BMJ Open

# Exploring the prevalence, knowledge, attitudes and influencing factors of e-cigarette use among university students in Palestine: a cross-sectional study

Zaher Nazzal ,[1] Beesan Maraqa ,[2,3] Razan Azizeh,[1] Bara' Darawsha,[1] Ibraheem AbuAlrub,[1] Mousa Hmeidat,[4] Fadel Al-Jabari[4]

**To cite:** Nazzal Z, Maraqa B, Azizeh R, *et al*. Exploring the prevalence, knowledge, attitudes and influencing factors of e-cigarette use among university students in Palestine: a cross-sectional study. *BMJ Open* 2024;**14**:e080881. doi:10.1136/bmjopen-2023-080881

► Prepublication history and additional supplemental material for this paper are available online. To view these files, please visit the journal online (https://doi.org/10.1136/bmjopen-2023-080881).

Received 13 October 2023
Accepted 31 January 2024



[1]Department of Medicine, Faculty of Medicine and Health Sciences, An-Najah National University, Nablus, Palestine
[2]Department of Family and Community Medicine, Faculty of Medicine, Hebron University, Hebron, Palestine
[3]Primary Health Care, Ministry of Health, Hebron, Palestine
[4]Department of Medicine, Faculty of Medicine, Hebron University, Hebron, Palestine

**Correspondence to**
Dr Zaher Nazzal;
znazzal@najah.edu

## ABSTRACT

**Objectives** E-cigarettes have gained popularity, especially among young adults. This study aims to determine the prevalence of e-cigarette smoking, assess knowledge and attitudes and identify associated factors among Palestinian university students.

**Design** A cross-sectional study.

**Setting and participants** The study was conducted among Palestinian university students in early 2023. A self-administered questionnaire was used to survey 1792 students from six Palestine universities in the West Bank. The questionnaire covered various aspects, including sociodemographic information, daily habits, exposure to smoking, attitudes and knowledge about e-cigarettes. Data were analysed using descriptive statistics, $\chi^2$ tests and multivariate regression analysis.

**Results** The study revealed a high prevalence of tobacco use (41.2%), with e-cigarette use prevalent among 19.7% of participants. Knowledge about e-cigarettes was suboptimal, with misconceptions regarding their safety and health effects. Negative attitudes towards e-cigarettes were common, and students with negative attitudes were more likely to use e-cigarettes (aOR=2.6, 95% CI: 1.9 to 3.6). Gender (aOR=2.1, 95% CI: 1.4 to 3.0), waterpipe smoking (aOR=4.5, 95% CI: 3.2 to 6.3), physical inactivity (aOR=1.4, 95% CI: 1.1 to 1.9), high coffee consumption (aOR=1.6, 95% CI: 1.1 to 2.3), spending time with friends (aOR=2.4, 95% CI: 1.5 to 3.7), having a mother who is a smoker (aOR=1.5, 95% CI: 1.1 to 2.2) and having a friend who uses e-cigarettes (aOR=1.5, 95% CI: 1.1 to 2.1) were significantly associated with e-cigarettes use.

**Conclusions** E-cigarette use is a growing concern among Palestinian university students. Combating this trend should include educational initiatives, social interventions and policy measures to promote informed decision-making and discourage e-cigarette use. Comprehensive tobacco control programs considering various tobacco and nicotine products and involving multiple stakeholders are warranted.

## STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ The prevalence of e-cigarette usage is on the rise, particularly among adolescents, fueled by misconceptions surrounding its use.
- ⇒ The high response rate (95.1%) and large sample size (1792 students) from six universities enhance the power and generalisability of the results.
- ⇒ The cross-sectional design limits the ability to establish causal relationships between variables, capturing only a snapshot in time.
- ⇒ The use of self-reported data may introduce information bias since participants' responses may be influenced by social desirability.

## INTRODUCTION

Tobacco use is widely recognised as a significant and preventable contributor to the global disease burden despite extensive efforts to combat the tobacco epidemic. Current smoking and passive smoking have been shown to increase the risk of all-cause, cardiovascular diseases (CVD)-related and cancer-related mortality.[1]

Electronic cigarettes (e-cigarettes), commonly known as vapes, are nicotine delivery devices that have been promoted as a healthier alternative to traditional cigarettes since they were first introduced. Initially, they were produced and advertised as a smoking cessation aid despite inevitable negative consequences on users' health. The emissions of e-cigarettes commonly consist of nicotine and various toxic substances, posing risks to both users and individuals who are indirectly exposed to the aerosols. The addictive nature of nicotine in e-cigarettes poses a severe risk to brain development in youth,[2] and the heavy metals and toxicants in their vapour may contribute to cancer development.[3]

The effectiveness and safety of e-cigarettes as a smoking cessation aid are still being debated. Nonetheless, their use has significantly increased recently, particularly among adolescents and young adults.[4 5] A systematic review and meta-analysis study reported that the lifetime and current prevalence of e-cigarette vaping was 23% and 11%, respectively;

the lifetime and current prevalence of e-cigarette vaping among women was 16% and 8%, while among males, it was 22% and 12%, respectively.[6] While the prevalence of young people's conventional cigarette use has decreased in many countries, e-cigarette use has risen. A recent international systematic review found that the global pooled prevalence of young people's lifetime usage of e-cigarettes was 15.3%, the current use was 7.7% and the dual use was 4.0%.[7] Many studies have shown that the prevalence of e-cigarette smoking among university students is high, reaching up to 40%.[8 9]

Tobacco smoking is particularly prevalent among young adults and university students in Palestine. Findings from the 2015 Youth Survey show that 23.5% of Palestinians aged 15–29 use cigarettes, with male respondents using tobacco at a higher rate (40.9%) than female respondents (5.4%).[7] Of university students, approximately 30% were identified as current tobacco users, 22.0%–25.0% as current waterpipe smokers and 18.0% as current cigarette smokers, with male students significantly more likely than female students to use cigarettes.[10–12]

The evidence shows that knowledge, attitudes and social norms about risky behaviours highly predict individuals' behavioural intentions.[13] However, university students' knowledge and attitudes about e-cigarettes are suboptimal. A Chinese study found that only 21.6% of university students believed e-cigarettes had carcinogens and were less addictive than conventional cigarettes.[14] In Saudi Arabia, only 22.5% and 48.4% of students believed e-cigarettes had the same risk and toxins as regular cigarettes.[15]

There has been no previous research on the prevalence of e-cigarette smoking among Palestinian university students. Therefore, one of the primary objectives of this study is to determine the prevalence of e-cigarette smoking among university students in Palestine and assess their knowledge and attitudes towards this behaviour. This will aid policymakers in developing initiatives to increase public awareness of e-cigarette use and its associated risks.

## METHODOLOGY

### Study design and population

This cross-sectional study occurred within Palestinian universities between January and May 2023, encompassing the entire student population across six major universities in the West Bank. These universities include The Arab American University, An-Najah National University and Palestine Technical University in the northern West Bank; Birzeit University in the central West Bank; and Hebron University and Bethlehem University in the southern West Bank.

The estimated target population consisted of 70 000 university students. We used OpenEpi's online sample size calculator to identify the required sample size.[16] With a population size of 70 000 students, a desired margin of error of 3%, and an anticipated proportion of 50%, the initial sample size was set at 1600 students. Subsequently, we increased the sample size by 20% to account for potentially incomplete questionnaires, leading to a final sample size of 1900 students. Initially, a random sampling method was planned, but due to constraints in accessing student enrolment records, a convenience sampling approach was adopted, with students drawn from each university's campuses. A proportional sample from each university was selected, ensuring that the selection process reflected the student population of each chosen university, with visits scheduled at different times, days, locations and faculties. We included all full-time undergraduate students enrolled at the specified universities.

### Patient and public involvement

Patients or the public were not involved in this study's design, conduct or reporting.

### Measurement tool and variables

The collection of data was conducted through a self-administered questionnaire. Students have been interviewed in person on campus and invited to participate voluntarily in the study. For those who agreed to participate, the questionnaire was disseminated through a QR code directing them to the corresponding Google Form.

The research team developed the questionnaire (online supplemental material 1), selecting the items carefully after thoroughly reviewing the relevant literature.[17–22] It consisted of three sections. The first section focused on collecting data regarding sociodemographic variables, including gender, age, place of residence, faculty, daily habits (like smoking, exercise, diet, coffee consumption and social interactions) and exposure to cigarette smoking (including the number of smokers nearby and the smoking habits of parents and friends). In line with the Centers for Disease Control and Prevention (CDC) definition, a smoker was identified as an individual who had smoked more than 100 cigarettes and was currently smoking at the time of the study.[23] A current regular e-cigarette smoker was defined as someone who had used an e-cigarette for at least 30 days, including the past 7 days.[24]

The second section consisted of 13 statements assessing students' attitudes regarding e-cigarettes. Statements expressing positive attitudes aligned with societal approval and community norms. These included statements advocating for government regulation of e-cigarette use, encouraging organisations and individuals to refrain from selling e-cigarettes to minors and prohibiting e-cigarette use in workplaces and public spaces. Participants expressed their level of agreement with these statements using a 4-point Likert scale, excluding a neutral option in statements assessing attitude to avoid potential bias.[25] For positive attitude items, 'strongly agree' received a score of 4, while 'strongly disagree' received a score of 1. However, the scoring was reversed for the items meant to measure negative attitudes. The total score ranged from 13 to 52, with a cut-off point at 39 (75%), where a score of ≥39 indicated a positive attitude, while a score of<39 indicated a negative attitude.[18]

The last part of the questionnaire included 13 carefully chosen items from different studies to evaluate participants' knowledge of e-cigarette smoking.[17 20–22] These statements addressed the effects of e-cigarettes on overall health and the respiratory system, the suitability of e-cigarette use for pregnant women and children and the potential for e-cigarette addiction. Each statement included three response options: 'yes', 'no' and 'do not know'. Participants were awarded 2 points for a correct 'yes' response, 0 points for a correct 'no' response and 1 point for selecting 'do not know'. In instances where 'no' was the correct answer, the scoring was reversed. This resulted in a scoring range from 0 to 26. The cut-off point was set at 20 (75%); a score of ≥20 denoted a high level of knowledge, while a score of<20 indicated a lower level of knowledge.

The questionnaire was first created in English and later translated into Arabic. Afterward, a proficient English speaker conducted a back-translation to verify linguistic accuracy. To validate the questionnaire, three experts in the field evaluated it, followed by a pilot test involving 20 university students. The questionnaire was adjusted based on feedback received during the pilot study. The reliability of the Attitude and Knowledge items was confirmed through Cronbach's alpha coefficients, which yielded satisfactory values of 0.78 and 0.75, respectively.

### Analysis plan

The data collected through Google Forms were processed into an Excel spreadsheet and analysed using IBM SPSS V.23 (IBM Corp, Armonk, New York, USA). Descriptive analyses included mean and SD for continuous variables and frequencies and percentages for categorical variables. Independent t-tests and $\chi^2$ tests were used to assess univariate associations. Multivariate regression analysis was conducted to account for potential confounding variables. The model outcomes were presented as adjusted ORs (aOR) and their 95% CIs to assess the precision of the estimations. There were no missing data on the variables of interest, and the significance level was set at 0.05.

The study adhered to ethical guidelines and received approval from An-Najah National University's Institutional Review Board before initiation (Reference #: Med. Jan.2023/1). Participants were informed about their voluntary participation, the study's purpose and confidentiality. They were assured that their involvement would not affect their academic standing or university life. Data were anonymised and stored securely, with access restricted to the research team. Confidentiality measures were implemented throughout the research, including data collection, analysis, and reporting. Personal identifiers were removed, and participants were assigned unique codes.

## RESULTS

The study involved 1884 university students, with 1792 willingly participating, resulting in a response rate of 95.1%. The participants were primarily female (66.4%), with over half (53.3%) from rural areas, and their average age was 20.1±1.6 years. The study revealed that 41.2% (95% CI: 39.4% to 43.8%) of students were smokers, with 16.0% (95% CI: 14.4% to 17.8%) smoking traditional cigarettes, 20.1% (95% CI: 18.2% to 22.0%) smoking waterpipes and 19.7% (95% CI: 17.8% to 21.6%) smoking e-cigarettes. Most (63.3%) were physically inactive, and only 27.6% adhered to a healthy diet. The majority (54.2%) had smoking fathers, 14.4% had smoking mothers and 68.1% had smoking friends (table 1).

Table 2 illustrates the various levels of knowledge among participants regarding e-cigarettes. Notably, many respondents expressed a lack of knowledge about several aspects of e-cigarettes. More than one-third (35.6%) were unaware that e-cigarettes do not contain any dangerous compounds other than nicotine, and 20.0% incorrectly believed that e-cigarettes were Food and Drug Administration (FDA) approved. Furthermore, a significant majority of respondents had misconceptions about the link between e-cigarettes and health hazards. For example, 23.8% do not know or think that e-cigarettes are suitable for pregnant women, and 23.8% do not know or think that e-cigarettes have no risk to the heart. Over 60% of students were categorised as having lower knowledge of e-cigarettes. Female students, those enrolled in medical science colleges, and those with positive attitudes towards e-cigarettes had significantly higher knowledge about e-cigarettes. On the other hand, students who smoked cigarettes, those residing in environments with a more significant number of smokers and students with close friends who smoked were associated with significantly lower knowledge levels regarding e-cigarettes (online supplemental table 1).

Table 3 examines the attitudes regarding e-cigarettes. A significant percentage of the respondents agreed that e-cigarettes are safer than conventional smoking (19.2%) and that using e-cigarettes is perceived as a sign of sophistication and civilisation (17.4%). Furthermore, a significant percentage agreed that individuals using e-cigarettes should not be labelled as smokers (34.4%) and believed that e-cigarettes are more cost-effective than traditional cigarettes (37.9%). Moreover, 24.8% opposed the idea of banning e-cigarettes in workplaces and public spaces, and a high percentage (92.2%) thought that the availability of various e-cigarette flavours contributes to the widespread adoption of this practice. Only 40.2% of university students were categorised as having positive attitudes regarding e-cigarettes, with significantly higher levels of positive attitudes observed among female students, those enrolled in colleges of medical sciences and students with higher levels of knowledge on e-cigarettes. Conversely, students who smoked traditional cigarettes or waterpipes were physically inactive, had smoking parents, had close friends who were smokers or lived in environments with more smokers tended to exhibit more negative attitudes towards e-cigarettes (online supplemental table 2).

Table 4 reveals that e-cigarette smoking prevalence is significantly influenced by various factors, including

Table 1 Demographic characteristics, daily habits and exposure to smoking among the study participants (n=1792)

| Variable | Frequency (%) |
|---|---|
| Age (mean±SD) | 20.02±1.602 |
| Gender | |
| Male | 603 (33.6%) |
| Female | 1189 (66.4%) |
| Faculty | |
| Colleges of medical science | 484 (27.3%) |
| Non-medical scientific colleges | 442 (24.9%) |
| Humanities faculties | 848 (47.8%) |
| Missing | 18 |
| Residency | |
| Urban | 854 (47.7%) |
| Rural | 938 (53.3%) |
| Students' smoking status (smoker) | 735 (41.2%) |
| Traditional cigarettes | 287 (16.2%) |
| Waterpipe | 359 (20.1%) |
| E-cigarettes | 352 (19.7%) |
| Physically active (no) | 1135 (63.3%) |
| Adhered to a healthy diet (yes) | 495 (27.6%) |
| Coffee drinking | |
| No | 324 (18.9%) |
| 1–6 cups a week | 497 (27.7%) |
| One cup or more a day | 971 (54.2%) |
| Number of smokers where you live | |
| Zero | 430 (24.2%) |
| 1–5 | 1197 (67.3%) |
| More than 6 | 151 (8.5%) |
| Missing | 11 |
| Father is a smoker (yes) | 971 (54.2%) |
| Missing | 20 |
| Mother is a smoker (yes) | 258 (14.4%) |
| Missing | 2 |
| A close friend's smoking status (smoker) | 1220 (68.1%) |
| Traditional cigarettes | 753 (42.4%) |
| Waterpipe | 699 (39.4%) |
| E-cigarettes | 457 (25.7%) |
| Missing | 17 |
| Daily time spent with friends | |
| Less than 2 hours | 386 (21.5%) |
| 2–5 hours | 758 (42.3%) |
| More than 5 hours | 648 (36.2%) |

E-cigarettes, electronic cigarettes.

gender, type of faculty, urban residency, daily habits, physical inactivity and time spent with friends. Living with smokers and parental smoking are also linked to e-cigarette use. Additionally, having friends who smoke or use e-cigarettes and having lower knowledge levels with a negative attitude towards e-cigarettes are additional factors. It is essential to highlight that a statistically significant positive correlation has been observed between knowledge and attitude scores (correlation coefficient (r): 0.37, p value<0.001).

On multivariate analysis, the results showed that males (aOR=2.1, 95% CI: 1.4 to 3.0, p<0.001), waterpipe smoking students (aOR=4.5, 95% CI: 3.2 to 6.3, p<0.001), physically inactive students (aOR=1.4, 95% CI: 1.1 to 1.9, p=0.025) and students who drank seven or more cups of coffee per week (aOR=1.6, 95% CI: 1.1 to 2.3, p=0.28) were more likely to use e-cigarettes. Additionally, the prevalence of e-cigarette use was significantly higher among students residing with six or more smokers (aOR=2.1, 95% CI: 1.2 to 4.0, p=0.021), spending over 5 hours per day with friends (aOR=2.4, 95% CI: 1.5 to 3.7, p<0.001), or having a mother (aOR=1.5, 95% CI: 1.1 to 2.2, p=0.038) or close friend (aOR=1.5, 95% CI: 1.1 to 2.1, p=0.036) who smokes. Attitudes towards e-cigarette smoking exhibited a significant influence, with students holding negative attitudes having 2.6 times higher odds of e-cigarette use (aOR=2.6, 95% CI: 1.9 to 3.6, p<0.001) (table 4).

## DISCUSSION

E-cigarette smoking has been on the rise, especially among young adults.[26 27] Previous research has shown varying prevalence rates of e-cigarette use among university students and adults.[26 28] The study's findings are crucial for stakeholders like public health experts, healthcare professionals, social workers and families in addressing rising e-cigarette smoking patterns. The study reveals that students often have suboptimal health habits, including physical inactivity (63.3%), unhealthy diet (73.4%) and high coffee consumption (54.2%). These habits are linked to various illnesses like obesity, diabetes, cardiovascular disease and mental health issues. Recognising the interconnectedness of these hazardous behaviours is crucial since engaging in one may increase the risk of engaging in others, such as smoking.[29]

The study found a smoking prevalence rate of 41.2% among students in the West Bank, consistent with the Palestinian Central Bureau of Statistics (40.1%).[30] This reflects the persistent issue of young individuals using tobacco despite public health efforts. The study also revealed a variety of tobacco and nicotine products consumed by students, with 16.0% using traditional cigarettes, 20.1% using waterpipes and 19.7% using e-cigarettes.

The prevalence of e-cigarette usage among students is notable, as it approaches 20%. This aligns with a prevailing global pattern of e-cigarette utilisation, particularly among the younger population.[27 31] Despite being seen as a less harmful alternative to traditional cigarettes, e-cigarettes still carry risks like addiction and adverse health effects.[2 3] Moreover, the majority of the university

Table 2 Study participants' level of knowledge about e-cigarettes (n=1792)

| Statement | Yes | No | Do not know |
|---|---|---|---|
| E-cigarettes are FDA-approved | 358 (20.0%) | 315 (17.6%) | 1119 (62.4%) |
| Some flavours of e-cigarettes are more harmful than others | 617 (34.4%) | 362 (20.2%) | 813 (45.4%) |
| E-cigarettes are associated with decreased male fertility | 544 (30.4%) | 143 (8.0%) | 1105 (61.7%) |
| E-cigarettes are associated with bladder cancer | 555 (31.0%) | 142 (7.9%) | 1093 (61.1%) |
| Swallowing the liquid in e-cigarettes accidentally can cause potentially fatal poisoning | 835 (46.6%) | 210 (11.7%) | 747 (41.7%) |
| E-cigarettes are not associated with lung cancer | 282 (15.7%) | 905 (50.5%) | 605 (33.8%) |
| E-cigarettes do not contribute to secondhand smoking | 320 (17.9%) | 994 (55.5%) | 478 (26.7%) |
| E-cigarettes contain other harmful substances than nicotine | 1056 (58.9%) | 100 (5.6%) | 636 (35.5%) |
| E-cigarettes in Palestine contain nicotine | 1099 (61.3%) | 91 (5.1%) | 602 (33.6%) |
| E-cigarettes are not addictive | 230 (12.8%) | 1240 (69.2%) | 322 (18.0%) |
| E-cigarettes negatively affect the functioning of the heart | 1291 (72.0%) | 75 (4.2%) | 426 (23.8%) |
| E-cigarettes are safe for pregnant women | 106 (5.9%) | 1384 (77.2%) | 302 (16.9%) |
| E-cigarettes are safe for children | 100 (5.6%) | 1505 (84.0%) | 187 (10.4%) |

E-cigarettes, electronic cigarettes; FDA, Food and Drug Administration.

students reported living with other smokers, exposing them to the potential dangers of secondhand smoking. Recent evidence suggests that students surrounded by smoky environments are more likely to accept smoking or become smokers, including e-cigarettes.[32]

The study revealed that university students lack sufficient knowledge about e-cigarettes, many of them believing they are harmless and not linked to health issues like lung cancer or decreased fertility and that they are FDA-approved. These results align with previous literature from Saudi Arabia,[33] China[34] and Qatar.[35] This implies that significant efforts are required to enhance awareness and offer smoking cessation services to university students.

Table 3 Attitude regarding e-cigarettes among university students (n=1792)

| Statement | Strongly agree | Agree | Disagree | Strongly disagree | Mean±SD |
|---|---|---|---|---|---|
| E-cigarettes are safer than traditional smoking | 70 (3.9%) | 274 (15.3%) | 961 (53.6%) | 487 (27.2%) | 3.0±0.76 |
| E-cigarette use is regarded as a sign of sophistication and civilisation | 84 (4.7%) | 227 (12.7%) | 773 (43.1%) | 708 (39.5%) | 3.2±0.83 |
| E-cigarettes are easier to get than cigarettes | 117 (6.5%) | 602 (33.6%) | 942 (52.6%) | 131 (7.3%) | 2.4±0.80 |
| E-cigarettes would be an effective way to help with smoking cessation | 128 (7.1%) | 566 (31.6%) | 821 (45.8%) | 277 (15.5%) | 2.7±0.82 |
| Those who use e-cigarettes are not considered smokers | 132 (7.4%) | 466 (26.0%) | 831 (46.4%) | 363 (20.3%) | 2.8±0.85 |
| E-cigarettes cost less money than cigarettes | 144 (8.0%) | 535 (29.9%) | 812 (45.3%) | 301 (16.8%) | 2.7±0.84 |
| E-cigarettes are more pleasurable than cigarettes | 200 (11.2%) | 868 (48.4%) | 560 (31.3%) | 164 (9.2%) | 2.4±0.80 |
| E-cigarette use can lead to the initiation of traditional cigarette smoking | 228 (12.7%) | 853 (47.6%) | 611 (34.1%) | 100 (5.6%) | 2.7±0.77 |
| E-cigarette use is considered more socially acceptable than cigarettes | 263 (14.7%) | 854 (47.7%) | 538 (30.0%) | 137 (7.6%) | 2.31±0.81 |
| The government should regulate the use of e-cigarettes | 545 (30.4%) | 830 (46.3%) | 323 (18.1%) | 94 (5.2%) | 3.0±0.93 |
| E-cigarettes should be banned in both workplace and public settings | 747 (41.7%) | 601 (33.5%) | 376 (21.0%) | 68 (3.8%) | 3.1±0.87 |
| The existence of various e-cigarette flavours plays a role in promoting the dissemination of this trend | 754 (42.1%) | 898 (50.1%) | 94 (5.2%) | 46 (2.6%) | 3.3±0.69 |
| E-cigarettes should not be sold to minors | 1106 (61.7%) | 558 (31.1%) | 92 (5.1%) | 36 (2.0%) | 3.5±0.69 |

E-cigarettes, electronic cigarettes.

**Table 4** Univariate and multivariate analysis of the relationship between sociodemographic status, daily habits, exposure to smoking, e-cigarette knowledge and attitude and e-cigarette smoking

| Variables | E-cigarette smoker | | P value | Multivariate analysis | |
|---|---|---|---|---|---|
| | Yes | No | | aOR (95% CI) | aP value |
| Age (mean±SD) | 20±1.48 | 19.9±1.42 | 0.210 | -- | -- |
| Gender | | | | | |
| Male | 174 (29.1%) | 424 (70.9%) | 0.001 | 2.1 (1.4 to 3.0) | <0.001 |
| Female* | 178 (15.0%) | 1008 (85.0%) | | 1 | |
| Faculty | | | | | |
| Colleges of medical science | 76 (15.8%) | 406 (84.2%) | | 0.97 (0.69 to 1.4) | 0.884 |
| Non-medical scientific colleges | 82 (18.7%) | 356 (81.3%) | 0.008 | 1.3 (0.90 to 1.8) | 0.178 |
| Humanities faculties* | 192 (22.7%) | 654 (77.3%) | | 1 | |
| Residency | | | | | |
| Urban | 205 (24.1%) | 645 (75.9%) | 0.001 | 1.4 (1.1 to 1.9) | 0.102 |
| Rural* | 147 (15.7%) | 787 (84.3%) | | 1 | |
| Cigarette smoker | | | | | |
| Yes | 94 (32.8%) | 193 (67.2%) | <0.001 | 1.4 (0.96 to 2.1) | 0.077 |
| No* | 258 (17.2%) | 1239 (82.8%) | | 1 | |
| Waterpipe smoker | | | | | |
| Yes | 159 (44.3%) | 200 (55.7%) | <0.001 | 4.5 (3.2 to 6.3) | <0.001 |
| No* | 193 (13.6%) | 1213 (86.4%) | | 1 | |
| Physically active | | | | | |
| Yes* | 167 (16.4%) | 486 (83.6%) | 0.001 | 1 | |
| No | 185 (25.6%) | 946 (74.4%) | | 1.4 (1.10 to 1.9) | 0.025 |
| Adhered to a healthy diet | | | | | |
| Yes | 99 (20.2%) | 391 (79.8%) | 0.760 | -- | -- |
| No | 253 (19.6%) | 1041 (80.4%) | | | |
| Coffee drinking | | | | | |
| No* | 52 (16.0%) | 272 (84.0%) | | 1 | |
| 1–6 cups a week | 108 (21.9%) | 385 (78.1%) | 0.001 | 1.1 (0.82 to 1.6) | 0.469 |
| One cup or more a day | 192 (19.9%) | 775 (80.1%) | | 1.6 (1.1 to 2.3) | 0.028 |
| Daily time spent with friends | | | | | |
| Less than 2 hours* | 39 (10.2%) | 344 (89.8%) | | 1 | |
| 2–5 hours | 144 (19.1%) | 609 (80.9%) | 0.001 | 1.5 (1.1 to 2.0) | 0.016 |
| More than 5 hours | 169 (26.1%) | 479 (73.9%) | | 2.4 (1.5 to 3.7) | <0.001 |
| Number of smokers where you live | | | | | |
| Zero* | 53 (12.0%) | 388 (88.0%) | <0.001 | 1 | |
| 1–5 | 253 (21.0%) | 952 79.0%) | | 1.4 (0.86 to 2.5) | 0.159 |
| More than 6 | 45 (35.4%) | 82 (64.4%) | | 2.1 (1.2 to 4.0) | 0.021 |
| Father is a smoker | | | | | |
| Yes | 215 (22.2%) | 754 (77.8%) | 0.006 | 1.1 (0.83 to 1.5) | 0.786 |
| No* | 135 (17.0%) | 1415 (80.2%) | | 1 | |
| Mother is a smoker | | | | | |
| Yes | 87 (33.7%) | 171 (66.3%) | <0.001 | 1.5 (1.1 to 2.2) | 0.038 |
| No* | 265 (17.4%) | 1259 (82.6%) | | 1 | |
| A close friend is a cigarette smoker | | | | | |
| Yes | 223 (29.8%) | 525 (70.2%) | 0.001 | 1.5 (1.1 to 2.1) | 0.036 |

Continued

Table 4 Continued

| Variables | E-cigarette smoker | | P value | Multivariate analysis | |
|---|---|---|---|---|---|
| | Yes | No | | aOR (95% CI) | aP value |
| No* | 129 (12.6%) | 892 (87.4%) | | 1 | |
| A close friend is an e-cigarette smoker | | | | | |
| Yes | 179 (39.4%) | 275 (60.6%) | 0.001 | 3.3 (2.4 to 4.5) | <0.001 |
| No* | 173 (13.2%) | 1142 (86.8%) | | 1 | |
| Level of knowledge | | | | | |
| Low | 242 (22.4%) | 840 (77.6%) | 0.001 | 1.1 (0.84 to 1.49) | 0.439 |
| High* | 110 (15.7%) | 592 (84.3%) | | 1 | |
| Attitude | | | | | |
| Negative | 289 (27.2%) | 774 (72.8%) | 0.001 | 2.6 (1.9 to 3.6) | <0.001 |
| Positive* | 63 (8.7%) | 658 (91.3%) | | 1 | |

*Reference group.
aOR, adjusted OR; aP value, adjusted p value; E-cigarettes, electronic cigarettes.

The study reveals that university student's e-cigarette use is significantly influenced by gender, with males being 2.1 times more likely to use them than females, a finding consistent with previous research suggesting gender disparities in tobacco and nicotine product use.[26 36] Waterpipe smoking was found to be significantly related to e-cigarette use, with those using waterpipes being 4.5 times more likely to use e-cigarettes. This underscores the potential link between tobacco and nicotine consumption among young adults, emphasising the need for comprehensive tobacco control programmes.[37]

Physical activity and coffee consumption are significant predictors of tobacco use, with physically inactive students being 1.4 times more likely to use e-cigarettes and students consuming one cup of coffee or more per day being 1.6 times more likely to use e-cigarettes. The findings align with a study on Spanish university graduates, where physical inactivity and higher coffee consumption were identified as critical predictors of tobacco use.[38]

Social factors significantly influence e-cigarette use. Spending over 5 hours with friends increases the likelihood of e-cigarette use by 2.4 times. Additionally, individuals with more smokers in their living environment are more likely to use e-cigarettes, highlighting the importance of social context in determining tobacco and nicotine product use.[39 40] Family and peer behaviours significantly influence e-cigarette use, with higher chances of usage if one's mother or friend is a smoker.[41 42] Notably, having a friend who uses e-cigarettes showed the strongest association, emphasising the considerable impact of peer behaviour and attitudes on young adults' e-cigarette use.[43]

The study revealed that a significant number of university students have a negative attitude towards e-cigarettes, highlighting their diverse opinions and perceptions. These concerns include safety, social norms, government regulation and potential as smoking cessation aids. Students with negative attitudes were 2.6 times more likely to use e-cigarettes, emphasising the importance of understanding these attitudes as behavioural predictors.[43] Students with negative attitudes towards e-cigarette use may view them as a safer alternative to traditional smoking and associate their use with sophistication and cultural advancement, consistent with findings documented in other countries.[33–35]

The study emphasises the need for policymakers to develop targeted initiatives to address negative attitudes and behaviours related to e-cigarettes, which can help reduce usage and aid current smokers in quitting. It also found a positive correlation between knowledge and attitude scores, suggesting that knowledge-based initiatives can influence and correct attitudes towards e-cigarettes.

The study's primary strengths lie in its large sample size and that it was conducted across a diverse selection of six large universities, emphasising its statistical power and the potential for generalisability of its findings. However, the study is subject to several limitations that should be considered. First, the cross-sectional design of a study is efficient for data collection. However, it limits the ability to establish causal relationships between variables due to its limited ability to track changes over time. Second, despite efforts to enhance the reliability of the measurement tool, the reliance on self-reported data introduces potential information bias, as participants' responses may be influenced by social desirability. Third, while the study had a large sample size of Palestinian university students, caution should be taken when extrapolating the findings to other populations since cultural and environmental differences may influence the generalisability of the results. Finally, the knowledge section of the study may have covered only some aspects of e-cigarette awareness. This was done to keep the questionnaire concise and promote increased student participation.

## CONCLUSION

This study highlights the worrying rise in e-cigarette use among young people, particularly university students. Negative attitudes towards e-cigarettes underline the need for specific initiatives to clarify misperceptions and encourage educated student decision-making. The study reflects the importance of knowledge in shaping attitudes and behaviours regarding e-cigarettes, as many students were unaware of their health risks. Social factors, including peer interactions and living surroundings, also affect university students' e-cigarette use. Gendered differences, waterpipe smoking, physical activity, and coffee consumption affect e-cigarette use.

Strategies to address smoking among university students should be multifaceted, considering factors such as peer influence, marketing and advertising tactics by the tobacco and vaping industries, and the role of educational institutions in promoting healthy behaviours.

**Acknowledgements** The authors would like to express their sincere appreciation and gratitude for all those who participated in the study. We thank the university administrations for granting permission and cooperating with data gathering at their campuses. The authors would like to thank An-Najah National University ( www.najah.edu) for the technical support provided to publish this article.

**Contributors** ZN and BM contributed to the study conception. ZN led the study design and supervised data collection and analysis. ZN also acted as guarantor for this study. RA, BD, MH, FA-J and IA were responsible for data collection. ZN and BM did the final analysis and interpretation and wrote the first draft of the manuscript. All authors contributed to successive drafts of the manuscript. All authors approved the final draft.

**Funding** The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

**Competing interests** None declared.

**Patient and public involvement** Patients and/or the public were not involved in the design, or conduct, or reporting or dissemination plans of this research.

**Patient consent for publication** Not applicable.

**Ethics approval** This study involves human participants and was approved by Institutional Review Board of An-Najah National University (Reference #: Med. Jan.2023/1), Participants gave informed consent to participate in the study before taking part.

**Provenance and peer review** Not commissioned; externally peer reviewed.

**Data availability statement** Data are available upon reasonable request.



**ORCID iDs**
Zaher Nazzal http://orcid.org/0000-0002-2655-6109
Beesan Maraqa http://orcid.org/0000-0002-6997-0449

## REFERENCES

1 Kim J, Song H, Lee J, *et al*. Smoking and passive smoking increases mortality through mediation effect of cadmium exposure in the United States. *Sci Rep* 2023;13:3878.
2 Klein MD, Sokol NA, Stroud LR. Electronic cigarettes: common questions and answers. *Am Fam Physician* 2019;100:227–35.
3 Besaratinia A, Tommasi S. An opportune and unique research to evaluate the public health impact of electronic cigarettes. *Cancer Causes Control* 2017;28:1167–71.
4 Zhang Y-Y, Bu F-L, Dong F, *et al*. The effect of E-cigarettes on smoking cessation and cigarette smoking initiation: an evidence-based rapid review and meta-analysis. *Tob Induc Dis* 2021;19:04.
5 Levett JY, Filion KB, Reynier P, *et al*. Efficacy and safety of E-cigarette use for smoking cessation: a systematic review and meta-analysis of randomized controlled trials. *Eur Heart J* 2021;42:ehab724.
6 Tehrani H, Rajabi A, Ghelichi- Ghojogh M, *et al*. The prevalence of electronic cigarettes vaping globally: a systematic review and meta-analysis. *Arch Public Health* 2022;80:240.
7 Kim J, Lee S, Chun J. An international systematic review of prevalence, risk, and protective factors associated with young people's E-cigarette use. *Int J Environ Res Public Health* 2022;19:11570.
8 Jones RD, Asare M, Lanning B. A retrospective cross-sectional study on the prevalence of E-cigarette use among college students. *J Community Health* 2021;46:195–202.
9 Wamamili B, Wallace-Bell M, Richardson A, *et al*. Electronic cigarette use among university students aged 18-24 years in New Zealand: results of a 2018 national cross-sectional survey. *BMJ Open* 2020;10:e035093.
10 Al Sabbah H, Assaf EA, Dabeet E. Prevalence of smoking (cigarette and waterpipe) and its association with obesity/overweight in UAE and Palestine. *Front Public Health* 2022;10:963760.
11 Tucktuck M, Ghandour R, Abu-Rmeileh NME. Waterpipe and cigarette tobacco smoking among Palestinian university students: a cross-sectional study. *BMC Public Health* 2017;18:1.
12 Nazzal Z, Abu Al-Halaweh M, Musmar S. Prevalence of water-pipe smoking and associated factors among university students in Palestine a cross sectional study. *Pal Med Pharm J* 2020;5:107–601.
13 Tavafian SS, Aghamolaei T, Madani A. Predictors of speeding behavior among a sample of Iranian commercial automobile drivers: an application of the theory of planned behavior. *Traffic Inj Prev* 2011;12:274–8.
14 Wang W, Lu M, Cai Y, *et al*. Awareness and use of E-cigarettes among university students in Shanghai, China. *Tob Induc Dis* 2020;18:76.
15 Alduraywish SA, Aldakheel FM, Alsuhaibani OS, *et al*. Knowledge and attitude toward E-cigarettes among first year university students in Riyadh, Saudi Arabia. *Healthcare (Basel)* 2023;11:502.
16 OpenEpi menu. Available: https://www.openepi.com/Menu/OE_Menu.htm [Accessed 20 Nov 2022].
17 Lødrup Carlsen KC, Skjerven HO, Carlsen KH. The toxicity of E-cigarettes and children's respiratory health. *Paediatr Respir Rev* 2018;28:63–7.
18 Aghar H, El-Khoury N, Reda M, *et al*. Knowledge and attitudes towards E-cigarette use in Lebanon and their associated factors. *BMC Public Health* 2020;20:278.
19 Kandra KL, Ranney LM, Lee JGL, *et al*. Physicians' attitudes and use of E-cigarettes as cessation devices, North Carolina, 2013. *PLoS One* 2014;9:e103462.
20 Hagren B, Pettersen IM, Severinsson E, *et al*. The haemodialysis machine as a lifeline: experiences of suffering from end-stage renal disease. *J Adv Nurs* 2001;34:196–202.
21 Whittington JR, Simmons PM, Phillips AM, *et al*. The use of electronic cigarettes in pregnancy: a review of the literature. *Obstet Gynecol Surv* 2018;73:544–9.
22 National Center for Chronic Disease Prevention and Health Promotion (US) Office on Smoking and Health. *E-Cigarette use among youth and young adults: a report of the surgeon general*. Atlanta (GA): Centers for Disease Control and Prevention (US), 2016.
23 CDC. Adult tobbaco information. 2018.
24 Foulds J, Veldheer S, Yingst J, *et al*. Development of a questionnaire for assessing dependence on electronic cigarettes among a large sample of ex-smoking E-cigarette users. *Nicotine Tob Res* 2015;17:186–92.
25 Garland R. The mid-point on a rating scale: is it desirable?. *Mark Bull* 1991;2:66–70.
26 Al-Sawalha NA, Almomani BA, Mokhemer E, *et al*. E-cigarettes use among university students in Jordan: perception and related knowledge. *PLoS One* 2021;16:e0262090.

27 Zyoud SH, Al-Jabi SW, Sweileh WM. Worldwide research productivity in the field of electronic cigarette: a bibliometric analysis. *BMC Public Health* 2014;14:667.
28 Qanash S, Alemam S, Mahdi E, *et al*. Electronic cigarette among health science students in Saudi Arabia. *Ann Thorac Med* 2019;14:56–62.
29 Milicic S, Piérard E, DeCicca P, *et al*. Examining the association between physical activity, sedentary behavior and sport participation with E-cigarette use and smoking status in a large sample of Canadian youth. *Nicotine Tob Res* 2019;21:285–92.
30 PCBS. *Announces the preliminary results of the Smoking and Tobacco Consumption Survey*. 2021.
31 Cornelius ME, Wang TW, Jamal A, *et al*. Tobacco product use among adults - United States, 2019. *MMWR Morb Mortal Wkly Rep* 2020;69:1736–42.
32 Le HTT, Tran ATV, Nguyen AQ, *et al*. E-cigarette use among university students from one University in Hanoi, Vietnam, and associated factors. *Asian Pac J Cancer Prev* 2022;23:3649–55.
33 Almutham A, Altami M, Sharaf F, *et al*. E-cigarette use among medical students at Qassim University: knowledge, perception, and prevalence. *J Family Med Prim Care* 2019;8:2921.
34 Fang J, Ren J, Ren L, *et al*. Electronic cigarette knowledge, attitudes and use among students at a University in Hangzhou, China. *Tob Induc Dis* 2022;20:09.
35 Kurdi R, Al-Jayyousi GF, Yaseen M, *et al*. Prevalence, risk factors, harm perception, and attitudes toward E-cigarette use among university students in Qatar: a cross-sectional study. *Front Public Health* 2021;9:682355.
36 Higgins ST, Kurti AN, Redner R, *et al*. A literature review on prevalence of gender differences and intersections with other vulnerabilities to tobacco use in the United States, 2004–2014. *Prev Med* 2015;80:89–100.
37 Hammal F, Chappell A, Wild TC, *et al*. Herbal' but potentially hazardous: an analysis of the constituents and smoke emissions of tobacco-free Waterpipe products and the air quality in the Cafés where they are served. *Tob Control* 2015;24:290–7.
38 Neddermann-Carrillo S, Abidi L, Gea A, *et al*. "Tobacco and alcohol co-use: lifestyle and Sociodemographic factors, and personality aspects as potential predictors in the "Seguimiento Universidad de Navarra" cohort". *Res Nurs Health* 2024. 10.1002/nur.22367 [Epub ahead of print 13 Jan 2024].
39 Christakis NA, Fowler JH. The collective dynamics of smoking in a large social network. *N Engl J Med* 2008;358:2249–58.
40 Yong H-H, Chow R, East K, *et al*. Do social norms for cigarette smoking and nicotine vaping product use predict trying nicotine vaping products and attempts to quit cigarette smoking amongst adult smokers? Findings from the 2016-2020 International tobacco control four country smoking and vaping surveys. *Nicotine Tob Res* 2023;25:505–13.
41 Coleman M, Donaldson CD, Crano WD, *et al*. Associations between family and peer E-cigarette use with adolescent tobacco and marijuana usage: a longitudinal path analytic approach. *Nicotine Tob Res* 2021;23:849–55.
42 Trucco EM, Cristello JV, Sutherland MT. The impact of parents and peers on adolescent electronic cigarette use. *J Adolesc Health* 2021;68:780–6.
43 Scheinfeld E, Crook B, Perry CL. Understanding young adults' E-cigarette use through the theory of planned behavior. *Health Behav Policy Rev* 2019;6:115–27.