The epidemiology of electronic cigarette smoking among university students in the West Bank: Practice, motivation, and dependence of a new emerging hazard

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ABSTRACT

INTRODUCTION Tobacco smoking has reached an alarming rate among the young Palestinian population, specifically university students. Electronic cigarettes or e-cigarettes, are an emerging hazard in the West Bank. However, the epidemiology of e-cigarette smoking among Palestinians is poorly described. Therefore, we aimed to determine the prevalence, pattern, motivation, dependence, and readiness to quit e-cigarette smoking among male university students.

METHODS In 2022, face-to-face interviews were conducted in a cross-sectional study that included male students from the largest public universities north of the West Bank. The Fagerström test was used to determine dependence on e-cigarette smoking. In addition, a Ladder contemplation scale was used to assess the readiness to quit smoking. Finally, adjusted binary logistic regression was used to assess the association between e-cigarettes and other tobacco forms.

RESULTS A total of 548 students agreed to participate, and 20 were excluded. Most e-cigarette smokers (71.4%) had low dependence on e-cigarette smoking, while 17.1% and 11.4% had moderate and high dependence, respectively. Moreover, 58.6% were ready to quit, and 42.9% tried quitting smoking for several days to a month. E-cigarette smoking was associated with cigarette smoking (AOR=2.16; 95% CI: 1.18–3.95, p=0.013), waterpipe smoking (AOR=4.31; 95% CI: 2.44–7.61, p<0.001), and energy drink use (AOR=2.80; 95% CI: 1.43–5.48, p=0.003). E-cigarette smokers believed that e-cigarettes tasted better (68.6%), cheaper (37.1%), less harmful (28.6%), and more refined than traditional cigarettes (27.8%).

CONCLUSIONS Because of its alluring flavors and perceived lack of harmful health effects, e-cigarette smoking has grown popular among Palestinian university students. E-cigarette smokers were also cigarette and waterpipe smokers, and energy drink consumers. We recommend cessation programs for students willing to quit and provide better education regarding e-cigarette smoking and its health effects.

INTRODUCTION

Tobacco smoking is a major cause of preventable morbidity and premature mortality[1]. Non-traditional tobacco smoking forms like waterpipes and electronic cigarettes (e-cigarettes) have become more prevalent in the past few years, especially among youth and young adults[2-5]. The key factors in their popularity are various, starting with the different flavors one can use, peer pressure, or the perception that they are less harmful[6,7]. Although the primary purpose of using e-cigarettes was to aid smoking cessation, many studies have shown that e-cigarettes are linked to smoking relapse in former smokers and even initiation in non-smokers[5,8,9].

Tobacco smoking is a growing problem among the young Palestinian population, specifically university students[10-13]. According to the Palestinian Central Bureau of Statistics (PCBS), in 2010, the percentage of male smokers aged

15–29 years in the West Bank reached 38.1%[14]. In 2016, the prevalence of lifetime cigarette and waterpipe smoking had reached an alarming rate among 10th-grade male Palestinian students; 40.6% were current cigarette smokers and lifetime use of cigarettes reached 59.7%[15]. In 2017, the current cigarette and waterpipe smoking percentage among Palestinian university students was 30.0% and 33.4%, respectively[11]. A recent study in 2021 revealed that the most daily consumed substances were cigarettes (58.9%), waterpipe (23.6%), and e-cigarettes (17.5%), with mean initiation ages of 16.9, 16.5, and 18.3 years, for cigarettes, waterpipes, and e-cigarettes, respectively[13]. Moreover, the PCBS announced in 2021 that 4% of individuals aged ≥18 years in the West Bank were e-cigarette smokers[10]. All previous studies concluded that smoking is a growing problem among the young Palestinian population, specifically university students, making smoking an ever rising problem. Moreover, these studies indicated that e-cigarettes are emerging hazards in the West Bank, specifically among university students[7,13]. However, these studies revealed no information on e-cigarette smoking among Palestinian university students. Due to the high prevalence of tobacco smoking among male Palestinians and the emergence of e-cigarettes among young adults, we conducted a cross-sectional study to thoroughly investigate the prevalence of e-cigarette smoking, dependence, practice, motivation for use, and readiness to quit smoking.

METHODS

Study design, settings, and population

This cross-sectional study was completed between June 2022 and November 2022. It was conducted in three universities north of the West Bank; An-Najah National University (ANNU) in Nablus, Palestinian Technical University (PTU) in Tulkarm, and Al-Quds Open University in Nablus, Palestine. Students were included if they were males, aged 18–24 years, and signed an informed consent. Students were excluded if they were from the Faculty of Physical Education as they exercise more than other students and are less likely to smoke, and students from the Faculty of Sharia - Islamic Studies as religious beliefs may interfere with smoking.

Sample size and sampling technique

According to a previous study, the prevalence of e-cigarette smoking among Palestinian young adults was estimated to be 17.5%[13]. In a population of 21000 male students in the three universities, and with a level of confidence of 95% and a precision of 5%, the minimum estimated sample size to meet the study objectives was 221. Students were invited to participate through flyers, social media, and the university portals. First, a proportional sampling technique was used to select participants from the three universities (2:1:1), and then the sample was stratified based on the academic years and the faculties. Finally, a convenience sampling technique was used to select participants from each academic year in each university. To reduce selection bias, we increased the target sample size to 442.

Research tools, validity and reliability, and operational definitions

Data on smoking status and other factors were collected via interview. A face-to-face interview was chosen to ensure no missing data. The questionnaire consisted of five parts. Part one was for the sociodemographic data. Part two was data regarding smoking and other related substance intake, factors influencing smoking, energy drink, coffee, black and green tea, and chocolate. Part three was the modified Fagerström test for e-cigarette dependence scale, from 0 to 10 with equivalent six Fagerström scale questions[16]. This scale categorizes e-cigarette dependence into low (0–3 points), moderate (4–6 points) and high (7–10 points)[16]. Part four was data regarding e-cigarette smoking, motivation, and attitudes. Part five was about quitting e-cigarette smoking and the Ladder contemplation scale, which is a 10-point scale with a cutoff of 6 or more, meaning preparedness to quit smoking[17]. The Arabic versions of the modified Fagerström

Table 1. Sociodemographic characteristics of university students from the West Bank, 2022 (N=528)

Characteristics	n (%)
Residence	
City	175 (33.1)
Village	331 (62.7)
Camp	22 (4.2)
Social status	
Single	509 (96.4)
Married	4 (0.8)
Other	15 (2.8)
Employment status	
Unemployed	247 (46.8)
Employed	281 (53.2)
Academic year	
First	129 (24.4)
Second	160 (30.3)
Third	109 (20.6)
Fourth	95 (18.0)
Fifth	16 (3.0)
Sixth	19 (3.6)
Study field	
Medicine and Health Sciences	212 (40.2)
Other	316 (59.8)

Table 2. Frequencies and patterns of tobacco and caffeine intake of university students from the West Bank, 2022 (N=528)

Use status	n (%)	Use pattern	n (%)
E-cigarettes		**E-cigarettes**	
Current user	70 (13.3)	1–10 mL daily	47 (67.1)
Never user	455 (86.2)	11–20	13 (18.6)
Ex-user	3 (0.6)	21–30	4 (5.7)
		>30	6 (8.6)
Cigarettes		**Cigarettes**	
Current user	196 (37.1)	1–10 cigarettes daily	67 (34.2)
Never user	325 (61.6)	11–20	82 (41.8)
Ex-user	7 (1.3)	21–30	24 (12.2)
		>30	23 (11.7)
Waterpipe		**Waterpipe**	
Current user	159 (30.1)	Less than half a head daily	78 (49)
Never user	359 (68.0)	0.5–1 head	30 (18.9)
Ex-user	10 (1.9)	More than one head	51 (32.1)
Dual			
All types	29 (5.5)		
Cigarettes and waterpipe	47 (8.9)		
E-cigarettes and cigarettes	11 (2.1)		
E-cigarettes and waterpipe	16 (3.0)		
Energy drinks		**Energy drinks**	
Current user	275 (52.1)	1–5 cans (250 mL) weekly	184 (66.9)
Never user	243 (46.0)	6–10	56 (20.4)
Ex-user	10 (1.9)	>10	35 (12.7)
Coffee and its derivatives		**Coffee and its derivatives**	
Current user	402 (76.1)	1–5 cups (250 mL) weekly	183 (45.5)
Never user	126 (23.9)	6–10	115 (28.6)
		>10	104 (25.9)
Black tea		**Black tea**	
Current user	343 (65.0)	1–5 cups (250 mL) weekly	189 (55.1)
Never user	185 (35.0)	6–10	97 (28.3)
		>10	57 (16.6)
Green tea		**Green tea**	
Current user	60 (11.4)	1–5 cups (250 mL) weekly	49 (81.7)
Never user	467 (88.4)	6–10	11 (18.3)
Ex-user	1 (0.2)	>10	0 (0.0)
Chocolate		**Chocolate**	
Current user	439 (83.1)	1–5 bars weekly	233 (53.1)
Never user	89 (16.9)	6–10	134 (30.5)
		>10	72 (16.4)

test for the e-cigarette dependence scale and the Ladder contemplation scale were translated by the back-to-back method by bilingual persons. A pilot study (n=30) was conducted to evaluate the questionnaire's validity and the time required to finish the interview. The questionnaire was revised and re-tested. The reliability of the Fagerström test in Arabic was found to be 0.686, which is considered reliable[18] and the Ladder contemplation high test-retest reliability (r=0.985).

A current smoker of a particular tobacco product is a student who smoked this product during the past 30 days[19,20]. A heavy cigarette smoker is defined as smoking 20 or more daily[21]. A current intake of related substances (energy drinks, coffee and its derivatives, black tea, green tea, chocolate) is a user for a particular substance in the last 30 days. The amount of smoking was defined as the amount of e-cigarette liquid (mL) smoked per day, the number of cigarettes per day for traditional cigarettes, and the number of waterpipe heads per day.

Statistical analysis

All analyses were performed using IBM SPSS Statistics for Mac, version 23 (IBM Corp., Armonk, NY, USA). Kolmogorov-Smirnov test was used to test the normality of continuous variables distribution. Descriptive statistics were calculated for the point-prevalence of reported substance use. The adjusted binary logistic regression model was used to assess the association of cigarette and waterpipe smoking with e-cigarette smoking and to evaluate the relative risk by generating the adjusted odds ratios (AOR) and 95% confidence intervals (CI) for factors associated with e-cigarette smoking. The model was adjusted to age, academic year, working status (with work vs without work), place of living (urban vs rural), faculty (Medical and Health Sciences vs Other), and energy drink, black tea, green tea, and coffee (users vs non-user). In addition, the interaction between variables, cigarette smoking, waterpipe smoking, and energy drink use, was tested. Finally, $p<0.05$ was used as the significance level.

RESULTS

Background information

In total, 548 students agreed to participate; 20 were excluded as they were not in the age group. The final sample size was 528. The mean age was 20.2 ± 1.6 years. The majority (96.4%) were singles, 62.7% were from villages, 53.2% had work, and 40.2% were Medical and Health Sciences students (Table 1).

Tobacco smoking practice and pattern of use

For current tobacco smoking, 13.3% were e-cigarette smokers, 37.1% were cigarette smokers, 30.1% were waterpipe smokers, 5.5% smoked all types of tobacco, 8.9% were dual cigarette and waterpipe smokers, and 2.1% were dual e-cigarette, and cigarette smokers. For current caffeine

Table 3. E-cigarette smoking, dependence, motivation, and readiness to quit of university students from the West Bank, 2022 (N=528)

Variable	n (%)
Modified Fagerström scale questions	
How soon after waking do you vape your electronic cigarette (minutes)?	
<5	14 (20.0)
5–30	5 (7.1)
31–60	6 (8.6)
>60	45 (64.3)
Do you find it difficult to refrain from vaping in places where it is forbidden, such as mosques, churches, and libraries?	
Yes	15 (21.4)
No	55 (78.6)
Which vaping would you hate to give up?	
First-morning vape	23 (32.9)
Any other time vape	47 (67.1)
Do you vape more frequently in the morning?	
After waking	20 (28.6)
During the day	50 (71.4)
Do you vape even if you are sick in bed most of the day?	
Yes	24 (34.3)
No	46 (65.7)
E-cigarette dependence by the modified Fagerström scale	
High	8 (11.4)
Moderate	12 (17.1)
Low	50 (71.4)
Motivation for e-cigarette smoking	
I am an ex-smoker, and now I use vaping as a replacement	8 (11.4)
I never used cigarettes, and I vape instead	22 (31.4)
I use both cigarettes and e-cigarettes	27 (38.6)
E-cigarettes are cheaper than cigarettes	26 (37.1)
E-cigarettes taste better than cigarettes	48 (68.6)
I was told e-cigarettes are less harmful than cigarettes	20 (28.6)
E-cigarettes are considered to be more fashionable than cigarettes by the society	19 (27.1)
Someone encouraged me to smoke e-cigarettes	8 (11.4)
I do not have a good reason	16 (22.9)

Continued

Table 3. Continued

Variable	n (%)
My friends smoke e-cigarettes	16 (22.9)
Multiple reasons	61 (87.1)
Quitting e-cigarette smoking	
Readiness to quit smoking-based ladder contemplation scale	41 (58.6)
Have you tried to quit vaping (Yes)	30 (42.9)
Have you succeeded in quitting (Yes)	24 (80)
If you succeeded, for how long did you quit?	
Less than a week	4 (16.7)
One week to one month	8(33.3)
More than a month	12 (50.0)
What helped you quit vaping?	
Family support	3 (12.5)
Friends support	4 (16.7)
Doctor support	3 (12.5)
Medications	2 (8.3)
Its use resulted in health problems	4 (16.7)
No specific reason	4 (16.7)
It's expensive	2 (8.3)
My own determination	2 (8.3)

intake, 52.1% were energy drinks consumers, 76.1% were coffee and its derivatives consumers, 65% were black tea consumers, 11.4% were green tea consumers, and 83.1% were chocolate consumers. Of the cigarette smokers, 23.9% smoked more than 20 daily, considered heavy smoking. Moreover, 67.1% of e-cigarette smokers smoked 1–10 mL daily, and 51% of waterpipe smokers smoked ≥0.5 head a day (Table 2).

E-cigarette smoking dependence, motivation, and attempts to quit

Among e-cigarette smokers, 71.4%, 17.1%, and 11.4% had a low, moderate, and high dependence on e-cigarettes, respectively. The majority (87.1%) had multiple reasons or motivations to smoke e-cigarettes, 68.6% believed that e-cigarettes tasted better than regular cigarettes, 37.1% believed that e-cigarettes were cheaper than cigarettes, 28.6% believed that e-cigarette smoking is less harmful than traditional cigarette smoking, and 27.1% believed that e-cigarette smoking was more fashionable than traditional cigarettes. The percentage of e-cigarette smokers with readiness to quit smoking based on the Ladder contemplation scale was 58.6%. Moreover, 42.9% tried to quit e-cigarette smoking, and only 50% could quit for a few days to one month, and the rest for more than one month (Table 3).

Factors associated with e-cigarette smoking

Table 4 describes the adjusted binary logistic regression

Table 4. Adjusted binary logistic regression for the association between e-cigarette smoking and other tobacco forms, cigarette and waterpipe smoking of university students from the West Bank, 2022 (N=528)

E-cigarette smoking (Yes)[a]	Reference category	AOR	95% CI		p
			Lower	Upper	
Cigarette smoking (Yes)	No	2.16	1.18	3.95	0.013*
Waterpipe smoking (Yes)	No	4.31	2.44	7.61	<0.001*
Energy drinks intake (Yes)	No	2.80	1.43	5.48	0.003*
Coffee and derivatives intake (Yes)	No	0.50	0.24	1.04	0.06
Black tea intake (Yes)	No	0.83	0.46	1.51	0.55
Green tea intake (Yes)	No	1.32	0.62	2.82	0.47
Chocolate intake (Yes)	No	1.72	0.68	4.34	0.25
Living in a city	Live in a rural area	1.52	0.85	2.72	0.15
Being a medical student	Not a medical student	1.10	0.57	2.14	0.78
Working and studying	Not working	1.15	0.58	2.30	0.69
Working sometimes		1.18	0.51	2.72	0.71
Academic year		1.08	0.76	1.54	0.66
Age		0.87	0.65	1.16	0.35

a The reference category for e-cigarette smoking is 'No'. AOR: adjusted odds ratio; adjusted for age, academic year, working status (with work vs without work), place of living (urban vs rural), faculty (Medical and Health Sciences vs Other), and energy drink, black tea, green tea, and coffee (user vs non-user). *p<0.05.

for the factors associated with e-cigarette smoking. Factors associated with the e-cigarette smoking were cigarette smoking (AOR=2.16; 95% CI: 1.18–3.95, p=0.013), waterpipe smoking (AOR=4.31, 95% CI: 2.44–7.61, p<0.001), and energy drink use (AOR=2.80; 95% CI: 1.43–5.48, p=0.003). No interaction between variables, cigarette smoking, waterpipe smoking, and energy drink intake, was determined (p>0.05).

DISCUSSION

In agreement with other studies, e-cigarette smoking was associated with energy drink use and all other tobacco forms[8,9,22]. Although traditional cigarette smoking remains the most prevalent form of tobacco smoking, e-cigarette smoking is becoming a more socially acceptable alternative, emphasizing that e-cigarettes are becoming popular and socially accepted among Palestinian university students.

Most e-cigarette smokers in this study presented multiple motivations for vaping. The most frequent reason was the perceived better taste of e-cigarettes compared with traditional cigarettes. In agreement with other studies, around a third of the students considered vaping safer and cheaper than traditional smoking[23-25]. Moreover, around one-third of the study participants stated that e-cigarettes are more refined than traditional cigarettes, which agrees with the notion that e-cigarettes are becoming more socially accepted among the youth[7,26]. Considering these notions, it is imperative to conduct further studies to examine the safety of e-cigarette smoking and the potential health hazards associated with it. This is important because positive perceptions about e-cigarette smoking can make it harder for smokers to quit. In addition, most e-cigarettes contain highly addictive substances, mainly nicotine[27]. However, they deliver different nicotine levels, potentially varying their addictive potential[28]. Reports have shown that the amount of nicotine varies based on the liquid used and has an average consumption that may exceed what is equivalent to one pack of cigarettes at 200 puffs[29]. Therefore, it was estimated that nicotine dependence levels were higher among e-cigarette smokers than traditional ones, and the dependence increases when used with cigarette smoking[30,31]. However, it is a controversial topic that requires more research[32]. In this study, 28.5% of e-cigarette smokers had a moderate or high dependence on smoking. Furthermore, e-cigarette smokers were more likely to be cigarette and waterpipe smokers. In addition, one-third of the e-cigarette smokers smoked more than 10 mL of e-cigarette liquid daily. These results indicate that Palestinian e-cigarette smokers are heavy smokers. Further studies are recommended to explore the factors and risks associated with increased e-cigarette dependence among Palestinians[33]. There have been connections made between e-cigarettes smoking and both the relapse of former smokers and the initiation of non-smokers into smoking[7-9]. The odds of smoking cessation were lower among people who smoked e-cigarettes than those who did not[34], which supports the notion that e-cigarettes are highly addictive. Although around two-thirds of the e-cigarette smokers in this study were ready to quit smoking, only 42.9% of the e-cigarette smokers succeeded in quitting for less than one month. Only 0.3% of the study population were ex-users. In addition, few of them sought medical assistance for quitting, highlighting the importance of implementing educational programs that enable students to find and seek advice from reliable sources. We recommend implementing cessation programs for students who smoke, providing better education to them about the health effects of e-cigarettes, and further studying the relation between energy drinks and e-cigarettes.

Limitations

This study has some limitations. First, this study did not determine the amount of nicotine and components of the e-liquids in the e-cigarettes, which could be correlated to the dependence levels. Moreover, we did not measure the dependence on waterpipe and cigarette smoking by the Fagerström scale to correlate it with e-cigarette dependence. We did not also ask about the initiation age and the number of quitting attempts. Moreover, the lack of previous similar studies about e-cigarette smoking in Palestine and neighboring countries made it difficult to predict the change in Palestine regarding the use, motivation, dependence and quitting of this hazard. In addition, potential response bias, cross-sectional study design, and convenience sampling limit generalizability of findings and prevalence estimates of tobacco use. Despite these limitations, this is the first study to address motivations, readiness to quit, and dependence on e-cigarette smoking among Palestinians. Our study adds to the growing literature demonstrating the association between tobacco forms and dependence on e-cigarettes.

CONCLUSIONS

Because of its alluring taste, perceived lack of harmful health effects, and the perception that it is a more socially acceptable substitute for traditional cigarettes, e-cigarette smoking has grown popular among Palestinian university students. Moreover, cigarette and waterpipe smoking and energy drink use were factors associated with e-cigarette smoking. We recommend starting cessation programs for smokers and providing better education for the students and the general population regarding e-cigarettes and their health effects.

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DATA AVAILABILITY
The data supporting this research are available from the authors on reasonable request.

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