

Non-traditional tobacco smoking: An emerging risk in the West Bank among male Palestinians

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Popul. Med. 2024;6(May):15

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KEYWORDS

tobacco, e-cigarettes, vape, waterpipe, West Bank, hazard

Received: 1 December 2023, **Revised:** 11 April 2024,

Accepted: 27 May 2024

<https://doi.org/10.18332/popmed/189375>

ABSTRACT

INTRODUCTION Non-traditional tobacco products, such as waterpipes and e-cigarettes, are perceived to be less harmful than cigarettes. The north of the West Bank has become the site for growing tobacco production and consumption. This study aimed to estimate the current prevalence of non-traditional tobacco smoking (waterpipes and e-cigarettes) and associated risk factors among men in the West Bank.

METHODS In a cross-sectional study, a self-administered questionnaire was distributed among males aged ≥ 16 years in 2022 from the largest three governorates in the north of the West Bank ($n=1241$). Body mass index and waist circumferences were measured.

RESULTS The final number of participants was 1204, aged 16–58 years; 58.9% were singles, 69.4% were young adults, 22.1% were adolescents, 67.5% were cigarette smokers (53.9% heavy smokers), 35.3% were waterpipe smokers, and 15% e-cigarette smokers. Adjusted logistic regression results

revealed that risk factors associated with waterpipe smoking were e-cigarette smoking (AOR=3.29; 95% CI: 2.30–4.70), energy drink intake (AOR=1.62; 95% CI: 1.24–2.13), young adult age (AOR=2.15; 95% CI: 1.15–4.03), being a student without work (AOR=1.95; 95% CI: 1.09–3.50) or a working student (AOR=2.73; 95% CI: 1.32–5.65), and less likely to be associated with cigarette smoking (AOR=0.23; 95% CI: 0.18–0.31). In addition, an increased likelihood of central obesity was associated with waterpipe smoking (AOR=2.15; 95% CI: 1.15–4.03) and decreased with coffee intake (AOR=0.44; 95% CI: 0.27–0.87).

CONCLUSIONS Non-traditional tobacco smoking is an emerging hazard among male Palestinians, with waterpipe smoking linked to increased central obesity. Further research is needed to investigate the health consequences of this trend in the West Bank.

INTRODUCTION

Over one billion people frequently smoked tobacco in 2020, with men making up the majority compared to women¹. Smoking tobacco has a variety of forms, with cigarettes, the traditional form, being the most popular form, followed by waterpipe and electronic cigarettes (e-cigarettes) or vape (non-traditional forms)². Some studies attempted to describe non-traditional tobacco smoking's prevalence and highlighted its popularity^{3,4}. Non-traditional tobacco smoking has become increasingly popular globally, particularly among school and university students³⁻⁵. Waterpipe, also known as hookah, shisha, and nargile, is quite popular worldwide, particularly in the Middle East³. Moreover, e-cigarettes have become more prevalent in recent years, especially among university students⁶. This popularity is a result of its use

as a tool to assist smokers in quitting traditional smoking⁷. However, studies have revealed that e-cigarettes contribute to the relapse of former smokers, and some have even linked it to smoking initiation^{8,9}. Many factors also contribute to the increased prevalence of waterpipe smoking, including family members and peer pressure^{4,5}. Most importantly, there is misperception about the negative consequences of waterpipe tobacco smoking on health and a mistaken belief that it is less harmful than cigarette smoking¹⁰.

The north of the West Bank has become the site for growing tobacco production and consumption¹¹. Traditional tobacco smoking, or cigarette smoking, has shown a sharply increased prevalence among Palestinian males over the last decade in Palestine¹¹. The Palestinian Central Bureau of Statistics (PCBS) announced in 2021 that the percentage

of tobacco smoking in the West Bank reached 40.1%, and the results vary based on age, gender, and the governorate¹¹. However, in the last decade, the local epidemiological trend of tobacco smoking has undergone alarming changes, particularly in waterpipe tobacco smoking^{12,13}. A study conducted in 2021 revealed that cigarettes were the most commonly used by daily smokers (58.9%), followed by waterpipe (23.6%) and e-cigarettes (17.5%)¹⁴. Other studies revealed that waterpipe smoking was more common among males, younger age groups, those with a lower education level^{12,13} and as an alternative to cigarettes smoking¹⁵. A recent study in 2023 described the epidemiology of e-cigarette smoking among Palestinians and indicated that e-cigarette smoking is prevalent among university students (13.3%)¹⁶, while the PCBS indicated that 4% of individuals aged ≥ 18 years in the West Bank were e-cigarette smokers¹¹. Another study reported a high prevalence of tobacco smoking among Palestinian refugee men and linked their use with eating behaviors and obesity¹⁷. Moreover, waterpipe smoking was inversely associated with increased body mass index¹⁷. All previous research indicates that smoking is a growing problem among young Palestinians, particularly university students, and that waterpipe and e-cigarettes are emerging as significant hazards in the West Bank^{15,18-20}. However, most of these studies focused on university students. The high rates of waterpipe smoking among young people in Palestine are concerning and could have serious health consequences in the future. Therefore, this study aimed to estimate the prevalence of non-traditional tobacco smoking (waterpipe and e-cigarettes) and compare it to cigarette smoking among men in the West Bank. In addition, the study aimed to investigate possible factors associated with waterpipe smoking and its association with obesity among male Palestinians in the general population.

METHODS

Study design and setting

A cross-sectional study was held in 2022 in the largest three governorates in the north of the West Bank: Nablus, Tulkarm, and Jenin. We aimed to cover all geographical and demographic categories of the Palestinian population in the north of the West Bank.

Population, sample size, and sampling techniques

The targeted population was males, adolescents, and adults (aged ≥ 16 years) from the three governorates in the north of the West Bank. There are 954000 residents in these governorates, which is 78% of the population of the north of the West Bank. In order to give subjects an equal chance to participate in this study, the study area was stratified based on the governorates and then into three locations: cities, villages, and camps. Each location was divided into four substrata: east, west, north, and south. A proportional sample size was chosen based on the governorate, the location, and then on the sub-strata of the location. Subjects

were recruited to participate in this study through social media, flyers, and public announcements. Flyers were posted near or in hospitals, restaurants, municipalities, schools, and telecommunication centers. Stations and locations to meet the subjects were announced. In refugee camps, the stations were in the Committee Services for Refugee Camps. A convenience sampling technique was then used to choose the recruited subjects. The target sample size was 217 from each governorate. Those who did not consent or incompletely filled in the questionnaires, were excluded. The minimum age of selected participants was 15 years, as daily smoking often begins at this age²¹. This study was approved by the Institutional Review Board of An-Najah National University (ANNU) in Palestine with archived number 12 for the protocol. The study was completely anonymous, with no disclosure of personal details. Informed consent was obtained from all the participants before filling out the questionnaire.

Variables measurement

A self-administered questionnaire to report background information and variables related to general health and tobacco smoking was described elsewhere¹⁴. Briefly, the questionnaire consisted of four parts. Part one was for general information and sociodemographic data, including age, location, marital status, work status, and education level. Part two was data related to tobacco smoking, including frequency, pattern, and number of units per day. Part three was data regarding other related substance intakes: energy drinks, coffee, black and green tea, and chocolate. Part four was data related to body weight, height, and waist circumferences that were recorded by the investigators. Tobacco smoking was divided into two types: traditional and non-traditional. The traditional type included cigarette smoking, and the non-traditional type included waterpipe and e-cigarette smoking. A current smoker is defined as someone who has smoked a particular type of tobacco at least in the last 30 days. A heavy smoker was a participant who smoked >20 cigarettes per day²². Bodyweight was measured with minimal clothing and without shoes on a calibrated digital scale to the nearest 0.1 kg. The standing height without shoes was measured with a wall meter to the nearest 0.1 cm. Body Mass Index (BMI) was calculated as weight (kg) divided by height (m) squared. The waist circumference, or central obesity, was measured to the nearest 1.0 cm using a non-elastic tape. These measurements were taken following World Health Organization recommendations¹⁵. Waist circumference was measured halfway between the thoracic cage's inferior edge and the iliac crest's superior border²³. According to the International Diabetes Federation (IDF), a waist circumference ≥ 94 cm is considered high²⁴.

Data analysis

The whole process of analysis was performed using IBM

Table 1. Characteristics of participants, a cross-sectional study, West Bank, 2022 (N=1204)

Characteristics	Categories	n (%)
Age (years)	Adolescents 16–19	267 (22.1)
	Young adults 20–40	835 (69.4)
	Adults >41	102 (8.4)
Education level	No education, illiterate	134 (11.1)
	Elementary	413 (34.3)
	Secondary	57 (4.7)
	High school	551 (45.8)
	Undergraduate	49 (4.1)
Marital status	Single	709 (58.9)
	Married or other	495 (41.1)
Work status	Student without work	161 (13.4)
	Student with work	402 (33.4)
	Worker	566 (47.0)
	Without work	71 (5.9)
Location	City	447 (37.1)
	Village	413 (34.3)
	Camp	344 (28.6)

SPSS Statistics for Mac, version 22 (IBM Corp., Armonk, NY, USA). Percentages were used to represent categorical variables. An adjusted binary logistic regression model was used to generate the odds ratios (OR) and 95% confidence intervals (CI) for risk factors. To account for various factors associated with waterpipe smoking, the model was adjusted for age, marital status, location, job, and other substance use, such as cigarette, e-cigarettes, chocolate, coffee, tea, energy drinks, and alcohol. Similarly, for factors associated with increased waist circumferences, the model was adjusted for age, work, BMI, and other substance use, including cigarette, e-cigarettes, chocolate, coffee, tea, and energy drinks. Next, the interaction between confounders was tested. Finally, a comparison of significant differences between groups was made. A $p < 0.05$ was used as the significance level.

RESULTS

Characteristics of participants

In total, 1241 male subjects agreed to participate, and 37 questionnaires were excluded as they had incomplete information. The final number of participants was 1204 males aged 16–58 years. Most of the participants were singles (58.9%), with an education level of high school or lower (95.9%), had work (80.4%), and 33.4% were working students. The majority were young adults (69.4%), followed by adolescents (22.1%) and late adults (8.4%). The location

Table 2. Frequencies and patterns of tobacco smoking and other substance use, a cross-sectional study, West Bank, 2022 (N=1204)

	n (%)	Duration (years)		Daily use	n (%)
		Median (IQR)	Range		
Tobacco smoking					
Cigarettes	813 (67.5)	7.00 (4–14)	0–47	1–10 sticks	143 (17.6)
				11–20	232 (28.5)
				>21	438 (53.9)
Waterpipe	425 (35.3)	5.00 (3–8)	0–17	<½ head	110 (25.9)
				½–1	247 (58.1)
				>1	68 (16.0)
E-cigarettes	181 (15.0)	2.00 (1–3)	0–4	<10 puffs	36 (19.9)
				11–20	24 (13.3)
				21–30	26 (14.4)
				>30	95 (52.5)
Other substances					
Energy drinks	558 (46.3)	7.00 (3–11)	1–14	1–2 cans	358 (64.1)
Coffee and its derivatives	939 (78.0)				
Tea	688 (57.1)				

IQR: interquartile range.

Table 3. Univariate analysis for waterpipe use based on different factors, a cross-sectional study, West Bank, 2022 (N=1204)

Variables	Categories	Waterpipe yes n (%)	Waterpipe no n (%)	p
Cigarette smoking	Yes	216 (26.6)	597 (73.4)	<0.001
	No	209 (53.5)	182 (46.5)	
E-cigarette smoking	Yes	108 (59.7)	73 (40.3)	<0.001
	No	317 (31.0)	706 (69.0)	
Energy drinks intake	Yes	211 (37.8)	347 (62.2)	0.090
	No	214 (33.1)	432 (66.9)	
Coffee intake	Yes	318 (33.9)	621 (66.1)	0.050
	No	107 (40.4)	158 (59.6)	
Tea intake	Yes	240 (34.9)	448 (65.1)	0.728
	No	185 (35.9)	331 (64.1)	
Age (years)	Adolescents 15–19	109 (41.0)	157 (59.0)	0.012
	Young adults 20–40	290 (34.8)	544 (65.2)	
	Adults >41	25 (24.8)	76 (75.2)	
Education level	Illiterate	42 (31.3)	92 (68.7)	0.076
	Elementary	129 (31.2)	284 (68.8)	
	Secondary	19 (33.3)	38 (66.7)	
	High school	220 (39.9)	331 (60.1)	
	Diploma	1 (50.5)	1 (50.0)	
	University	14 (29.8)	33 (70.2)	
Marital status	Single	267 (37.7)	442 (62.3)	0.040
	Married or other	158 (31.9)	337 (68.1)	
Work status	Student without work	75 (46.6)	86 (53.4)	0.003
	Student with work	149 (37.1)	253 (62.9)	
	Worker	178 (31.4)	388 (68.6)	
	Without work	21 (29.6)	50 (70.4)	
Location	City	172 (38.5)	275 (61.5)	0.137
	Village	144 (34.9)	269 (65.1)	
	Camp	109 (31.7)	235 (68.3)	

of residence was closely distributed between the city (37.1%), village (34.3%), and camp (28.6%) (Table 1).

Prevalence and pattern of tobacco smoking and other substance use

The prevalence of cigarette smoking was 67.5%, with 53.9% smoking more than 20 cigarettes (pack) per day with a median duration of 7.00 years. The prevalence of waterpipe smoking was 35.3%, with a median duration of 5.00 years. The majority (58.1%) were smoking on average 0.5 to one head per day. For e-cigarettes, the prevalence was 15.0%, with 52.5% having more than 30 puffs on average per day.

The prevalence of other substances was as follows: coffee (78.0%), tea (57.1%), and energy drinks (46.3%) (Table 2).

Univariate analysis of waterpipe use based on different factors

Table 3 represents the associations between waterpipe tobacco smoking and different factors. The univariate analysis shows that the prevalence of waterpipe smoking is significantly higher among cigarette smokers ($p < 0.001$) and e-cigarette smokers ($p < 0.001$) than non-smokers, among singles (37.7%) than married (31.9%) ($p = 0.04$), among students without work (46.6%) than worker students

Table 4. Adjusted binary logistic regression for factors associated with waterpipe smoking*, a cross-sectional study, West Bank, 2022 (N=1204)

Covariates	Categories	OR	95% CI	p
Age (years)	Adolescents	1.170	0.833–1.644	0.366
	Young adults	2.149	1.145–4.032	0.017
	Adults ®	1		
Marital status	Single	0.842	0.534–1.327	0.459
	Married ®	1		
Location	Refugee camp	0.894	0.602–1.328	0.579
	City	0.917	0.618–1.359	0.666
	Village ®	1		
Work status	None working student	1.952	1.089–3.497	0.025
	Worker	1.277	0.848–1.924	0.241
	Working student	2.729	1.318–5.650	0.007
	No work ®	1		
Cigarette smoking	Yes*	0.234	0.175–0.313	<0.001
E-cigarette smoking	Yes*	3.287	2.301–4.696	<0.001
Energy drink intake	Yes*	1.624	1.237–2.134	<0.001
Coffee intake	Yes*	1.111	0.805–1.532	0.522
Tea intake	Yes*	1.146	0.842–1.560	0.385

*The reference value is the category 'No' for the substance use. ® Reference categories.

Table 5. Adjusted binary logistic regression for the risk of increased waist circumference* associated with e-cigarette smoking, a cross-sectional study, West Bank, 2022 (N=1204)

Covariates	Categories	Reference	AOR	95% CI	p
Age (years)			1.61	1.382–1.999	0.006
Body mass index (kg/m ²)	≥25	<25	2.43	1.871–3.141	<0.001
Work	Yes	No	0.913	0.358–1.012	0.067
Cigarette smoking	Yes	No	0.871	0.341–1.334	0.67
Waterpipe smoking	Yes	No	2.15	1.970–5.122	0.038
E-cigarettes	Yes	No	1.001	1.000–1.201	0.05
Energy drink consumption	Yes	No	1.251	0.690–1.573	0.413
Coffee consumption	Yes	No	0.437	0.266–0.865	0.015
Tea consumption	Yes	No	0.825	0.924–1.723	0.98
Chocolate consumption	Yes	No	0.481	0.228–1.013	0.054

*The reference category is 'Normal' for Waist circumference. AOR: adjusted odds ratio.

(37.1%) and workers (31.4%) (p=0.003), and among adolescents (41.0%) than young adults (34.8%) and late adults (24.8%) (p=0.012).

Factors associated with increased waterpipe smoking

Table 4 shows the factors that were associated with increased waterpipe smoking. Adjusted logistic regression

results revealed that factors that were associated with increased waterpipe smoking were cigarette smoking (AOR=0.23; 95% CI: 0.175–0.313, p<0.001), energy drink intake (AOR=1.62; 95% CI: 1.237–2.134, p<0.001), non-working students (AOR=1.95; 95% CI: 1.089–3.497, p=0.025), young adults (AOR=2.15; 95% CI: 1.145–4.032, p=0.017), working student (AOR=2.73; 95% CI: 1.318–5.650,

$p=0.007$), and e-cigarette smoking (AOR=3.29; 95% CI: 2.301–4.70, $p<0.001$).

Increased central obesity associated with smoking

Table 5 displays the odds of increased central obesity associated with smoking. Adjusted logistic regression results revealed that waterpipe smoking was associated with increased odds of central obesity (AOR=2.15; 95% CI: 1.97–5.12, $p=0.038$). Other factors that were associated with an increased odds of increased central obesity were age (AOR=1.61; 95% CI: 1.38–2.00, $p=0.006$) and increased body mass index (AOR=2.43; 95% CI: 1.87–3.14, $p<0.001$). Coffee consumption showed an inverse association with central obesity (AOR=0.44; 95% CI: 0.27–0.87, $p=0.015$).

DISCUSSION

In this study, cigarette and waterpipe smoking were highly prevalent among Palestinians in the West Bank (67.5% and 35.3%, respectively). These results are higher than the estimated global percentage (32.6%)¹, and even those of previous local studies^{14,17}. These results indicate that cigarette and waterpipe smoking has increased in recent years. Moreover, the prevalence of e-cigarette smoking (15%) was high compared to neighboring countries²⁵. The lack of previous studies to compare e-cigarette results in the general population is one of the constraints of this study. Therefore, there is a need for further research in the area of study.

In this study, the majority of e-cigarette (68.5%) and waterpipe (50.8%) smokers were cigarette smokers, which indicates dual traditional and non-traditional smoking⁸. Waterpipes and e-cigarettes are misconstrued as being safer than cigarettes^{10,26}. However, most e-cigarettes contain highly addictive substances, mainly nicotine, although they deliver different levels of nicotine²⁷. Therefore, e-cigarette smokers had higher nicotine dependence than traditional smokers, and it increased with cigarette smoking²⁷. However, it is a controversial topic that requires more research. Although e-cigarettes main purpose of use may be to help with smoking cessation, many studies have linked them to smoking relapse in former smokers and even initiation in non-smokers^{7,8}. In addition, the duration of usage of cigarette smoking (≤ 47 years and a median of 7 years) and waterpipe smoking (≤ 17 years and a median of 5 years) was greater than that of e-cigarette smoking (≤ 4 years and a median of 2 years), indicating that waterpipe and e-cigarette smoking are new emerging hazards in the West Bank. In agreement with other studies, most non-traditional tobacco smokers were single young adults and students. However, more investigation is required to fully comprehend the reasons behind e-cigarette smoking among this population, given the unique cultural and social context of Palestine. This can be made through exploring factors like peer pressure, social norms, and the advertising strategies used by e-cigarette companies in Palestine^{12,13,17}. Moreover, researchers and policymakers can work toward developing more effective

strategies to prevent and reduce e-cigarette usage among young adults and students in Palestine by gaining a more comprehensive understanding of these factors. In this study, the results show a significant association between energy drinks and waterpipe smoking. Moreover, the study found that 46.3% of male Palestinians consume energy drinks, which is consistent with previous studies. These results highlight the importance of understanding the factors that can influence both consumption of energy drinks and waterpipe smoking among young adults in Palestine, specifically males. Further research in this area could help develop targeted interventions that address the unique challenges^{15,17}.

Most waterpipe smokers (58.1%) smoked up to one head per day. In addition, the majority (53.9%) of cigarette smokers were heavy smokers (>20 cigarettes per day). One head of unflavored tobacco equals 70 cigarettes, and one session inhales several times more smoke than traditional smoking²⁸. Likewise, most e-cigarette users (52.5%) smoke >30 puffs per day, consuming 72–164 μg of nicotine per puff (equivalent to 13–30 cigarettes at 200 puffs)²⁷. Waterpipes have been shown to have similar respiratory effects to cigarettes²⁹. Therefore, these findings suggest that the more a person is exposed to these materials, the greater the health risks²⁹. Recently, Palestinian adolescent refugees who smoked waterpipes had higher rates of metabolic syndrome, dyslipidemia, and central obesity³⁰. E-cigarettes decrease airway resistance and conductivity and increase asthma and COPD risk³¹. They also caused anxiety, insomnia, and depression³².

In addition to extrapulmonary effects like immunological and neurodevelopmental^{33,34}, there may be a relation between using e-cigarettes and having greater weight³⁵. Many of these effects are dose-dependent³⁶. Waterpipe smokers' lack of physical activity is often shown during long smoking sessions in cafes or while eating meals as part of socio-cultural norms that cause metabolic effects and contribute to cardiovascular disease¹⁵. In this study, increased central obesity was associated with waterpipe smoking. Although the result of e-cigarette smoking being associated with central obesity was not statistically significant, it is on the boundary of statistical significance and hence should not be ignored. Therefore, these results indicate that waterpipe and e-cigarette smoking could have a similar effect on health. However, e-cigarette health effects on body mass index are poorly described and controversial. One study found that e-cigarette smoking increased abdominal obesity in Koreans³⁷. However, further longitudinal studies were recommended³⁷. On the other hand, another study linked e-cigarette use to a lower BMI³⁸. Considering the different types of tobacco smoking, the long duration of smoking, and Palestinians' heavy tobacco use, more studies are needed to determine the health effects of e-cigarette smoking. Moreover, to avoid the health consequences of non-traditional tobacco smoking, Palestinians should be

encouraged to quit and adopt healthier lifestyles. This could include evidence-based education, prevention programs, and effective smoking cessation aids.

Limitations

This study has several limitations. One of the limitations of this study is the lack of previous research to compare the results to, which could potentially limit the generalizability of the findings and make it difficult to draw firm conclusions. Therefore, we recommend further research on these topics. In addition, the number of puffs inhaled from e-cigarettes was measured regardless of the liquid concentration, which would significantly affect nicotine levels. Moreover, the initiation age for tobacco smoking was not assessed. Finally, the tea and coffee intake durations were not assessed due to recall bias. Despite these limitations, besides the large sample size, this is the first study to investigate non-traditional smoking in the general population of Palestine.

CONCLUSIONS

This study showed a new challenge in treating Palestinian males' emerging health conditions. This study found alarmingly high rates of traditional and non-traditional tobacco smoking among Palestinian men. Over two-thirds of the general tested population smoked cigarettes, and one-third smoked waterpipes. The study recommends working on more research on the health effects of non-traditional tobacco smoking, a new West Bank hazard. We also recommend helping smokers quit and educating students and the public about e-cigarettes and their health risks. These findings can raise awareness of the adverse events that may result from continued use of these hazards and spur change.

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ACKNOWLEDGEMENTS

The authors would like to thank the participants in this study. The authors are very thankful to the Committee Services for Refugee Camps in Jenin, Nablus, and Tulkarm and other centers for their help and providing locations to conduct the study.

CONFLICTS OF INTEREST

The authors have completed and submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest and none was reported.

FUNDING

There was no source of funding for this research.

ETHICAL APPROVAL AND INFORMED CONSENT

Ethical approval was obtained from the Institutional Review Board of An-Najah National University (ANNU) in Palestine (Approval number: 12; Date: September 2019). Participants provided informed consent.

DATA AVAILABILITY

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

PROVENANCE AND PEER REVIEW

Not commissioned; externally peer reviewed.