healthier behaviors. To mitigate the rising trend of e-cigarette use, educational institutions must implement comprehensive programs focused on enhancing students' knowledge, fostering critical thinking, and equipping them with essential life skills. Collaborative efforts between schools, parents, and health authorities are crucial to create a supportive environment that empowers

students to resist peer pressure and make informed decisions regarding e-cigarette use.

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