

## Understanding vaping among female students in Saudi Arabia: Prevalence, causes, and student-suggested interventions

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World Journal of Biology Pharmacy and Health Sciences, 2025, 21(03), 479-487

Publication history: Received on 10 February 2025; revised on 18 March 2025; accepted on 20 March 2025

Article DOI: <https://doi.org/10.30574/wjbphs.2025.21.3.0295>

### Abstract

Vaping among teenagers, particularly in middle and high schools, has become increasingly prevalent, posing significant health risks. This issue is especially concerning for young women, yet there is limited research on vaping's causes and effects in the Arab region. This study examines the prevalence of vaping among female students in Saudi Arabian schools, explores its underlying causes and academic consequences, and presents student-suggested solutions.

A descriptive research method was employed, using a questionnaire distributed to 104 female students. Data reliability was assessed using Cronbach's Alpha. The findings indicate that 38% of students know peers who vape, and 7% admitted to vaping themselves. Among those who vape, 87% started in middle school, primarily due to peer influence. Reported consequences included reputational damage (73%) and anxiety related to school and parental reactions (55%). To mitigate vaping, 80% of students emphasized the need for professional intervention, 79% suggested engaging in productive activities, and 77% highlighted the importance of choosing non-smoking friends.

This study underscores the urgency of addressing vaping among young women by identifying its causes, effects, and prevention strategies. The findings contribute to the ongoing discussion on public health interventions and school policies aimed at reducing vaping prevalence among students.

**Keywords:** Vaping Prevalence; Female Students; Vaping Effects; Prevention Strategies

### 1. Introduction

An electronic cigarette (vape) is a rolled cylinder that contains tobacco, a harmful and flammable substance, and comes in several types. Many people use them, including adults who are authorized to purchase them. Over the last decade, vaping prevalence has increased substantially among adolescents in the United States (US), Canada, and England, while cigarette smoking has either decreased or remained relatively unchanged. [1] Among young adults in the United States (ages 18–24), e-cigarette use was 9.3% in 2019, with more than half of e-cigarette users having never smoked conventional cigarettes. [2] The times of use vary from person to person, but it is usually when feeling sad, upset, bored, etc. Peak hours for vaping include morning, before and after school, before parents return from work, and after parents go to bed. Several individuals vape to address anxiety and stress. [3] They are sold in various places and in different types, shapes, and colors. The most prominent places include groceries, stores, supermarkets, and malls. The costs are a burden on students in many respects, as they are considered additional expenses that pose a risk to their budget. Cost was a common reason for many participants to quit. Vaping was described as expensive, a 'waste of money,' and 'not worth it.' One participant estimated that vaping for the 'really addicted' costs \$100 per month. [3] The frequency of use varies from person to person, and the more frequently they are used, the greater the possibility of addiction. Use rates,

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addiction, and harms are alarming, as the negative effects of nicotine on adolescent brain development are well documented, and e-cigarette use is predictive of cigarette smoking initiation. [4] In this research, 'students' refers to adolescent girls, a period of self-discovery for many. Risk-taking and crime can link economic motives with aspects of identity development. This can be observed as a spike in risky behavior during adolescence, followed by desistance over time, and has a number of testable hypotheses. [5] The age of students ranges from twelve to nineteen years, and they belong to the category called adolescents. Their level of education falls into two categories: middle school and high school students. These students are surrounded by many people in the community who influence them, both at school and at home. In 2014, e-cigarettes surpassed cigarettes as the most commonly used tobacco product by middle school and high school students, according to an annual U.S. survey. [6] What surrounds a student is important because it affects her in several ways, whether positive or negative. Smoking cigarettes is a negative activity that an individual can practice, often due to friends or other influences. While the community can impact people of all ages, its effect is stronger during adolescence, a stage of self-discovery. With minimal persuasion, you can convince a teenage student. A recent meta-analysis representing 69 countries/territories found a 17% estimated prevalence of ever using e-cigarettes and 8% of current (i.e., past 30 days) e-cigarette use among youth under the age of 20, with the highest prevalence in high-income countries. [7] The environment usually affects students in both positive and negative ways, such as smoking e-cigarettes, which can lead to addiction or dependence on cigarettes and smoking. There are many laws and regulations imposed in schools that are typically for the benefit of students, as school has always been considered a second home for them. Schools also tighten penalties for using cigarettes and smoking, which are very harmful. While there were notable increases in the use of e-cigarettes among youth in several countries, some countries like Finland and the USA reported reductions in connection with strengthening regulations. [7] The senior management in schools sets the laws and regulations, which are based on the violations committed by students. These rules are imposed on the students by the school. The laws vary from one student batch to another and are renewed at the beginning of each academic year. Schools should increasingly adopt effective anti-smoking programs to address e-cigarette problems and provide parents and the public with knowledge about the harmful effects of e-cigarette products, as well as the risks faced by non-smokers who are exposed to passive smoking from e-cigarette products. [8]

The electronic cigarette is a battery-powered device that simulates the process of smoking tobacco without burning it. It consists of a battery, a heating coil, and a solution tank. The electronic solution, which is the substance that is evaporated, typically contains nicotine, flavors, and a base of glycerol or propylene glycol. [9] Electronic cigarettes (e-cigarettes) are devices that use battery power to heat liquids for aerosolization. Studies show that while e-cigarettes are commonly used by adults, a significant portion of users are adolescents. Despite their popularity, e-cigarettes pose serious health risks, including cancers and various diseases. Exposure to e-cigarettes increases the incidence of periodontal, dental, and gingival diseases, as well as changes in oral microbiota. [10] According to thresholds published by the California Office of Environmental Health Hazard Assessment (OEHHA, the State of California EPA), 1,3-butadiene is the main contributor to the calculated cancer risk index—more than twice that of acrylonitrile, the second-highest carcinogen. Arsenic ranks third. [11] E-cigarettes can be purchased online, in specialized stores, or in malls. However, some sellers do not include warning information about their potential harms. To raise public awareness, the United States Food and Drug Administration (FDA) requires all tobacco products, including e-cigarettes, to display warning statements about their health risks. [12] People use electronic cigarettes for different reasons. Some use them to cope with stress or sadness, while others vape for recreation. Studies show that the primary reason for e-cigarette use is attractive flavors, followed by social influences from family and friends. Additionally, a significant percentage of smokers cite curiosity as their motivation for trying e-cigarettes. [9] Adolescents, in particular, are vulnerable to the harmful effects of e-cigarettes due to their toxic and dangerous substances, which can lead to severe health issues over time. E-cigarettes produce inhalable aerosols that contain various toxicological and biologically harmful components that can impact respiratory health. [13] Smoking—whether traditional or electronic—poses serious health risks. While some young adults attempt to use e-cigarettes as a smoking cessation aid, their effectiveness varies. Factors such as adequate nicotine delivery, perceived safety, and perceived benefits influence success in quitting smoking. Behavioral counseling and standardized e-cigarette products may enhance smoking cessation efforts. [14] E-cigarette use is common in various places, including schools, homes, and public areas such as cafes or markets. Although smoking among girls is increasing, it is not a source of pride, as it leads to health issues and challenges. Over the past decade, e-cigarettes have gained significant popularity worldwide, with both young people and adults using them. Vaping devices deliver aerosolized nicotine and other solvents. [15] The rising use of e-cigarettes correlates with an increase in depression and visits to psychiatrists. Many people turn to vaping as a way to cope with anxiety and stress, despite the fact that nicotine is an addictive substance that poses serious health risks. Marketing strategies, such as advertisements and celebrity endorsements, play a crucial role in the increasing popularity of vaping. Exposure to e-cigarette advertisements—especially in retail stores, on the Internet, and on social media—has been linked to increased use among adolescents and young adults. Given that e-cigarettes may act as a gateway to traditional smoking, stricter regulations and advertising restrictions are necessary. [16] Adolescents are particularly susceptible to peer influence, media, and advertising. Many start smoking due to the influence of friends, family, or advertisements. Research indicates

that substance use during adolescence is associated with peer pressure, socioeconomic status, and family dynamics, such as permissive parenting, poor communication, or parental substance use. [17] Long-term e-cigarette use affects individuals physically, socially, and economically. From a health perspective, it can lead to chronic diseases and cancers. The link between cigarette smoking and severe diseases, including oncological, cardiovascular, and respiratory conditions, is well-established and poses a major public health threat. [18] Socially, smokers may experience isolation, as non-smokers often distance themselves due to health concerns. Economically, smoking results in financial loss, as users spend money on a habit that harms their well-being. To address these issues, several solutions can be considered. Quitting smoking is essential to prevent diseases and cancers. Prevention is always better than treatment. Steps to quit include avoiding negative influences, recognizing the importance of quitting, and participating in awareness campaigns about the dangers of vaping. Religious and moral support, imposing penalties for e-cigarette use, and seeking medical treatment in specialized hospitals or clinics can also help individuals quit. There is a growing interest in raising awareness about the health risks of e-cigarettes. Research studies continue to assess students' knowledge and perceptions of vaping. [19]

### *Research Objectives*

This research aims to measure the prevalence of electronic cigarette (vape) use among female students in middle and high schools in the Kingdom of Saudi Arabia. It also seeks to examine the impact of vaping on female students' academic life and to present the most notable proposed solutions from their perspective in the year 2024..

## **2. Research Method**

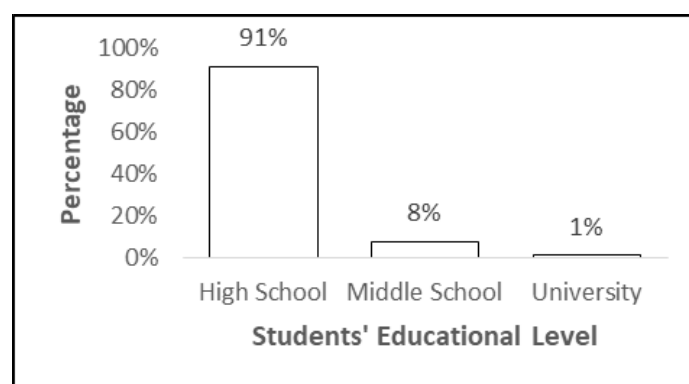
A questionnaire was designed to measure the prevalence of electronic cigarette use among female students in middle and high schools in the Kingdom of Saudi Arabia, as well as its impact on their academic life. Additionally, the questionnaire aimed to present the most prominent solutions from the students' perspective. It was administered to a sample of 104 female students to collect data for the study and achieve the research objectives. The reliability of the data obtained from the questionnaire was verified using Cronbach's Alpha, which measures the internal consistency of the items to ensure they are correlated as a cohesive group

## **3. Results**

### **3.1. Characteristics of the research sample of female students**

#### *3.1.1. Students' educational level*

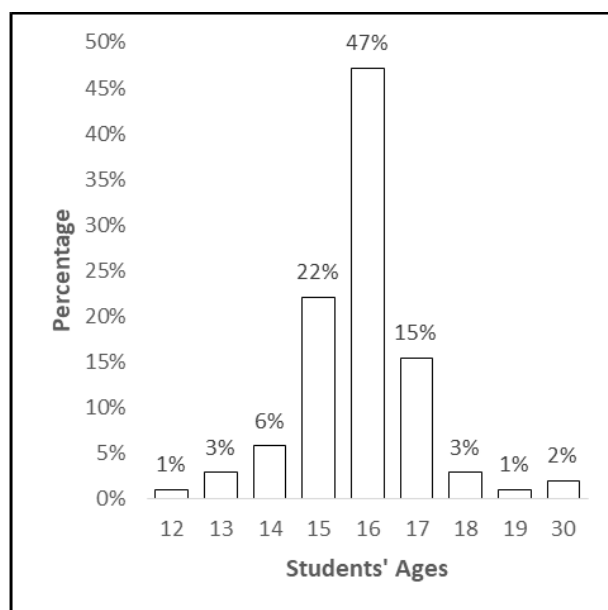
The questionnaire was sent to a large group of female students and the response was from (104) female students only. Figure No. (1) shows the educational level of the female students according to the study sample, where 91% of the sample was from high schools.



**Figure 1** Educational Level of The Female Students

### 3.1.2. Ages of female students

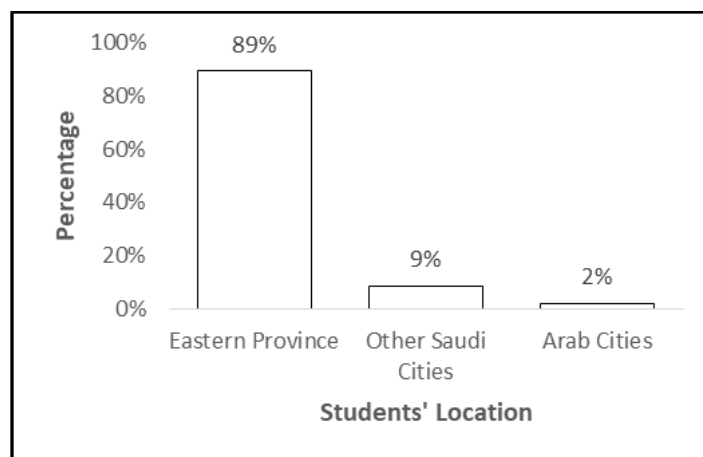
Figure (2) shows the ages of the female students who responded in the study sample, where nearly half of them (47%) are sixteen years old. Their ages range from twelve to thirty years old in the university stage and they represent only 2%.



**Figure 2** Ages of The Female Students In The Study Sample

### 3.1.3. Location of the female students subject to the study

The geographical distribution of the study sample in Figure (3) shows that 89% of the sample of female students are from the Eastern Province in the Kingdom of Saudi Arabia, while the rest of the cities in the Kingdom of Saudi Arabia and some Arab cities represent 9% and 2% respectively.

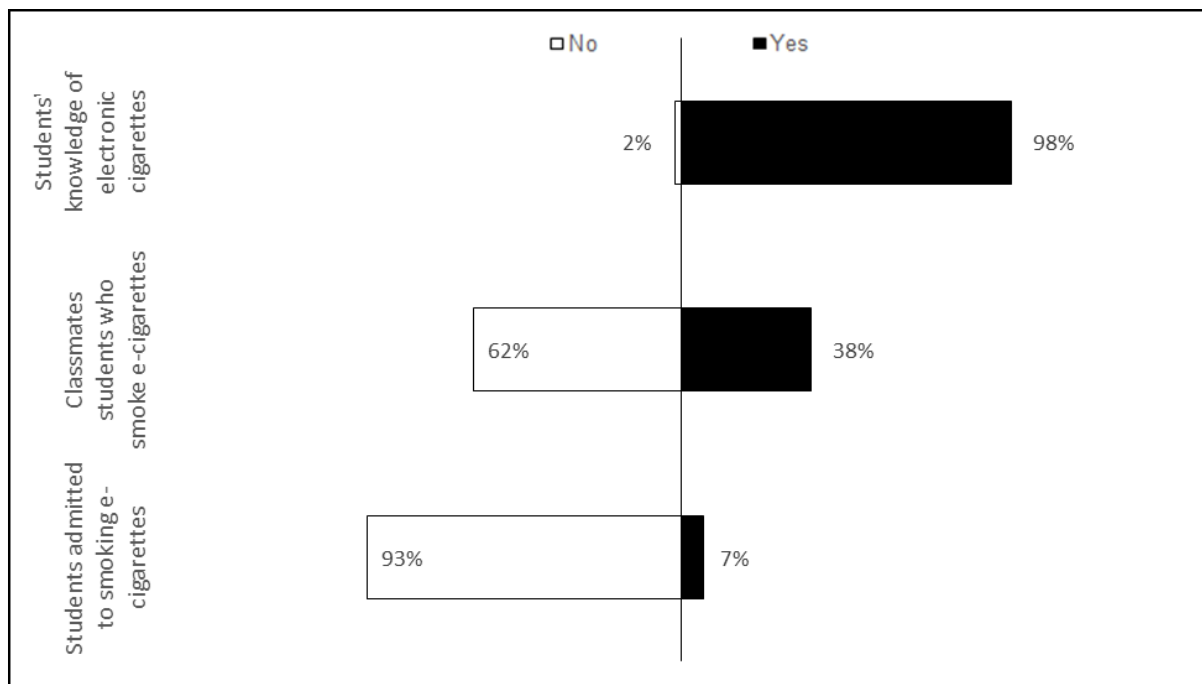


**Figure 1** Location of the female students In The Study Sample

## 3.2. Prevalence of e-cigarette smoking among female students

In Figure (4), the results of the questionnaire show that 98% of the students are aware of the nature of electronic cigarettes, the subject of the research, in order to continue with the rest of the questionnaire questions according to its objectives. Also, 38% of the students in the study sample confirmed that they know students who smoke electronic cigarettes. However, 62% of the students in the study sample do not know any students who smoke electronic cigarettes, which means that there is a percentage, albeit a small one, of students who smoke electronic cigarettes. This

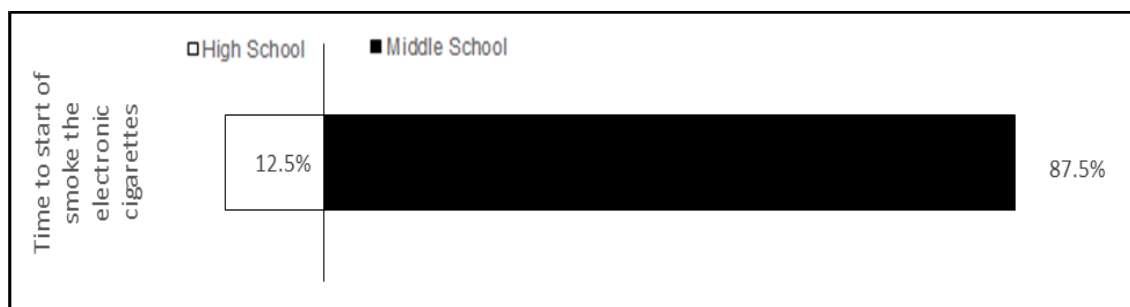
is confirmed by the fact that only 7% of the students in the study sample confirmed that they smoke electronic cigarettes, while 93% of the students say that they do not smoke electronic cigarettes.



**Figure 2** Prevalence of e-cigarette smoking among female students

### 3.3. Starting to smoke vape

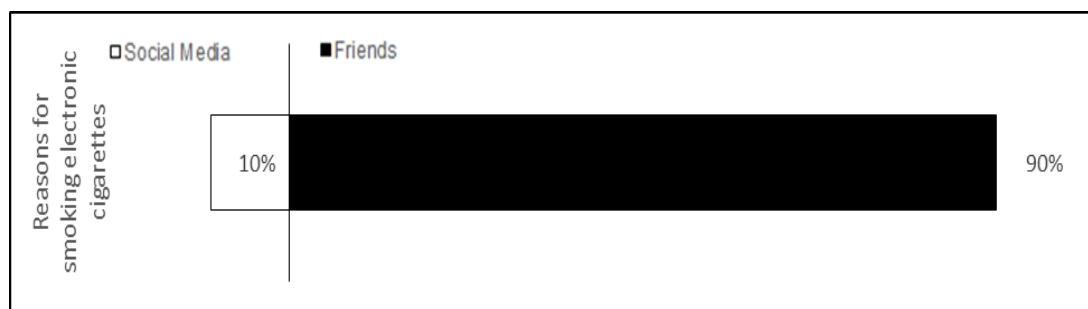
Regarding the beginning of smoking the vaping, approximately 87% of female smokers started smoking vaping in middle school, compared to 13% who started smoking vaping in high school, as shown in Figure (5).



**Figure 3** Starting to vape the E-cigarette

### 3.4. Causes and effects of vaping

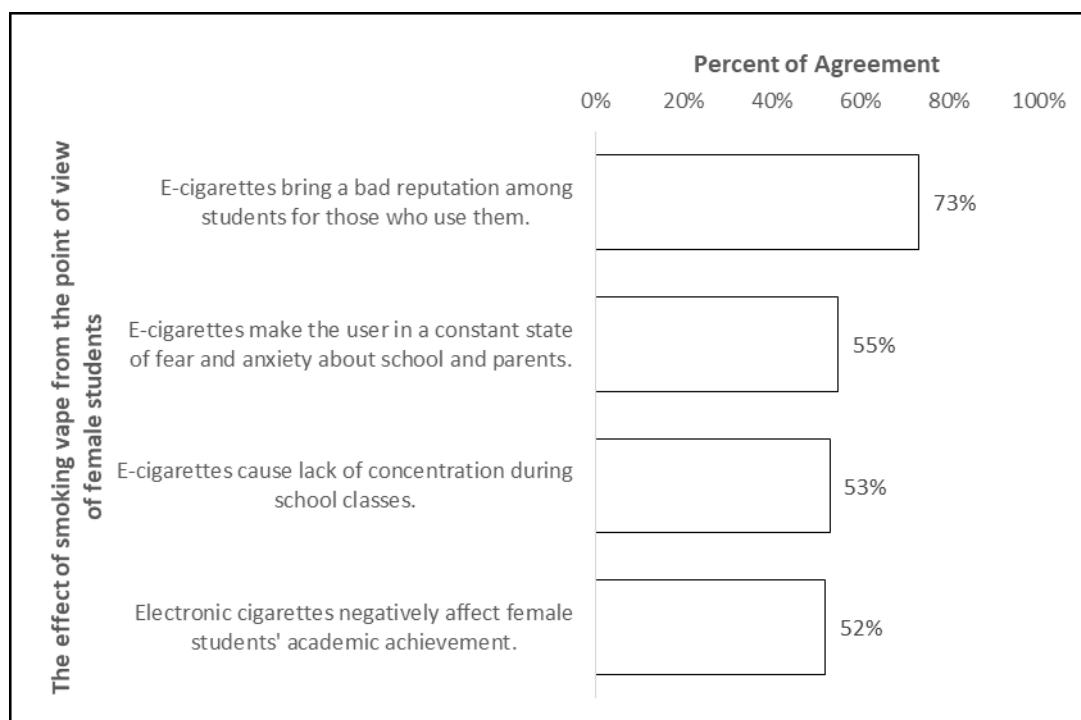
From the many reasons and influences of smoking electronic cigarettes among female smokers that were mentioned in the questionnaire, the focus was on bad friends being the main reason for smoking, at a rate of 90%, compared to 10% of female smokers who attributed the reason for their smoking to social media, as shown in Figure (6).



**Figure 4** Causes of vaping e-cigarettes

### 3.5. The impact of smoking electronic cigarettes on female students from the students' point of view

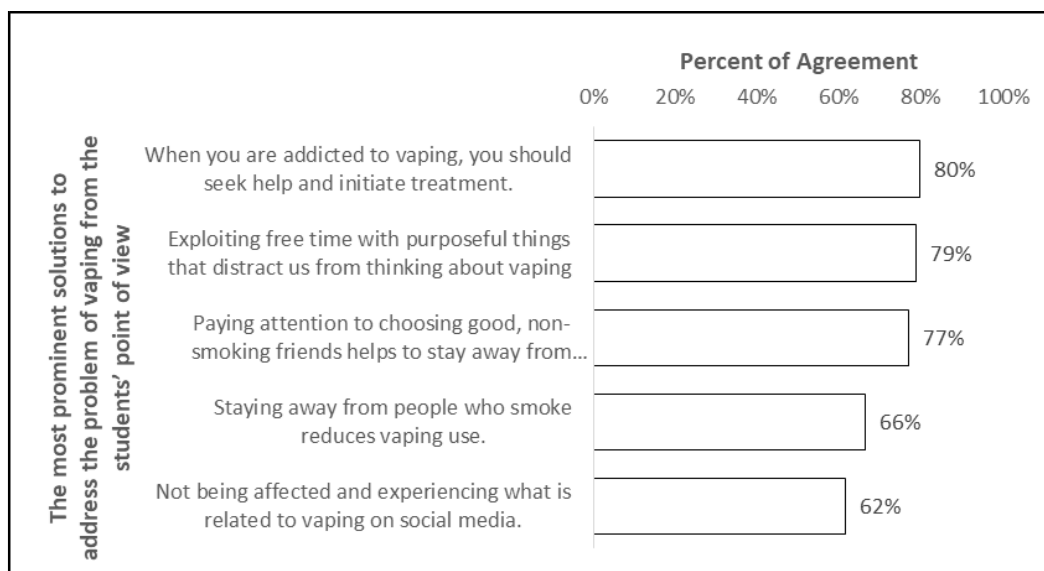
Figure (7) shows the percentages of approval of the effects of smoking electronic cigarettes, which were mentioned in the questionnaire to be voted on. We find that 73% of female students confirmed that smoking vapes brings a bad reputation among female students, and 55% of female students confirmed that smoking vapes causes fear and anxiety from school and parents, while 53% of female students believe that smoking causes poor concentration during daily classes at school, and finally, 52% of female students agreed that smoking vapes negatively affects the academic results of female smoking students.



**Figure 5** The impact of smoking electronic cigarettes on female students

### 3.6. The most prominent solutions to address the vaping problem

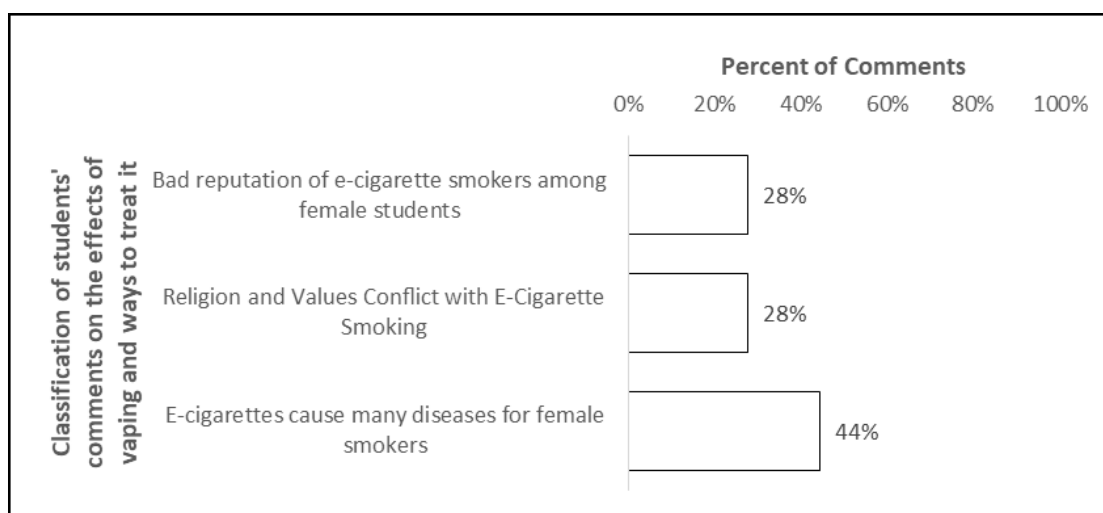
From the students' point of view, the approval of the proposed set of solutions to address the problem of smoking electronic cigarettes was confirmed, as Figure (8) shows the percentages of students' approval of each proposed solution, as 80% of the students confirmed the importance of electronic cigarette addicts seeking help from specialists to provide treatment for the addiction problem. Also, 79% of the students agreed that filling free time may help not to think about smoking electronic cigarettes and help solve the problem. While 77% of the students confirmed that choosing non-smoking friends may help to stay away from smoking electronic cigarettes, and 66% of the students confirmed that staying away from electronic cigarette smokers may help to stay away from smoking electronic cigarettes, and 62% of the students agreed that staying away from the temptations of smoking electronic cigarettes displayed on social media.



**Figure 8** The most prominent solutions to address the vaping problem

### 3.7. Classification of students' observations about the effects of vape and ways to treat them

By classifying the students' comments through the open question in the questionnaire regarding the effects of electronic cigarettes and methods of treating them, Figure (9) shows that 44% of the students' comments went in the direction that smoking electronic cigarettes causes many diseases. While 28% of the comments talked about the fact that religious values and directives conflict with smoking electronic cigarettes and their effects, and with the same previous percentage, the students' comments focused on the fact that female e-cigarette smokers have a bad reputation among female students.



**Figure 6** Classification of students' observations about the effects of vape

## 4. Discussion

In this research, a survey was conducted on a group of female students attending girls-only schools, where they are not mixed with male students. It was important to emphasize this distinction. Additionally, most of the participants are in their teenage years, which helps explain the nature of some of the responses in the survey results. The topic of electronic cigarette (vape) use is relatively new but has significant health implications for society. While the dangers of smoking are well known, the appealing and modern designs of vaping devices may attract some teenagers. This highlights the need to study the problem of vaping, its effects from the perspective of teenage female students, and their readiness to address its spread and promotion. According to the survey results, 7% of the study sample reported that they smoke vapes. This relatively low prevalence is attributed to students' adherence to conservative societal values, as well as their

fear of the consequences and health effects of vaping. However, 38% of students stated that they know fellow students who vape. Additionally, 98% of students are aware of electronic cigarettes, meaning they have encountered them in some form and have developed specific perceptions about vaping and their users. Regarding the age at which female students begin vaping, 87% of respondents indicated that they started in middle school. This is largely due to the characteristics of adolescence, including curiosity and a willingness to try new experiences. Middle school students are generally more impressionable and more easily influenced by peers compared to high school students, who tend to be more mature and rational. The survey results also reveal that 90% of vape users attributed their smoking to peer influence, which is expected given the susceptibility of adolescents to social pressure. This finding aligns with the previously mentioned trend of vaping initiation in middle school. Furthermore, 73% of female students believe that vaping damages one's reputation, reinforcing the idea that maintaining a good reputation is a key reason for avoiding vaping. Additionally, 52% of students reported that vaping has significant negative effects on both academic and social life, which may help explain the relatively low prevalence of vaping among female students. One of the most prominent solutions proposed by students to address vaping addiction was seeking specialist treatment. This is a logical response, as vaping is a relatively new phenomenon, and many students may be unfamiliar with effective methods to quit. Another major concern highlighted by students is having too much free time, as boredom may increase thoughts about vaping and make quitting more difficult. Conversely, staying away from friends who vape was seen as a major factor in successfully quitting. To further validate the questionnaire results, students' open-ended responses focused primarily on the health risks associated with vaping. Many comments also emphasized that religious values discourage electronic cigarette use and that the negative reputation of vape users leads other students to avoid them. This aligns with the survey findings, which indicate that concerns about reputation and social perception play a significant role in discouraging vaping among female students.

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## 5. Conclusion

The research results can be summarized as follows: 87% of female vape smokers started vaping in middle school, with the primary reason being peer influence, as confirmed by 90% of the students. Regarding students' perceptions of female smokers, 70% stated that vape users have a bad reputation, while 55% reported that vaping causes fear and anxiety related to school and parental reactions. Additionally, 52% of students acknowledged that vaping negatively impacts their academic performance. Students proposed several solutions to address vaping, with 80% emphasizing the importance of seeking help from specialists. Furthermore, 77% highlighted the importance of engaging in productive activities to fill free time, while 66% stressed the need to avoid socializing with vapers. Open-ended responses revealed that 44% of students believe vaping causes many diseases, 28% cited religious values as a reason for avoiding vaping, and 28% reiterated that vape users have a bad reputation among students. Lastly, 7% of the study sample confirmed that they vape, while 38% reported knowing fellow students who vape, and 98% of female students are aware of electronic cigarettes and vaping.

This research contributes to the field of vaping studies by shedding light on the emerging issue of vaping among female adolescents, with the aim of limiting and preventing its spread. It provides an analysis of vaping prevalence, the factors contributing to its use, and the most effective solutions from the perspective of female students. It also offers insight into how adolescents perceive vaping, a relatively new phenomenon, and their proposed solutions. For future research and preventive efforts, raising awareness among middle school students—where vaping initiation is most common—should be a key focus. Addressing the underlying reasons for vaping's spread and working to mitigate them could help reduce its prevalence. Additionally, enhancing vaping cessation methods in schools and even within families at home is essential. Understanding students' perspectives on vaping and their aspirations could further contribute to fostering a healthier and safer environment. The primary scientific motivation for conducting this research was to obtain accurate data on the prevalence of vaping among adolescent girls, understand the reasons behind vaping, and explore potential solutions from students' viewpoints. As a result, this research can be valuable for school social supervisors, the Ministry of Health, and broader health and social sectors. Additionally, it provides insights for families, helping them address this issue within their households and communities.

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## Compliance with ethical standards

### *Disclosure of conflict of interest*

No conflict of interest to be disclosed.

### *Statement of informed consent*

Informed consent was obtained from all individual participants included in the study.



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