

A Comparison of Knowledge and Attitudes Toward E-Cigarette Use Among Lower Secondary School Students in Dusit District, Bangkok

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Abstract

Aim/Purpose: This research aimed to compare knowledge and attitudes toward e-cigarette use among students by gender, Grade Point Average (GPA), daily income, having friends who use e-cigarettes, and having family members who use e-cigarettes.

Introduction/Background: E-cigarette use among adolescents remains a significant public health concern in Thailand and worldwide. As a relatively new form of tobacco product, e-cigarettes often contain higher levels of nicotine than conventional cigarettes, leading to potential adverse effects on physical health, mental well-being, the economy, and the environment. Recent evidence indicates a rapid increase in new e-cigarette users among adolescents aged 13–15 years, affecting both males and females. However, research examining e-cigarette use in Thailand among adolescents in this age group remains limited.

Methodology: This research employed a comparative research design. The sample comprised 288 lower secondary school students in Grades 7–9, selected via cluster sampling. The research instruments included: (a) a demographic information questionnaire of five items, (b) a questionnaire assessing lower secondary students' knowledge of e-cigarettes of 19 items, and (c) a questionnaire measuring lower secondary students' attitudes toward e-cigarette use of 25 items. Content validity was evaluated by three experts. The Index of Item-Objective Congruence (IOC) for the e-cigarette knowledge questionnaire ranged from .67 to 1.00, while the IOC for the attitude questionnaire was 1.00. The reliability of the e-cigarette knowledge questionnaire was assessed using the Kuder–Richardson Formula 20 (KR-20), yielding a coefficient of .81. The reliability of the attitude questionnaire was evaluated using Cronbach's alpha coefficient, which was .89. Data were analyzed using Descriptive Statistics, Independent *t*-Tests, One-Way Analysis of Variance, and pairwise comparisons using the Bonferroni Method.

Findings: The data analysis revealed several important findings regarding students' knowledge and attitudes toward e-cigarette use. First, when comparing male and female students, no statistically significant differences were observed in either their level of knowledge or their attitudes toward e-cigarette use. Second, peer influence emerged as a noteworthy factor. Students who reported having friends who used e-cigarettes demonstrated significantly higher levels of knowledge about e-cigarettes compared to those whose friends did not use them ($t = 2.206, p = .028$). However, there was no significant variation in attitudes between the two groups. Third, knowledge scores did not differ significantly between students who had family members who used e-cigarettes and those who did not. Nevertheless, students whose family members did not use e-cigarettes exhibited more appropriate and health-conscious attitudes toward e-cigarette use compared to those with family members who did use them ($t = -3.308, p = .001$). Fourth, knowledge scores regarding e-cigarette use did not differ significantly across students with varying GPAs. However, students with GPAs ranging from 3.50 to 4.00 demonstrated more appropriate attitudes toward e-cigarette use than those with GPAs of 3.00 or lower ($F_{3,284} = 4.721, p = .003$). Finally, students' daily income levels did not show any significant differences in either knowledge or attitudes toward e-cigarette use.

Contribution/Impact on Society: The findings of this study indicated that students with friends who use e-cigarettes demonstrated higher levels of knowledge compared to those whose friends did not use e-cigarettes. In addition, students without family members who use e-cigarettes and those with GPAs of 3.50 or above exhibited more appropriate attitudes than other groups. These results suggest that certain groups of students may be at greater risk of initiating e-cigarette use. Educational administrators can utilize these findings to design targeted measures and prevention campaigns focusing on at-risk students, while also promoting positive peer networks to prevent e-cigarette use. Furthermore, policymakers and public health personnel may apply this information to strengthen family-based strategies for e-cigarette prevention.

Recommendations: This study's significant findings provide important implications for adolescents, parents, school counselors, school administrators, public health practitioners, and policymakers in developing effective strategies to prevent e-cigarette use among adolescents. Schools should implement continuous educational programs that provide accurate information about e-cigarettes and relevant legal regulations. Such programs should also strengthen students' critical thinking, decision-making, and refusal skills related to e-cigarette use, particularly among students with lower academic achievement. In addition, prevention efforts should emphasize the roles of peers, parents, and family members by promoting participatory activities that actively engage these groups in reducing e-cigarette use among adolescents.

Research Limitations: The data for this study was collected from a single school; therefore, the findings may not be generalizable to students in other contexts that differ in terms of environmental conditions, school policies, resources, or social backgrounds. In addition, the results of this study may not be generalized to lower secondary school students at the national level, nor to students in private schools or schools located in rural areas.

Future Research: Future research should include a larger sample size and be conducted in private schools or schools in rural areas. In addition, technology should be utilized to develop innovative e-cigarette prevention interventions that are appropriate for lower secondary school students.

Keywords: *Knowledge/attitudes toward e-cigarettes, lower secondary school students*

Introduction

Electronic cigarettes (e-cigarettes) are a new tobacco product that is harmful to health. This is because the aerosol particles produced by e-cigarettes are smaller than 2.5 micrometers and contain higher levels of nicotine than conventional cigarettes. As a result, e-cigarettes can easily deliver numerous harmful substances into the body. These substances can penetrate deeply into the body, potentially at the DNA level, leading to a high risk of addiction, increased difficulty in quitting, and severe adverse health effects (Tobacco Products Control Committee Office, 2024).

E-cigarettes have significant adverse effects that should not be overlooked on various body systems. Nicotine causes inflammation of brain cells, delays brain development during adolescence, and leads to addiction. Arsenic, a component commonly found in herbicides, affects blood coagulation and increases the risk of uncontrolled bleeding. Formaldehyde damages epithelium in the respiratory tract and increases the risk of cancer. Propylene glycol, a substance used in lubricants and toilet cleaning solutions, can cause retinal degeneration. Glycerin can enter the bloodstream, leading to dizziness and nausea. Cadmium and lead, which are battery components, are carcinogenic substances (Thai Health Promotion Foundation, 2024; Tobacco Products Control Committee Office, 2024).

The psychological impacts of e-cigarette use include an increased risk of depression, anxiety, irritability, insomnia, and emotional dysregulation, which can lead to aggressive behavior. The economic impacts involve the government bearing the cost of treating diseases caused by e-cigarette use, including chronic obstructive pulmonary disease, stroke, ischemic heart disease, and asthma. These healthcare costs exceed the revenue generated from tobacco taxes. The environmental impacts

include the contribution to higher concentrations of PM_{2.5}. Cartridges, batteries, metal coils, and microchips from e-cigarettes are considered hazardous waste (Tobacco Products Control Committee Office, 2024).

In response to the dangers of e-cigarettes, Thailand enacted the Tobacco Product Control Act of 2017. Under Section 26 of the Act, it is prohibited for anyone to sell or provide tobacco products to individuals under the age of 20 (Department of Disease Control, 2017). Despite legislation prohibiting the sale of e-cigarettes, the number of new adolescent users continues to rise. In 2021, a health survey of 3,618 students found that 8.1% of lower secondary students had used e-cigarettes. In 2022, a survey on youth tobacco consumption of 6,752 students reported that the prevalence of e-cigarette use among lower secondary students had increased to 17.6%. These statistics indicate that within one year, the rate of e-cigarette use among lower secondary students increased by 9.5%, highlighting e-cigarettes as a significant threat to youth, who represent the future of the nation (Tobacco Products Control Committee Office, 2024).

A review of the literature shows that numerous studies have examined the knowledge, attitudes, and behaviors related to e-cigarette use among upper secondary students, vocational certificate students, and university students. These studies primarily focused on assessing levels of knowledge and attitudes toward e-cigarette use (Khamchu et al., 2024; Konkaew & Konkaew, 2022) and examining the relationships between personal factors and e-cigarette use behavior (Panaschai, 2023; Waeduraemae, 2024; Yupa et al., 2024), as well as developing programs to enhance knowledge and attitudes regarding the prevention of e-cigarette use. (Phimaikun & Kotchasee, 2023; Surangsee et al., 2024). However, according to surveys on tobacco consumption conducted by the Tobacco Products Control Committee Office (2024) and the World Health Organization (2024), the number of new e-cigarette users among children and adolescents aged 13–15 has increased. Therefore, e-cigarette use among youth remains a significant problem in Thailand and worldwide.

Lower secondary school students are adolescents, both male and female, aged 13–15 years, who are currently attending school. They are considered early adolescents, a developmental stage that carries a higher risk of e-cigarette use. This is because they tend to form close friendships, exhibit curiosity and a desire to experiment, engage in similar activities as their peers, and seek peer acceptance. Their main social environments are school and peer groups, and at times they may disregard parental guidance regarding safety and appropriate behavior (Areemit, 2016). In addition, studies on knowledge and attitudes toward e-cigarette use among lower secondary students in Thailand are still limited. One study examining e-cigarette use among Grade 7 students found that male students used e-cigarettes more frequently than female students. Furthermore, students with GPAs below 3.00 used e-cigarettes more often than those with GPAs above 3.00 (Patanavanich et al., 2021)

However, comparative research on the levels of knowledge and attitudes toward e-cigarette use among lower secondary school students remains limited, particularly studies analyzing differences across personal and social factors. Moreover, there remains a lack of clear empirical evidence on this issue within the Dusit District of Bangkok. Therefore, the researchers aimed to compare the knowledge and attitudes toward e-cigarette use among lower secondary school students in Dusit District, Bangkok, in relation to gender, educational level, GPA, students' daily income, having friends who use e-cigarettes, and having family members who use e-cigarettes. The findings are intended to benefit parents, youth, school administrators, guidance teachers, students, public health personnel, and other researchers. Moreover, the study aimed to provide fundamental information on students' knowledge and attitudes toward e-cigarette use, which can serve as a basis for designing prevention campaigns and developing appropriate counseling and support systems within educational institutions. This is considered an important issue for the development and care of youth, who represent a vital force for the future of society.

Research Objective

To compare knowledge and attitudes toward the use of e-cigarettes among students according to differences in gender, GPA, students' daily income, having friends who use e-cigarettes, and having family members who use e-cigarettes.

Operational Definitions

Attitudes toward e-cigarette use refer to an individual's opinions, beliefs, and feelings regarding e-cigarette use, including both appropriate and inappropriate aspects. This includes perceptions of addiction, legality, body odor or bad breath, health risks, social disapproval, and ease of social integration with peer groups.

Knowledge of e-cigarette use refers to students' understanding of the laws prohibiting e-cigarette use, restrictions on the sale and distribution of e-cigarettes, smoke-free areas, the addictive substances and hazardous compounds contained in e-cigarettes, as well as the health impacts of e-cigarette use.

Lower secondary school students refer to students in Grades 7, 8, and 9 who were currently studying at Rajavinit Mathayom School, under the Secondary Educational Service Area Office Bangkok 1, which is governed by the Office of the Basic Education Commission, Ministry of Education, located in Dusit District, Bangkok.

Personal factors refer to the background characteristics of the participants, including gender, whether they have friends who use or do not use e-cigarettes, and whether they have family members who use or do not use e-cigarettes. For GPA and students' daily income, students were categorized into groups as follows:

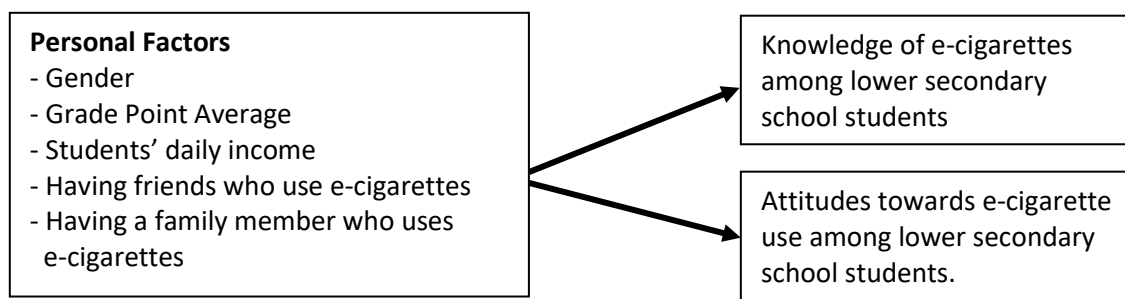
GPA: .00–2.49, 2.50–3.00, 3.01–3.49, and 3.50–4.00, and

Students' daily income (in Thai Baht): 1–50, 51–100, 101–150, 151–200, 201–250, and 251–300.

Research Framework

The research framework shown below in Figure 1 illustrates the relationship between selected personal factors and students' awareness and perceptions of e-cigarettes. Specifically, personal factors such as gender, grade point average, students' daily income, having friends who use e-cigarettes, and having family members who use e-cigarettes were considered potential influences on students' knowledge of e-cigarettes and their attitudes toward e-cigarette use. The framework proposed that these personal characteristics may shape how lower secondary school students understand e-cigarettes and how they perceive or respond to their use. Through this framework, the study examined how these factors contribute to variations in knowledge and attitudes among lower secondary school students.

Figure 1 Research Framework



Research Methodology

Research Design

This study employed a comparative research design to examine differences in knowledge and attitudes toward e-cigarette use among lower secondary school students based on selected personal factors.

Population and Sample

The population consisted of lower secondary school students of Grades 7–9 at Rajavinit Mathayom School. The population included 423 Grade 7 students, 369 Grade 8 students, and 349 Grade 9 students, for a total of 1,141 students (Rajavinit Mathayom School, 2025).

The sample consisted of students from Rajavinit Mathayom School. The sample size was determined using the Krejcie and Morgan (1970) sample size determination table, resulting in a total of 288 participants. Cluster sampling was then employed. The sample included 95 Grade 7 students, 97 Grade 8 students, and 96 Grade 9 students. Participation was voluntary, and all participants provided informed consent prior to taking part in the study.

Research Instrument

Part 1: *Demographic Information Questions*—This section included five items covering gender, GPA, students' daily income, friends who use e-cigarettes, and family members who use e-cigarettes.

Part 2: *Knowledge of Lower Secondary School Students on E-Cigarettes Questions*—This section was developed by the researchers based on academic information regarding e-cigarettes (Department of Disease Control, 2017; Tobacco Products Control Committee Office, 2024). It consisted of 19 items; responses were scored as 1 point for answering “know” and 0 points for answering “do not know”.

Part 3: *Attitudes of Lower Secondary School Students Toward E-Cigarette Use Questions*—This section was developed by researchers based on a review of the literature (Nazzal et al., 2024; Phimaikun & Kotchasee, 2023). It consisted of 25 items measured using a five-point Likert scale, ranging from 1 (strongly inappropriate) to 5 (strongly appropriate), with total scores ranging from 25 to 125. Nine items (Items 1, 2, 3, 6, 7, 8, 9, 10, and 11) reflected inappropriate attitudes and were reverse-scored, with scores adjusted from 1 to 5 on a five-point Likert scale.

Content validity was examined by three experts. The Index of Item-Objective Congruence (IOC) values for e-cigarette knowledge questions ranged from .67 to 1.00, while the IOC value for attitudes towards e-cigarette use questions was 1.00. The reliability of the e-cigarette knowledge questions was assessed using the Kuder–Richardson Formula 20 (KR-20), yielding a coefficient of .81. The reliability of the attitude questionnaire was evaluated using Cronbach's alpha coefficient, which was .89.

Protection of Participants' Rights

The research project underwent ethical review by the Research, Development, and Academic Position Committee, in accordance with Resolution No. RRDC 2025-60, dated March 26, 2025, of Asia-Pacific International University.

Data Collection

Data were collected during May and June 2025. The researchers obtained permission from the principal of Rajavinit Mathayom School in Dusit District, Bangkok, and coordinated with homeroom teachers, informed parents, and scheduled the dates and times for data collection. Written informed consent was obtained from all participants before data collection. Before administering the questionnaires, the researchers provided a detailed explanation of the study's objectives and procedures to ensure that participants fully understood the research process, the benefits of acquiring accurate knowledge and appropriate attitudes, and the protection of their rights. Participants were informed that they had the right to decline participation or withdraw from the study at any time without any negative consequences. During questionnaire completion, participants were allowed to ask the researchers questions at any time if clarification was needed. The questionnaire required approximately 15–20 minutes to complete. All participant information was kept confidential and reported only in aggregate form as part of the research findings.

Data Analysis

Data were analyzed using the Statistical Package for the Social Sciences. The level of statistical significance was set at .05. Descriptive statistics, including percentages, means, and standard

deviations, were used to analyze demographic data. Independent *t*-tests were conducted to compare knowledge and attitudes toward e-cigarette use according to gender, having friends who use e-cigarettes, and having family members who use e-cigarettes. One-way Analysis of Variance (ANOVA) was used to compare knowledge and attitudes toward e-cigarette use according to GPA and students' daily income. Post hoc pairwise comparisons were performed using the Bonferroni Method.

Results of the Study

Participant Demographics

The total sample consisted of 288 participants, the majority of whom were male (168 students, 58.30%). The mean GPA was 3.27 (*SD* = .47), with the largest group of students having a GPA between 3.50 and 4.00 (115 students, 39.90%). The mean daily allowance received from parents was 120.96 Thai Baht (*SD* = 43.36), with a majority receiving between 51 and 100 Thai Baht per day (170 students, 59.00%). Most participants reported having friends who did not use e-cigarettes (197 students, 68.40%), and the majority reported that no family members used e-cigarettes (238 students, 82.60%).

Independent t-Test Analysis

Gender. The results of the comparative analysis by gender of their knowledge and attitudes toward e-cigarette use revealed no significant differences between male and female students in knowledge or attitudes ($p > .05$) [$t = -.275, p = .784$; $t = -1.927, p = .055$].

Friends Using E-Cigarettes: The results of a comparison of knowledge and attitudes toward e-cigarette use between those having friends who use and do not use e-cigarettes showed that students with friends who use e-cigarettes had a significantly higher knowledge about e-cigarettes than those whose friends do not use them ($t = 2.206, p = .028$). However, their attitudes did not differ significantly ($t = -.941, p = .348$).

Family Members Using E-Cigarettes: A comparison of knowledge and attitudes toward e-cigarette use between those having family members who use e-cigarettes and those having family members who do not indicated no significant differences in knowledge between these two groups ($t = .471, p = .638$). However, their attitudes differed significantly, with students whose family members use e-cigarettes showing less appropriate attitudes ($t = -3.308, p = .001$), as shown in Table 1.

Table 1 Comparison of Knowledge and Attitude Towards E-Cigarette Use

Independent Variables	Knowledge of E-Cigarettes					Attitudes towards E-Cigarettes				
	<i>M</i>	<i>SD</i>	<i>t</i>	<i>df</i>	Sig.	<i>M</i>	<i>SD</i>	<i>t</i>	<i>df</i>	Sig.
Gender										
Male = 168	14.01	3.37	-.275	286	.784	3.82	.69	-1.927	268.46	.055
Female = 120	14.12	3.09				3.97	.63			
Friends use E-Cigarettes										
Yes = 91	14.68	3.27	2.206*	286	.028	3.82	.63	-.941	286	.348
No = 197	13.77	3.21				3.90	.68			
Family Member(s) Uses E-Cigarettes										
Yes = 50	14.26	3.02	.471	286	.638	3.60	.73	-3.308**	286	.001
No = 238	14.02	3.30				3.94	.64			

Note: * $p < .05$, ** $p < .01$

One-way ANOVA Analysis

Grade Point Average. The analysis of GPAs, as shown in Table 2, revealed that students with varying grade point averages did not differ significantly in their mean knowledge scores regarding e-cigarette use ($F_{3,284} = 1.627, p = .183$). However, attitudes toward e-cigarette use differed significantly among at least one pair of GPA groups at the .05 level ($F_{3,284} = 4.721, p = .003$). Pairwise comparisons were subsequently conducted using the Bonferroni Method.

Table 2 Comparison of Knowledge of and Attitudes Toward E-Cigarette Use Across GPAs

Source of Variation		SS	df	MS	F	Sig.
Knowledge of E-Cigarette Use	Between Groups	51.462	3	17.154	1.627	.183
	Within Groups	2993.413	284	10.540		
	Total	3044.875	287			
Attitudes towards E-Cigarette Use	Between Groups	6.164	3	2.055	4.721**	.003
	Within Groups	123.599	284	.435		
	Total	129.763	287			

Note: ** $p < .01$

The pairwise comparison of attitudes toward e-cigarette use across GPAs using the Bonferroni Method revealed that lower secondary students with GPAs between 3.50 and 4.00 demonstrated significantly more appropriate attitudes toward e-cigarette use than students with GPAs between .00 and 2.49 or between 2.50 and 3.00. These findings were at the .05 significance level, as shown below in Table 3.

Table 3 Pairwise Comparison of Attitudes Toward E-Cigarette Use Across GPAs

GPA	M	.00–2.49	2.50–3.00	3.01–3.49	3.50–4.00
.00-2.49	3.53	-			
2.50-3.00	3.70	.16943	-		
3.01-3.49	3.95	.42178	.25235	-	
3.50-4.00	3.98	.45238*	.28295*	.03060	-

Note: * $p < .05$

Students' Daily Income. The analysis revealed that students with different daily income levels did not differ significantly in their knowledge of or attitudes toward e-cigarette use at the .05 level ($F_{5,282} = .784$, $p = .562$; $F_{5,282} = .376$, $p = .865$, respectively), as shown in Table 4.

Table 4 Comparison of Knowledge of and Attitudes Toward E-Cigarette Use Across Students' Daily Income

Source of Variation		SS	df	MS	F	Sig.
Knowledge of E-Cigarette Use	Between Groups	41.771	5	8.354	.784	.562
	Within Groups	3003.104	282	10.649		
	Total	3044.875	287			
Attitudes towards E-Cigarette Use	Between Groups	.860	5	.172	.376	.865
	Within Groups	128.903	282	.457		
	Total	129.763	287			

Discussion

Gender

The study found no significant differences between male and female students in their knowledge of or attitudes toward e-cigarette use. This may be explained by their exposure to similar learning environments, including health education curricula that cover substance-related harms (Taerakul, 2024) and continuous participation in school-based anti-drug campaigns. Furthermore, students regularly accessed information from various mass and social media platforms such as television, Facebook, TikTok, LINE, and Instagram, which likely enhanced their self-directed learning about the risks and consequences of e-cigarette use.

These findings were consistent with Vichayanrat et al. (2024), who reported that exposure to school and media information contributed to comparable risk perceptions across genders. Additionally, annual educational activities organized by schools and government agencies on World No Tobacco Day reinforce ongoing learning and promote appropriate attitudes toward e-cigarette prevention. These results also aligned with those of Surangsee et al. (2024), who demonstrated that

preventive education programs improved both knowledge and attitudes among lower secondary students, regardless of gender. Overall, the findings suggested that gender is not a determining factor influencing students' knowledge of or attitudes toward e-cigarette use.

Friends Using E-Cigarettes

The results indicated that students with friends who used e-cigarettes had higher levels of knowledge compared to those whose friends did not vape, while their attitudes did not differ. This indicates that peer e-cigarette use influences knowledge acquisition, but not attitudes. A plausible explanation is that peers who vape often share firsthand information such as restrictions and fines in smoke-free areas, regulations on e-cigarette sales, and practical experiences related to device use, providing greater access to operational knowledge than from peers who do not vape. However, the similarity in attitudes between the two groups may reflect the stronger influence of health and legal information disseminated through schools, governmental agencies (Tobacco Products Control Committee Office, 2024), and public media. These sources consistently highlight the health risks, legal consequences, and social stigma associated with e-cigarette use, which may help maintain preventive attitudes regardless of peer behavior.

These findings corresponded with evidence from university populations, where having friends who smoke or vape increased knowledge and the likelihood of experimentation, but did not necessarily shape attitudes toward e-cigarettes (Nazzari et al., 2024). This suggested that peer influence tends to shape information exposure and behavioral opportunities, rather than underlying attitudes toward e-cigarette use.

Family Members Using E-Cigarettes

Students with and without family members who use e-cigarettes did not differ in their knowledge levels, suggesting that foundational knowledge regarding the harms of e-cigarettes may primarily be derived from school-based learning or public information rather than family influence. However, students from non-e-cigarette-using families demonstrated more favorable attitudes, likely because families function as health role models that reinforce appropriate health-related attitudes through guidance and behavior modeling.

These findings corresponded with prior evidence showing that parental smoking behavior is associated with adolescents' intentions to use e-cigarettes (Konkaew & Konkaew, 2022) and that close contact with smokers is related to attitudes toward e-cigarettes (Waeduraemae, 2024). Overall, the results indicated that family influence shapes attitudes more strongly than knowledge and constitutes a key protective factor against health-risk behaviors in youth (Shell & Siriboonpipattana, 2024).

Grade Point Average (GPA)

The results showed that students across varying GPA levels did not differ in their knowledge of e-cigarette use, likely because essential information about e-cigarette risks is widely accessible through school-based learning and social media. However, students with higher GPAs (3.50–4.00) exhibited more appropriate attitudes than those with GPAs ≤ 3.00 . This aligned with Piaget's cognitive developmental theory, which posits that adolescents with more advanced cognitive skills demonstrate stronger reasoning and decision-making abilities (Shell & Siriboonpipattana, 2024). High-achieving students may therefore be better able to evaluate health, legal, and social consequences related to e-cigarette use. These findings are consistent with Patanavanich et al. (2021), who reported that lower academic achievement is associated with previous e-cigarette use among Thai youth.

Students' Daily Income

The findings showed no differences in e-cigarette related knowledge and attitudes among students with varying daily income levels. This suggests that access to information on the harms of e-cigarettes is not determined by students' economic status, as governmental and non-governmental agencies widely disseminate free educational materials nationwide. School-based activities, such as World No

Tobacco Day campaigns, further reinforce equitable exposure to essential health information across income groups. Student reports from both lower- and higher-income backgrounds demonstrated similar awareness of relevant laws, penalties, e-cigarette purchasing regulations, and refusal skills when confronted with peer pressure. Consequently, daily income does not appear to contribute to disparities in knowledge or attitudes toward e-cigarette use. These findings aligned with Chaisang et al. (2023), who found that school-based instruction and public health communication effectively reach students across socioeconomic backgrounds, ensuring equitable distribution of health information.

Recommendations

The key findings revealed that students whose friends did not use e-cigarettes possessed lower levels of knowledge regarding e-cigarette use. Moreover, students with family members who used e-cigarettes and those with GPAs of 3.00 or below exhibited less appropriate attitudes compared to other groups. Therefore, educational administrators should develop programs to enhance knowledge and promote appropriate attitudes regarding e-cigarette use. These programs should focus on developing appropriate knowledge and attitudes among both male and female lower secondary students, and on creating student-led peer groups to campaign for e-cigarette prevention within schools. Such programs could include screening for e-cigarette use, providing education on the harms of e-cigarettes, assisting peers in quitting smoking and e-cigarette use, teaching refusal skills in various situations where students are tempted to use e-cigarettes, and stress management training.

Research Limitation

This study collected data from only one school, which may limit the generalizability of the findings to students in other contexts with different environmental conditions, school policies, resources, and social backgrounds. Therefore, the results may not be representative of lower secondary students at the national level, in private schools, or in schools in rural areas.

Future Research

Future research should include larger sample sizes and examine students from diverse educational contexts, such as private schools and rural schools. Further studies should also investigate social and environmental factors influencing e-cigarette use among adolescents, including peer networks, family behaviors, and exposure to information from various media sources. In addition, future research should explore the use of technology to develop innovative prevention strategies tailored to lower secondary school students. These efforts would contribute to evidence-based policies and more effective interventions for preventing e-cigarette use among adolescents.

Author Contributions

Jirawan Klommek: literature review, writing proposal, data collection, data analysis, discussion, and write manuscript; **Orapen Pongklum:** literature review, data collection, discussion, writing and editing manuscript; **Chulaporn Asvahem:** data collection and discussion; **Pornrawin Anunchaitanakhul:** discussion and writing original draft.

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