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Assessment of the prevalence, knowledge, and perceptions of e-cigarette use among the Palestinian community: a cross-sectional study

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Electronic cigarettes (e-cigarettes) are an emerging global public health threat. In Palestine, tobacco use poses a significant challenge, but little is known about the prevalence of e-cigarette use and Palestinians' knowledge and perceptions of e-cigarettes. A cross-sectional study was conducted between 02/05/2024 and 16/06/2024 using a questionnaire composed of three sections. The first section collected sociodemographic data. The second section focused on the participants' sources of information about e-cigarettes and their current smoking status. The third section was designed to evaluate participants' knowledge and perceptions of e-cigarettes. The questionnaire was distributed through online platforms to Palestinians aged 18 years and above. Among the total number of 1160 participants, 14.9% were e-cigarette users. Out of the 173 e-cigarette users, 45.7% were dual users of tobacco and e-cigarettes, and 20.8% had replaced tobacco with e-cigarettes. There was significant variation between e-cigarette users and non-users in terms of sex and age. Moreover, there were significant variations between the reported level of knowledge about e-cigarettes and all of the assessed knowledge and perception in terms of e-cigarette users and non-users (p -value < 0.05). More than 60.0% of the participants agreed that e-cigarettes contain nicotine and carcinogenic substances. More than half of the participants disagreed with the statement that e-cigarettes are safe to use compared to cigarettes. 17.2% of the participants agreed that using e-cigarettes can aid in smoking cessation. 41.9% of the participants thought that e-cigarettes are cost-effective compared with cigarettes. Additionally, the presence of nicotine in e-cigarettes had a significant positive association with using e-cigarettes, while the presence of carcinogenic compounds in e-cigarettes had a significant negative association with using e-cigarettes. Disagreement about the greater safety of e-cigarette use compared to cigarettes, and support for the application of regulations on e-cigarette use had significant negative associations with using e-cigarettes. E-cigarette use is a growing and overlooked public health threat among Palestinians. Immediate actions are needed not only to increase awareness of e-cigarettes, but also to implement stricter regulations on their availability.

Keywords E-cigarettes, Prevalence, Knowledge, Perceptions, Palestine

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Tobacco consumption represents one of the biggest preventable threats to global public health¹. It is responsible for approximately one-third of all cancer deaths². Tobacco consumption is increasing, especially in Middle Eastern countries³. Recent research has indicated an increasing rate of tobacco-related deaths in developing countries⁴. This trend is both expected and alarming as these countries have the least capacity to manage smoking-related morbidities⁵.

Electronic cigarettes (e-cigarettes) are defined as devices that operate by heating a solution containing humectants, nicotine (in most cases), and flavorings to create an aerosol that can be inhaled⁶. E-cigarettes are among the most prevalent forms of tobacco consumed worldwide, particularly among youths⁷. In Palestine, the most recent reports revealed that approximately 18% of Palestinian university students use e-cigarettes⁸. In contrast, the prevalence of e-cigarette use was 1.1% among university students from central and eastern Europe⁹. These differences in the prevalence of e-cigarette use could be attributed to several factors. These factors include e-cigarette availability, the ability to use them in more places, peer influence, and the misconception that they are less addictive and harmful to health than traditional tobacco consumption¹⁰⁻¹². Additionally, it is believed that e-cigarettes help with cessation of traditional smoking¹³.

Recent research has shown that e-cigarettes are dangerous because they contain nicotine and other toxic compounds such as heavy metals and silicate particles¹⁴. Nicotine is a highly addictive substance with various side effects on the brain, pregnant women, and fetuses¹⁵. Several substances have been identified in e-cigarettes in addition to nicotine, including solvent carriers, tobacco-specific nitrosamines, aldehydes, metals, volatile organic compounds, phenolic compounds, polycyclic aromatic hydrocarbons, flavourings, tobacco alkaloids, and drugs¹⁶. These substances are toxic and potentially carcinogenic. Moreover, scientists have concluded that e-cigarettes are not considered a suitable option for smoking cessation¹⁷. Other studies reported that e-cigarette use was associated with a greater risk for subsequent cigarette smoking initiation¹⁸. Notably, several studies have reported a positive association between e-cigarette use and chronic diseases such as asthma exacerbation, cancer, and cardiovascular diseases¹⁹.

Insufficient knowledge and misunderstandings about e-cigarettes, even among medical students, have been reported in previous studies^{8,20}. Additionally, e-cigarette users showed significantly lower levels of knowledge about e-cigarettes compared to non-users among university students in Palestine⁸. Moreover, a recent article revealed that most general practitioners lacked knowledge about e-cigarettes, and had insufficient confidence in discussing the safety of e-cigarettes, and whether they could be efficient in smoking cessation with patients²¹.

In Palestine, tobacco consumption is a major threat to public health as several studies have reported a high and alarming prevalence of tobacco consumption among Palestinian youths²²⁻²⁴. The prevalence of tobacco consumption among Palestinians aged 18 years and above has increased from 23 to 31% between 2010 and 2021, according to the "Smoking and Tobacco Consumption Survey, 2021" issued by the Palestinian Central Bureau of Statistics²⁵. This report revealed that the most common forms of tobacco consumption in Palestine were traditional cigarettes among males, and water pipes among females. Recent research revealed that e-cigarette use is increasing among Palestinian university students, with a significant lack of knowledge^{8,26,27}. The current study aims to assess the prevalence, knowledge, and perceptions of e-cigarette use among the Palestinian community.

Methods

Study design and sampling

A cross-sectional questionnaire-based study was conducted between 02/05/2024 to 16/06/2024 to assess the prevalence, knowledge, and perceptions of Palestinians about e-cigarettes. The study involved a population survey of Palestinians aged 18 years and older. The population included individuals from all governorates of the West Bank, Palestine. Convenient sampling was employed for data collection. To determine the sample size, the researcher employed the Roasoft formula (www.raosoft.com), using a reference proportion of 50%, a 95% confidence interval, and a 5% margin of error. We established a minimum sample size of 386 to represent the larger population accurately. However, considering possible recovery or non-response mistakes, 1160 replies were obtained and enrolled in the study. We selected a large sample size to boost analytical power and accurately reflect the differences in the study population. Despite the calculated sample size being smaller than the chosen one, this was done to enhance the quality and reliability of the results and a more thorough comprehension of the population.

Data collection instrument

An online questionnaire, administered via Google Forms and consisted of three sections, the first section collected sociodemographic data, including age, gender, educational level, employment position, marital status, and place of residence. Section two focused on the participants' sources of information about e-cigarettes and their current smoking status. The last section was designed to evaluate participants' knowledge and perceptions of e-cigarettes. The knowledge and perception statements were measured on a Likert scale, including "strongly agree", "agree", "neutral", "disagree", and "strongly disagree". As some participants may not have sufficient knowledge about e-cigarettes or the fact that they present a health issue, the neutral option was added to the Likert scale, providing the participants with the needed response while answering such questions. The study used the Arabic version of the questionnaire constructed and validated by Barakat et al. (2021)²⁸. Furthermore, a pilot study was carried out to ensure the reliability of the questionnaire, and it was found to be reliable (Cronbach's alpha: 0.72). The questionnaire started with a clear consent statement in Arabic that it is intended for Palestinians. It was written that this questionnaire is limited to Palestinians who are 18 years and above. Accordingly, the questionnaire was distributed to participants via electronic means such as personal and professional email systems, Facebook and WhatsApp groups, and Palestinian social and research forums.

Ethical consideration

All aspects of the study protocol were authorized by the An-Najah National University Institutional Review Board (IRB), Nablus, Palestine (Ref: Med. April 2024/1). The study complied with the Declaration of Helsinki guidelines for the use of data from human subjects. The questionnaire included a consent form describing the premise of the study and assuring the anonymity of the participants, with no personal identifiers collected. Participants were informed of the voluntary nature of their participation. Informed consent was obtained from all participants before they could proceed to the online questionnaire.

Statistical analysis

The statistical analyses were conducted using IBM Corp.'s Statistical Package for the Social Sciences version 21 (SPSS 21), Armonk, N.Y., USA. Descriptive analyses were utilized for all variables. A chi-square test was employed to examine the associations between e-cigarette use, socio-demographic variables, and participants' beliefs about e-cigarettes. Then, variables that were significant in the Chi-square results were introduced into the post-hoc pairwise Bonferroni correction. In addition, variables showing significance at the bivariate level were incorporated in a multivariate binary logistic regression model to identify the potential determinants of e-cigarette use after adjusting for the confounding variables. *P*-values less than 0.05 were considered statistically significant.

Results

Sociodemographic characteristics of the participants and their associations with the use of e-cigarettes

As shown in Table 1, 1160 participants completed the study questionnaire. Among the study sample, 59.2% were females, more than half were under 26, more than two-thirds were bachelor's or postgraduate degree holders,

Variable (n = 1160)	Total (%)	Non-e-cigarette user n = 987 (85.1%)	E-cigarette user n = 173 (14.9%)	p-value
Gender				
Male	473 (40.8)	367 (37.2) ^a	106 (61.3) ^b	<0.001
Female	687 (59.2)	620 (62.8) ^a	67 (38.7) ^b	
Age group (years)				
18–20	376 (32.4)	330 (33.4) ^a	46 (26.6) ^a	0.014
21–25	296 (25.5)	246 (24.9) ^a	50 (28.9) ^a	
26–35	186 (16.0)	150 (15.2) ^a	36 (20.8) ^a	
36–50	212 (18.3)	183 (18.5) ^a	29 (16.8) ^a	
51–65	68 (5.9)	63 (6.4) ^a	5 (2.9) ^a	
More than 65	22 (1.9)	15 (1.5) ^a	7 (4.0) ^b	
Level of education				
Less than secondary school	17 (1.5)	16 (1.6)	1 (0.6)	0.092
Secondary school	194 (16.7)	160 (16.2)	34 (19.7)	
Vocational education	30 (2.6)	22 (2.2)	8 (4.6)	
Diploma	108 (9.3)	88 (8.9)	20 (11.6)	
Bachelor	678 (58.4)	581 (58.9)	97 (56.1)	
Postgraduate	133 (11.5)	120 (12.2)	13 (7.5)	
Job				
Student	557 (48)	479 (48.5)	78 (45.1)	0.489
Not working	111 (9.6)	95 (9.6)	16 (9.2)	
Employed/self-employed	418 (36)	349 (35.4)	69 (39.9)	
Retired	22 (1.9)	17 (1.7)	5 (2.9)	
Others	52 (4.5)	47 (4.8)	5 (2.9)	
Marital status				
Single	715 (61.6)	606 (61.4)	109 (63)	0.609
Married	421 (36.3)	362 (36.7)	59 (34.1)	
Others	24 (2.1)	19 (1.9)	5 (2.9)	
Place of residence				
City	508 (43.8)	430 (43.6) ^a	78 (45.1) ^a	0.017
Village	588 (50.70)	510 (51.7) ^a	78 (45.1) ^a	
Camp	64 (5.5)	47 (4.8) ^a	17 (9.8) ^b	

Table 1. Socio-demographic characteristics of the participants and their association with using e-cigarettes.

*The a and b superscripts indicate the results of the post-hoc Bonferroni correction. Significant values are in bold.

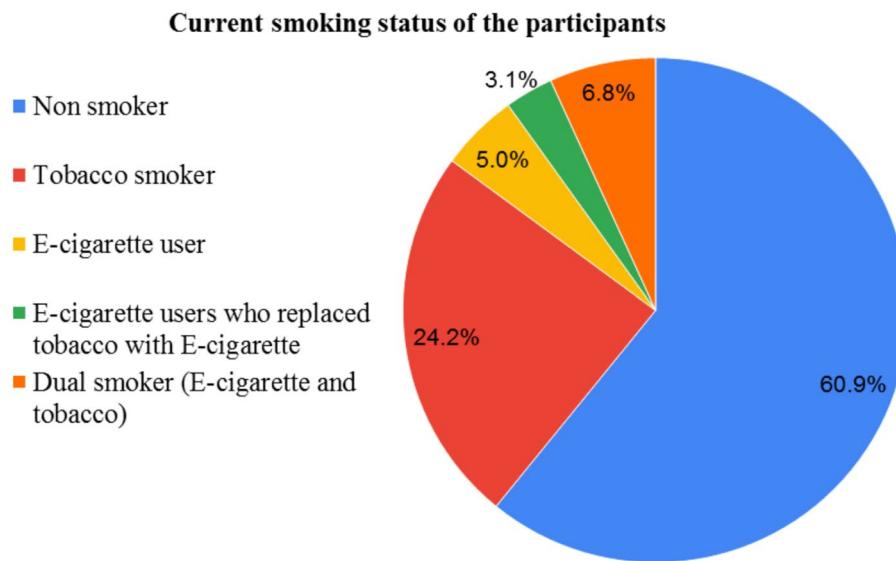


Fig. 1. Description of the participants' current smoking status (n = 1160).

Sources of information about e-cigarettes	Frequency (%)
Social media	426 (36.7)
Family members	330 (28.4)
Friends	664 (57.2)
Other sources	114 (9.8)
Have not heard about it	22 (1.9)

Table 2. Source of information about the e-cigarette as reported by the study participants (Participant can choose more than one source), (n = 1160).

48% were students, and 36.0% were employed. More than 60.0% were single, and the majority were living either in a village or a city.

Table 1 also presents the associations between demographic characteristics and the use of e-cigarettes. The use of e-cigarettes was found to be significantly associated with gender, age, and place of residence, whereas it was not significantly associated with the level of education, job, or marital status.

Post-hoc pairwise Bonferroni correction indicated that males were significantly more likely to be e-cigarette users (61.3% of e-cigarette users vs. 37.2% of non-users were males). Conversely, females were more likely to be non-users (62.8% of non-users vs. 38.7% of users were females). According to the age groups, older age (more than 65 years old) was significantly less likely to be e-cigarette users compared with younger ages. However, there is no significant difference within each younger age group between being an e-cigarette user and non-user. Compared with participants from cities or villages, participants from camps were significantly less likely to be e-cigarette users (9.8% of e-cigarette users were from camps compared with 45.1% from cities and 45.1% from villages). The Bonferroni correction results are shown as superscripts in Table 1.

The current smoking status of the study sample

The percentage of participants who use different forms of smoking was determined and is presented in Fig. 1. A total of 706 participants were nonsmokers (60.9%), 281 participants were only tobacco smokers (24.2%), and 173 participants were e-cigarette users (14.9%). Among the 173 e-cigarette users, 45.7% were dual smokers of tobacco and e-cigarettes, and 20.8% had replaced tobacco with e-cigarettes.

Source of information and knowledge level about the e-cigarette as reported by the study participants

As shown in Table 2, all study participants were asked about their sources of information about e-cigarettes. The most common source of information was friends (57.2%), followed by social media information (36.7%), and family members (28.4%). Only 1.9% of the participants had not heard of e-cigarettes. Additionally, participants were asked to report their knowledge level about e-cigarettes. A total of 9.5% of the participants did not know anything about e-cigarettes. 47.2%, 38%, and 5.3% of the participants reported their knowledge level as low, moderate, and high, respectively. Moreover, a significant variation in the reported knowledge level between e-cigarette users and non-users was observed (p -value < 0.005), with higher knowledge levels reported by e-cigarette users. The results are shown in Table 3.

Variable	Total n = 1160 frequency (%)	Non-e-cigarette user n = 987 (85.1%)	E-cigarette user n = 173 (14.9%)	p-value
1. How do you rate your knowledge level about e-cigarettes?				
Nothing	110 (9.5)	104 (10.5) ^a	6 (3.5) ^b	<0.001
Low	547 (47.2)	488 (49.4) ^a	59 (34.1) ^b	
Moderate	441 (38.0)	353 (35.8) ^a	88 (50.9) ^b	
High	62 (5.3)	42 (4.3) ^a	20 (11.6) ^b	
2. Do you think e-cigarettes contain nicotine?				
Agree/strongly agree	706 (60.9)	563 (57.0) ^a	143 (82.7) ^b	<0.001
Neutral	383 (33.0)	366 (37.1) ^a	17 (9.8) ^b	
Disagree/strongly disagree	71 (6.1)	58 (5.9) ^a	13 (7.5) ^a	
3. Do you think e-cigarettes contain carcinogenic materials?				
Agree/strongly agree	744 (64.1)	653 (66.2) ^a	91 (52.6) ^b	<0.001
Neutral	372 (32.1)	309 (31.3) ^a	63 (36.4) ^a	
Disagree/strongly disagree	44 (3.8)	25 (2.5) ^a	19 (11.0) ^b	
4. Do you believe e-cigarettes are safe to use compared to cigarettes?				
Agree/strongly agree	219 (18.9)	157 (15.9) ^a	62 (35.8) ^b	<0.001
Neutral	274 (23.6)	213 (21.6) ^a	61 (35.3) ^b	
Disagree/strongly disagree	667 (57.5)	617 (62.5) ^a	50 (28.9) ^b	
5. Do you believe passive vaping of e-cigarettes is safer than tobacco passive smoking?				
Agree/strongly agree	358 (30.9)	265 (26.8) ^a	93 (53.8) ^b	<0.001
Neutral	319 (27.50)	281 (28.5) ^a	38 (22.0) ^a	
Disagree/strongly disagree	483 (41.6)	441 (44.7) ^a	42 (24.3) ^b	
6. Do you believe the use of e-cigarettes can help in smoking cessation?				
Agree/strongly agree	200 (17.2)	137 (13.9) ^a	63 (36.4) ^b	<0.001
Neutral	251 (21.6)	213 (21.6) ^a	38 (22.0) ^a	
Disagree/strongly disagree	709 (61.1)	637 (64.5) ^a	72 (41.6) ^b	
7. For those who switched completely from tobacco smoking to e-cigarettes, do you believe that there is a positive impact on their general health status and normal life activities?				
Agree/strongly agree	267 (23.0)	205 (20.8) ^a	62 (35.9) ^b	<0.001
Neutral	326 (28.1)	273 (27.7) ^a	53 (30.6) ^a	
Disagree/strongly disagree	567 (48.9)	509 (51.5) ^a	58 (33.5) ^b	
8. Do you think e-cigarettes are cost-effective (cheaper) compared to tobacco smoking?				
Agree/strongly agree	486 (41.9)	381 (38.6) ^a	105 (60.7) ^b	<0.001
Neutral	320 (27.6)	298 (30.2) ^a	22 (12.7) ^b	
Disagree/strongly disagree	354 (30.5)	308 (31.2) ^a	46 (26.6) ^a	
9. Do you believe e-cigarettes may be a gateway to conventional smoking?				
Agree/strongly agree	839 (72.3)	724 (73.4) ^a	115 (66.5) ^a	0.001
Neutral	217 (18.7)	188 (19.0) ^a	29 (16.8) ^a	
Disagree/strongly disagree	104 (9.0)	75 (7.6) ^a	29 (16.8) ^b	
10. Do you believe e-cigarette use is a public health concern?				
Agree/strongly agree	932 (80.3)	822 (83.3) ^a	110 (63.6) ^b	<0.001
Neutral	173 (14.9)	129 (13.1) ^a	44 (25.4) ^b	
Disagree/strongly disagree	55 (4.7)	36 (3.6) ^a	19 (11.0) ^b	
11. Do you believe e-cigarette use can cause addiction to smoking?				
Agree/strongly agree	868 (74.8)	760 (77.0) ^a	108 (62.4) ^b	<0.001
Neutral	198 (17.1)	168 (17.0) ^a	30 (17.3) ^a	
Disagree/strongly disagree	94 (8.1)	59 (6.0) ^a	35 (20.2) ^b	
12. Do you believe e-cigarettes should be regulated in closed, public, or working places like other tobacco products?				
Agree/strongly agree	893 (77.0)	818 (82.9) ^a	75 (43.4) ^b	<0.001
Neutral	141 (12.1)	110 (11.1) ^a	31 (17.9) ^b	
Disagree/strongly disagree	126 (10.9)	59 (6.0) ^a	67 (38.7) ^b	

Table 3. The association between participants' knowledge and perceptions about e-cigarettes and their use of e-cigarettes (n = 1160). *The a and b superscripts indicate the results of the post-hoc Bonferroni correction. Significant values are in bold.

Participants' perceptions of e-cigarettes and their association with using e-cigarettes

More than 60.0% of the participants agreed that e-cigarettes contain nicotine and carcinogenic materials. More than half of the participants reported their disagreement with the statement that e-cigarettes are safe to use compared with cigarettes (57.5%). A total of 30.9% believed that passive vaping of e-cigarettes is safer than passive smoking of tobacco. Only 17.2% of the participants agreed that using e-cigarettes can help with smoking cessation, and 23.0% agreed that switching completely from tobacco smoking to e-cigarette use has a positive effect on general health status and normal life activities. A total of 41.9% thought that e-cigarettes were cost-effective compared with tobacco smoking. More than 70.0% of the participants believed that e-cigarettes may be a gateway to conventional smoking, are a public health concern, can cause addiction to smoking, and that e-cigarettes should be regulated in closed, public, or working places similar to tobacco products. The results are presented in Table 3.

Furthermore, significant variation in all the studied perceptions was observed between e-cigarette users and non-e-cigarette users (p -value < 0.05). Compared with 57.0% of non-users, more e-cigarette users (82.7%) agreed that e-cigarettes contain nicotine. On the other hand, a greater percentage of non-users (66.2%) agreed that e-cigarettes contain carcinogenic materials than do e-cigarette users (52.6%). Compared with non-e-cigarette users, e-cigarette users showed greater agreement with statements stating that e-cigarettes are safer to use than cigarettes are and that passive vaping of e-cigarettes is safer than passive tobacco smoking (35.8% compared with 15.9% and 53.8% compared with 26.8%, respectively). Additionally, 36.4% of e-cigarette users compared with 13.9% of non-users, believed that using e-cigarettes can help with smoking cessation; 35.9% of e-cigarette users, compared with 20.8% of non-users, believed that switching completely from tobacco smoking to e-cigarette use has a positive impact on general health status and normal life activities; and 60.7% of e-cigarette users, compared with 38.6% of non-users, believe that e-cigarette use is more cost-effective than tobacco smoking. For the last four belief statements, a significantly greater percentage of non-e-cigarette users believed that e-cigarettes may be a gateway to conventional smoking, are a public health concern, can cause addiction, and that e-cigarette use should be regulated in closed, public, or working places similar to other tobacco products. The results are shown in Table 3.

Post-hoc pairwise Bonferroni correction revealed that e-cigarette users reported significantly higher knowledge levels about e-cigarettes compared with non-users. 50.9% of e-cigarette users reported a moderate knowledge level compared with 35.8% of non-users, and 11.6% of e-cigarette users reported a high knowledge level compared with 4.3% of non-users. E-cigarette users were significantly more likely to recognize that e-cigarettes contain nicotine than non-users (82.7% vs. 57.0%). Conversely, e-cigarette users were significantly less likely to believe that e-cigarettes contain carcinogenic materials than non-users (52.6% vs. 66.2%). Moreover, e-cigarette users were significantly more likely to disagree with the presence of carcinogenic materials in e-cigarettes (11.0% vs. 2.5%). E-cigarette users were significantly more likely to perceive that e-cigarettes are safer than traditional cigarettes (35.8% vs. 15.9%). Conversely, non-users were more likely to disagree with the safety of e-cigarettes compared with users (62.5% vs. 28.9%). Compared to non-users, e-cigarette users showed significantly higher agreement with the safety of e-cigarette passive vaping (53.8% vs. 26.8%), the role of e-cigarette use in smoking cessation (36.4% vs. 13.9%), the positive impact of complete switching to e-cigarette use on the general health and normal life activities (35.9% vs. 20.8%), and the cost effectiveness of e-cigarettes compared to tobacco smoking (60.7% vs. 38.6%).

E-cigarette users were significantly more likely to disagree with the point stating that e-cigarettes may be a gateway to conventional smoking than non-users (16.8% vs. 7.6%). Moreover, e-cigarette users were significantly less likely to believe that e-cigarette use is a public health concern than non-users (63.6% vs. 83.3%), more likely to show a neutral response (25.4% vs. 13.1%), and more likely to disagree with the same statement (11% vs. 3.6%). E-cigarette users were significantly less likely to believe that e-cigarettes can cause addiction (62.4% vs. 77.0%) than non-users, and they were significantly more likely to disagree with the same statement compared to non-users (20.2% vs. 6.0%). Finally, e-cigarette users showed significantly less agreement with the regulation of e-cigarette use in closed, public, and working places than non-users (43.4% vs. 82.9%). More e-cigarette users revealed a neutral response with e-cigarette regulated use compared to non-users (17.9% vs. 11.1%). E-cigarette users were significantly more likely to disagree with e-cigarette use regulation than non-users (38.7% vs. 6%). The Bonferroni correction results are shown as superscripts in Table 3.

Binary logistic regression analysis between e-cigarette usage as the dependent variable and the predictors

The multivariate binary logistic regression was applied for the variables that were significant in the bivariate analysis to determine the predictors for using e-cigarettes while controlling for confounders. Results showed a significant positive effect of having moderate or high knowledge about e-cigarettes, based on participants' subjective rating, and using e-cigarettes compared with knowing nothing about e-cigarettes, with an odds ratio of 3.146 for moderate knowledge and 5.233 for high knowledge (p -value < 0.05).

Compared with neutral responses, a significant positive association was found between agreeing with the presence of nicotine in e-cigarettes and using e-cigarettes (OR: 3.571, p -value < 0.001). In contrast, a significant negative association was found between agreement with the presence of carcinogenic materials in e-cigarettes and using e-cigarettes (OR: 0.455, p -value: 0.002). Regarding the participants' beliefs about e-cigarettes, disagreement with the statement that e-cigarettes are safe to use compared to cigarettes showed a significantly negative association with using e-cigarettes (OR: 0.34, p -value < 0.001). Disagreement with the statements stating that e-cigarettes are more cost-effective compared with tobacco smoking showed a significant positive association with using e-cigarettes (OR: 2.12, p -value: 0.026). Finally, agreement with putting regulations for using e-cigarettes had a significantly negative association with using e-cigarettes (OR: 0.433, p -value: 0.005);

however, disagreement with this point had a positive significant association with using e-cigarettes (OR: 2.81, *p*-value: 0.002). The results of the multivariate analysis are shown in Table 4.

Discussion

The current study is one of the first to investigate the prevalence, knowledge, and perceptions of the Palestinians regarding e-cigarette use.

The overall e-cigarette use in the study sample was 19.4%; of whom 45.7% were dual users and 20.8% switched to e-cigarettes. The current findings are consistent with a previous study on the Palestinian university students in which the prevalence of e-cigarette use was 18.1% with 43.6% dual smokers⁸. The overall e-cigarette use among the Palestinian population is considered lower than that among the Jordanian population (33.1%). However, the proportion of dual users among e-cigarette users was greater in our study²⁸. Recent data from the National Health Interview Survey in 2021 revealed that 4.5% of people used e-cigarettes, which is significantly lower than the prevalence in the current study²⁹. The high prevalence of e-cigarette use among our participants emphasizes the need for early prevention and legislation to limit the spread and availability of e-cigarettes. Smoking remains a global public health concern, especially in low- and middle-income countries³⁰. Furthermore, the significant proportion of dual smokers makes it necessary to pay attention to this group because several studies have linked dual smokers to major physical or mental health issues, as well as sleep disruptions³¹. Additionally, people who have transitioned from tobacco to e-cigarettes should be cautious about the possibility of addiction.

According to the current findings, e-cigarette use is more prevalent among males than females, which is in line with previous studies conducted globally³². For instance, compared to females, males were more likely to have tried e-cigarettes, according to findings from the National Health Interview Survey in the United States. That finding is also consistent with a recently published article demonstrating that adults and men vaped at a higher frequency than their older adolescent and female counterparts did, indicating the necessity of a policy aimed at a specific age and gender group³³. However, a survey of Polish secondary schools indicated that e-cigarette consumption was almost equal between males and females³⁴. These gender differences in the prevalence of e-cigarette use should be interpreted with caution, as they may be influenced by societal and cultural norms about smoking. According to a recent survey of adults in the United States, the rates of e-cigarette use increased over time for both sexes, but the rates started higher and increased less rapidly for men³⁵.

The positive association between e-cigarette use and the 26–35 age group, in contrast to the 18–20 age group, aligns with global trends. Previous research indicated that e-cigarette use is widespread among young individuals, particularly those aged 25 to 34 years¹⁷. This group frequently encounters lifestyle options that involve experimenting with novel smoking alternatives. The higher prevalence of e-cigarette use among individuals aged 26–35 years, compared to younger users, may reflect greater disposable income and access to e-cigarettes.

Furthermore, the current analysis revealed that e-cigarette use among city and village residents was significantly greater than that among camp residents. However, no significant variation in the use of e-cigarettes was observed between village residents compared with city residents. A previous study in the United States examined the disparities between rural and urban residents and reported no significant differences in several regions, which is consistent with the current findings³⁶. Another survey of American adults revealed that e-cigarettes were more prevalent in rural areas than in urban areas³⁷. The variations in residency could be explained by differences in health services, awareness campaigns, and beliefs across areas.

The current data show that peer influence and social networks are the key sources of information regarding e-cigarettes. This aligns with other studies, which found that social influences had a significant positive influence on individual e-cigarette initiation over time³⁸. These trends underscore the relevance of social connections and digital platforms in shaping knowledge and perceptions regarding e-cigarettes. Peer-shared information is typically perceived as more trustworthy and relatable than official sources³⁹. Social media further amplifies this effect, with platforms serving as centers where information spreads quickly and frequently through visual and interactive formats that increase engagement and potentially influence health behaviors⁴⁰. Family members, although less commonly listed as sources, continue to exert a significant effect, particularly among younger people, who may rely on family feedback when making health-related decisions. This indicates a gap in family-based health communication regarding e-cigarettes, potentially because older family members are less familiar with vaping and its possible consequences⁴¹. These findings imply that public health efforts targeted at educating people about e-cigarettes may be more effective if they use peer networks and social media, as well as counteract any misinformation that may circulate there.

A significant finding of this study is the positive association between the presence of a higher level of knowledge about e-cigarettes and an increased propensity for their use, in contrast to individuals with no or little information. This finding aligns with those of previous studies and may stem from increased knowledge of e-cigarettes as substitutes for conventional cigarettes^{8,42}. It is essential to recognize that subjective knowledge can be deceptive and that individuals may lack a thorough comprehension of health hazards. The current findings also imply that knowledge levels may be associated with use behaviors: those who engage in e-cigarette use actively seek more information on the topic, possibly to understand health risks, manage their use, or interact with vaping communities. Indeed, this was evident, as most of the e-cigarette users, compared with only approximately half of the non-users, knew that e-cigarettes contain nicotine. Previous research indicated that newer e-cigarettes deliver nicotine more efficiently than cigarettes due to the rapid inhalation of highly concentrated liquids⁴³. The alarming finding of this study is that more than half of the participants considered e-cigarette use safe compared with traditional cigarettes. Additionally, only half of the e-cigarette users believed that e-cigarettes contain carcinogenic materials. Although e-cigarette vapors contain significantly lower levels of carcinogenic toxicants than traditional tobacco does⁴⁴, there is strong debate surrounding the harmfulness

Variable (reference)	B	Sig	Exp(B)	95% C.I. for EXP(B)	
				Lower	Upper
Gender (male)					
Female	-0.357	0.096	0.7	0.459	1.066
Age group (18–20)					
21–25	0.439	0.102	1.551	0.916	2.625
26–35	0.326	0.283	1.385	0.764	2.511
36–50	0.231	0.464	1.26	0.678	2.341
51–65	-0.478	0.402	0.62	0.202	1.897
More than 65	1.059	0.096	2.884	0.827	10.056
Place of residence (city)					
Village	-0.318	0.139	0.728	0.478	1.108
Camp	0.445	0.257	1.56	0.722	3.371
1. How do you rate your knowledge level about e-cigarettes? (Nothing)					
Low	0.978	0.065	2.66	0.941	7.521
Moderate	1.146	0.033	3.146	1.094	9.051
High	1.655	0.008	5.233	1.526	17.941
2. Do you think e-cigarettes contain nicotine? (Neutral)					
Agree/strongly agree	1.93	< 0.001	6.892	3.571	13.301
Disagree/strongly disagree	0.973	0.067	2.646	0.935	7.485
3. Do you think e-cigarettes contain carcinogenic materials? (Neutral)					
Agree/strongly agree	-0.787	0.002	0.455	0.275	0.755
Disagree/strongly disagree	0.272	0.567	1.313	0.517	3.336
4. Do you believe e-cigarettes are safe to use compared to cigarettes? (Neutral)					
Agree/strongly agree	-0.256	0.388	0.774	0.433	1.384
Disagree/strongly disagree	-1.08	< 0.001	0.34	0.198	0.584
5. Do you believe passive vaping of e-cigarettes is safer than tobacco passive smoking? (Neutral)					
Agree/strongly agree	0.517	0.066	1.677	0.966	2.912
Disagree/strongly disagree	0.317	0.292	1.373	0.761	2.478
6. Do you believe the use of e-cigarettes can help in smoking cessation? (Neutral)					
Agree/ strongly agree	0.41	0.183	1.506	0.824	2.753
Disagree/strongly disagree	-0.106	0.716	0.9	0.509	1.589
7. For those who switched completely from tobacco smoking to e-cigarettes, do you believe that there is a positive impact on their general health status and normal life activities? (Neutral)					
Agree/strongly agree	-0.255	0.375	0.775	0.441	1.362
Disagree/strongly disagree	-0.155	0.581	0.856	0.494	1.484
8. Do you think e-cigarettes are cost-effective (Cheaper) compared to tobacco smoking? (Neutral)					
Agree/strongly agree	0.459	0.141	1.582	0.858	2.916
Disagree/strongly disagree	0.751	0.026	2.12	1.093	4.112
9. Do you believe e-cigarettes may be a gateway to conventional smoking? (Neutral)					
Agree/ strongly agree	0.161	0.605	1.175	0.638	2.164
Disagree/strongly disagree	0.307	0.447	1.36	0.615	3.006
10. Do you believe e-cigarette use is a Public health concern? (Neutral)					
Agree/strongly agree	-0.071	0.82	0.932	0.507	1.713
Disagree/strongly disagree	-0.114	0.806	0.893	0.36	2.212
11. Do you believe e-cigarette use can cause addiction to smoking? (Neutral)					
Continued					

Variable (reference)	B	Sig	Exp(B)	95% C.I. for EXP(B)	
				Lower	Upper
Agree/strongly agree	0.121	0.704	1.129	0.605	2.107
Disagree/strongly disagree	0.48	0.228	1.616	0.741	3.524
12. Do you believe e-cigarettes should be regulated in closed, public, or working places like other tobacco products? (neutral)					
Agree/strongly agree	-0.838	0.005	0.433	0.241	0.778
Disagree/strongly disagree	1.033	0.002	2.81	1.44	5.482

Table 4. Multivariate binary logistic regression analysis between e-cigarette use as the dependent variable and the predictors (n = 1160). Significant values are in bold.

of e-cigarette vapors compared with traditional cigarettes and whether they are associated with reduced health risks, especially regarding lung cancer and other tobacco-related malignancies.

The current study demonstrated that most of the participants did not consider e-cigarettes to be an effective smoking cessation method, with no significant differences between users and non-users. This contrasts with previous research suggesting that e-cigarette users may be more inclined to perceive e-cigarettes as cessation aids on the basis of personal experience or community narratives, whereas non-users often rely on public health messages that highlight the lack of conclusive evidence regarding e-cigarettes as effective cessation tools⁴⁵.

When considering the perceived impact of switching from tobacco to e-cigarettes on general health, the results were similarly divided. Nearly half of the respondents disagreed that switching to e-cigarettes has a positive health impact, with non-users expressing stronger skepticism. This skepticism among non-users might be influenced by established health warnings and campaigns that emphasize the potential health risks associated with vaping, particularly when it serves as an alternative to complete cessation. Moreover, e-cigarette users may perceive relative health benefits, especially if they view e-cigarettes as a harm-reduction alternative to smoking, which has been echoed in some harm-reduction studies⁴⁶. Remarkably, most of the participants in the current study thought that e-cigarette use should be regulated at work and in public places similar to tobacco products. A cross-sectional study in Jordan revealed that the majority of the studied population recommended regulations on the availability and use of e-cigarettes in public places⁴⁷.

Most participants agreed on the addictiveness of e-cigarettes, with no significant differences between users and non-users. Several studies revealed a significant level of dependence among e-cigarette users⁴⁸. A cross-sectional study revealed a twofold increase in the nicotine dependency index among e-cigarette users, and a 1.5-fold increase among dual e-cigarette and traditional cigarette smokers⁴⁹. These findings highlight the addictive effects of e-cigarettes and suggest the concurrence of other behavioral factors of addiction that are specifically associated with e-cigarette use, such as a tendency for daily overuse and the use of E-liquids that are highly concentrated in nicotine. Notably, previous studies have shown that high nicotine dependency among adolescents is associated with an earlier onset of e-cigarette use, more frequent daily use, the use of highly concentrated nicotine E-liquid, and dual smoking⁵⁰.

Numerous studies have reported a discrepancy between perceived safety and the actual risks associated with e-cigarettes^{6,51}. The misconception that e-cigarettes are less detrimental contributes significantly to their usage, particularly among individuals who believe that these products are safer than traditional cigarettes⁵². Previous studies have reported that e-cigarettes are safer than cigarettes, and they can be used as a cessation aid for smoking⁶.

A common reason cited for the widespread use of e-cigarettes is their affordability. Additionally, many smokers make the transition to e-cigarettes because they believe they will save money over cigarettes. A previous study revealed that one factor that may encourage people to start using e-cigarettes and keep using them is the perception that they are less expensive⁵³. Disagreement about cost-effectiveness may indicate a lack of faith in the long-term affordability of e-cigarettes, particularly considering the high price of premium vaping devices and e-liquids. A randomized controlled study revealed that using e-cigarettes as a smoking cessation aid was more cost-effective than using nicotine replacement therapy⁵⁴. The complexity of the results' agreement and disagreement associations with e-cigarette use might be explained by the complexity of people's perceptions; for example, cost-sensitive people might still opt to use e-cigarettes even though they think they are more expensive. The results of the current study indicate the need for e-cigarette regulation that is inversely related to usage, but disagreement is positively associated, which corresponds with research indicating that e-cigarette users frequently oppose regulatory efforts. Research evaluating regulations on e-cigarette usage in designated locations is still limited. A prior study indicated that e-cigarette usage was predominantly prohibited in educational institutions, public transportation, healthcare facilities, public areas, and workplaces, mirroring existing smoking regulations⁵⁵. Notably, only one-third of nations in the WHO European region adhered to the WHO Framework Convention on Tobacco proposal to prohibit indoor e-cigarette use⁵⁶.

The current study had some limitations. Using an online questionnaire to collect a convenience sample might lead to misreporting and recall bias, and the inability to calculate the response rate. The potential influence of literacy and internet availability might have led to sampling bias in terms of including more participants who are educated and have better socioeconomic status. Limited research has investigated the correlation between the socioeconomic status of participants and e-cigarette use, with conflicting outcomes. Some studies indicated that better socioeconomic status is associated with increased e-cigarette use⁵⁷. This association was explained as

being due to the stronger effects of advertising exposure and curiosity among those with better socioeconomic status, while financial constraints can suppress individual curiosity and limit their desire to use e-cigarettes^{57–59}. However, other studies did not support this association between socioeconomic status and e-cigarette use^{60,61}. The association between the level of education and e-cigarette use has also been controversial in previous studies. One study found that participants with a high level of education were more likely to be e-cigarette users, and this was related to the increased curiosity and susceptibility to e-cigarette use⁶². However, other studies did not support the correlation between e-cigarette use and the educational level^{63–65}. To address the potential for sampling bias, the questionnaire was distributed through various channels to enhance its visibility across diverse demographic groups. Furthermore, the inclusion of a large sample size in the current study contributes to the generalizability of the findings. Another limitation is that the study did not account for potential confounding factors such as lifestyle behaviours (such as coffee and alcohol consumption and physical activity), which may be associated with e-cigarette use. Positive associations were reported between e-cigarette use and alcohol use⁶⁶, coffee consumption⁶⁷, and physical activity⁶⁸. Further studies are warranted to examine the possible association between e-cigarette use and coffee consumption and physical activity. Unexpectedly, a recent study revealed that alcohol consumption in Palestine is common, and that alcohol is easily available⁶⁸. Therefore, examining the association between e-cigarette use and alcohol consumption should not be excluded.

Conclusions

In conclusion, the current study is the largest on e-cigarette use among Palestinians in terms of sample size, methodology, and results. Several variables were compared between e-cigarette users and non-users. This research revealed a significant prevalence of e-cigarette use among Palestinians. Notably, e-cigarette use was associated with sociodemographic factors, peer and family influence, knowledge and perceptions of e-cigarettes, and the availability of e-cigarettes. These findings indicate that stakeholders should take urgent action through multifaceted interventions to increase public awareness of e-cigarettes and to regulate the availability and marketing of e-cigarettes. These interventions must be tailored to specific groups at risk of using e-cigarettes.

Data availability

All data generated or analysed during this study are included in this published article.

Appendix: The questionnaire

Section one: Socio-demographic questions about the participants

Questions
1. Gender
Male
Female
2. Age group (years)
18–20
21–25
26–35
36–50
51–65
More than 65
3. Level of education
Less than secondary school
Secondary school
Vocational education
Diploma
Bachelor
Postgraduate
4. Job
Student
Not working
Employed/self-employed
Retired
Others
5. Marital status
Single
Married
Others
6. Place of residence

Questions
City
Village
Camp

Section two: Answer the following questions based on your smoking status and your source/s of information about the e-cigarette

What is your current smoking status? (you can choose only one answer)
Non-smoker
Tobacco smoker
E-cigarette user
E-cigarette user who replaced tobacco with e-cigarette
Dual smoker (I am using e-cigarettes and tobacco)

What is/are the sources of your information about e-cigarettes? (you can choose more than one answer)
Social media
Family members
Friends
Other sources
I have not heard about e-cigarettes before

Section three: Answer the following question according to your knowledge and perceptions about e-cigarettes

1. How do you rate your knowledge level about e-cigarettes?	Nothing	Low	Moderate	High	
2. Do you think e-cigarettes contain nicotine?	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
3. Do you think e-cigarettes contain carcinogenic materials?	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
4. Do you believe e-cigarettes are safe to use compared to cigarettes?	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
5. Do you believe passive vaping of e-cigarettes is safer than tobacco passive smoking?	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
6. Do you believe the use of E-cigarettes can help in smoking cessation?	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
7. For those who switched completely from tobacco smoking to e-cigarettes, do you believe that there is a positive impact on their general health status and normal life activities?	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
8. Do you think e-cigarettes are cost-effective (cheaper) compared to tobacco smoking?	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
9. Do you believe e-cigarettes may be a gateway to conventional smoking?	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
10. Do you believe e-cigarette use is a public health concern?	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
11. Do you believe e-cigarette use can cause addiction to smoking?	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
12. Do you believe e-cigarettes should be regulated in closed, public, or working places like other tobacco products?	Strongly disagree	Disagree	Neutral	Agree	Strongly agree

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Author contributions

MR: Conceptualization, data collection, statistical analysis, and manuscript writing and editing. MG: Conceptualization, validation, supervision, data collection, and manuscript writing and editing. MAL: Conceptualization, data collection, and manuscript writing and editing. AH: Data collection and manuscript writing. MAB: Conceptualization, data collection, and manuscript writing and editing. BR: Data collection and manuscript writing. SQ: Data collection and manuscript writing. MB: Data collection and manuscript writing. MD: Data collection and manuscript writing. SA: Data collection and manuscript writing. WS: Data collection and manuscript writing. SJ: Data collection and manuscript writing. JA: Data collection, manuscript writing and editing.

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Declarations

Competing interests

The authors declare no competing interests.

Additional information

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