

# Water pipe Smoking: Prevalence and Addiction among University students in Palestine, Jordan, and Turkey

mohammed Hawash (✉ [mohawash@najah.edu](mailto:mohawash@najah.edu))

An-najah National University Faculty of Medicine and Health Sciences <https://orcid.org/0000-0001-5640-9700>

Rami Mosleh

An-najah National University Faculty of Medicine and Health Sciences

Ahmad Hanani

An-najah National University Faculty of Medicine and Health Sciences

Yazun Jarar

Al-Zaytoonah Private University of Jordan

Yousef Hajyousef

Cyprus International university



---

## Research

**Keywords:** Water pipe, Smoking, Addiction, Prevalence, Palestine, Jordan, Turkey

**Posted Date:** April 1st, 2020

**DOI:** <https://doi.org/10.21203/rs.3.rs-19928/v1>

**License:**   This work is licensed under a Creative Commons Attribution 4.0 International License. [Read Full License](#)

---

# Abstract

**Background** Smoking is one of the main causes of lung cancer. It was estimated that tobacco smoking might kill 10 million people annually in the next 20–30 years, and Shisha smoking has been a common habit worldwide during the last 20 years, especially in the Middle East. This study aimed to determine the prevalence of Shisha smoking and to make comparisons among three countries in the Middle East, thereby establishing factors associated with shisha smoking among university students in Palestine, Jordan, and Turkey.

**Method** An online cross-sectional study was carried out among university students from Palestine, Jordan, and Turkey. A total of 2030 students were selected for the study. The students were asked to answer an online structured questionnaire consisting of questions concerning the prevalence and patterns of Water pipe smoking and associated factors.

**Result** The overall prevalence of Water pipe smoking was 31.8%. Less than a quarter of university students (21.7%) had ever smoked Water pipe. The highest percentage of current Water pipe smokers were Palestinians (36.11%), and the lowest percentage was from Turkey (20.23%). Approximately 43% of Water pipe smokers believe that they will be addicted to Water pipe smoking and almost half of them smoke Water pipe daily. The highest percentage of Water pipe smokers were university students 25 years old and above. However, the highest percentages of university students who are Water pipe smokers were students with a low monthly income. The university students living with their families were smoking Water pipe less frequently than students living in private residencies.

**Conclusion** This study concludes that there is a high prevalence of Water pipe smoking among university students in Palestine, Jordan, and Turkey. The highest percentage was found among Palestinians, which might be because there are no Water pipe smoking regulations in Palestine, whereas there are in Turkey. Monthly income and living with the family were factors affecting the prevalence of Water pipe smoking.

## Background

Tobacco smoking is one of the main behavioural factors related to increased risk of cancer, which is one of the leading causes of death globally [1]. Cigarette smoking is a health-threatening factor that is associated with serious diseases, such as hypertension and atherosclerosis [2]. Nicotine is the predominant component in tobacco; it binds to nicotinic acetylcholine receptors in the brain causing an agonistic effect, which is why nicotine is addictive [3]. Tobacco kills about 6 million people annually, most of them in low-income countries, and the number is expected to increase to 8.3 million by 2030 due to smoking-related diseases [4]. Water pipe smoking has been related to multiple cancer types, such as keratoacanthoma and lung cancer [5, 6]. Water pipe smoking might affect multiple systems, both by direct contact with the Water pipe or by smoke inhalation. Water pipe smoking has been associated with a number of deleterious health outcomes, including periodontal disease respiratory illness, low birth-weight [5], elevation of total plasma lipids [7], and heart diseases (blood pressure, tachycardia, and deterioration of right ventricular function) [8, 9]. It was reported that Water pipe smokers have a significant decrease in lung function parameters [10].

Water pipe smoking is highly prevalent in developing countries, especially in the Eastern Mediterranean countries [11]. Water pipe smoking (by water pipe, Narghile, or Hookah) is a popular social habit, especially among adolescents. It has been claimed that more than 100 million people smoke Water pipe [12]. Smoking Water pipe is less harmful than cigarette smoking because the water helps to remove toxins and heavy metals. However, Water pipe smokers might inhale more smoke than cigarette smokers due to the longer duration of Water pipe smoking. In addition, one session of Water pipe smoking is found to be equivalent to smoking 100 cigarettes [13–15]. High concentrations of nicotine, tar, carbon monoxide, and heavy metals are present in the Water pipe smoke [13, 16]. Water pipe's country of origin is thought to be India, but others have stated that it is Ethiopia, South Africa, or Persia [17, 18].

Reviewing many published studies concerning the prevalence of Water pipe smoking conducted in various countries (Pakistan, Rwanda, Saudi Arabia, and Palestine), it is clear that the highest concentration of smokers was among the adolescent age group. Within these ages, the prevalence of Water pipe smoking has been reported as 19.7%, 21%, 12.6%, and 30–36% in Pakistan, Rwanda, Saudi Arabia, and Palestine, respectively [15, 19–21]. Compared to cigarette smoking, one study observed that Water pipe smoking is more addictive and more socially acceptable [12].

As reported by the World Health Organization (WHO) tobacco control papers, some countries have regulations to limit and restrict the water pipe smoking. In Turkey, a warning labelling must cover 65% of Water pipe bottles; this warns Water pipe smokers about the hazards of Water pipe smoking [22]. Due to the many harmful effects of Water pipe smoking on the smokers, our study focused on the prevalence of Water pipe smoking among university students in three countries in the Middle East (Palestine, Jordan, and Turkey). These countries differ by culture, race demographics, the educational level of the students and parents, age, income, and residency status. However, given the variation in Water pipe smoking regulation among these countries, we attempted to test for a relationship between these regulations (presence and absence) and the prevalence of Water pipe smoking. Furthermore, we also attempted to measure the rate of addiction to Water pipe smoking through questions addressing Water pipe smoking frequency and addiction.

## Methods

### Research design, setting, and population

An online cross-sectional study was carried out among university students from three Middle Eastern countries (Palestine, Jordan, and Turkey). A total of 2030 students were selected for the study. The data concerning the prevalence of Water pipe use and the associated factors were collected from university students. The Middle East is a transcontinental region centred on Western Asia. Geographically, the largest Middle East countries are Turkey, Egypt, and Saudi Arabia, and the smallest is Bahrain. However, Palestine, Jordan, and Turkey are pivotal in the Middle East due to their respective privacy [23]. Palestine is under Israeli occupation; Jordan is a fairly stable country, but it is surrounded by countries in conflict, including Iraq, Syria, and Palestine [24]; Turkey is a growing country (economically and politically) [25].

The selection criteria for the universities were based on region (Palestine, Jordan, and Turkey) geographic area, and size of student body. Nablus is an important city of the West Bank of Palestine because of its population, economic, and educational importance [26]; Amman is the capital city of Jordan, where two-thirds of the population live, which hosts many public and private universities [27]; North Cyprus hosts prestigious universities [28]. The selection criteria considered the choice of the basic university that represents an important geographical and educational area for each country included in the study. Furthermore, the highest possible number of enrolled students with the diversity of their affiliations and culture, as well as the widest range of faculties they operate, including arts, humanities, sciences, health sciences, and medicine were taken into consideration. Consequently, the universities agreed to be included mainly in the study among others are An-Najah National University-Nablus, Palestine, Al-Zaytoonah University of Jordan-Amman, Jordan, and Girne American University, Kyrenia-North Cyprus-Turkey.

An-Najah National University is the largest Palestinian university, with 300 professors and 23,345 enrolled students in 19 faculties [29]; Al-Zaytoonah University of Jordan is a private Jordanian university with 8000 enrolled students, of which 14% are international students representing 28 countries [30]; The Girne American University was the first private university in North Cyprus, with 18,000 students according to 2016 statistics [30, 31]. The total population size was 49,345 students.

The questionnaires were formulated using Google forms and the online copy is available as a Google™ document ([https://docs.google.com/forms/d/e/1FAIpQLSdwebHFniEECLYshw2CWpSV0EDdIP9Mx1nhP4y03BdAe88D1A/viewform?usp=sf\\_link](https://docs.google.com/forms/d/e/1FAIpQLSdwebHFniEECLYshw2CWpSV0EDdIP9Mx1nhP4y03BdAe88D1A/viewform?usp=sf_link)). This type of form has been used in other studies to gather answers online [32]. The process of contacting the students was facilitated using official Facebook pages of student associations and unions, and emails to invite them

to participate in the study and take part in a survey and provided survey URL to access the online copy of the study questionnaire formulated using Google forms system.

## **Ethical consideration**

The study was approved by the Institutional Review Board (IRB; 17.06.2019) at the Faculty of Medicine and Health Sciences of An-Najah National University, and the Ethical Research Committees of Al-Zaytoonah University of Jordan and Girne American University. Prior to online distribution of the questionnaire, the verbal consent was obtained from the students. The Students were informed by the researchers about the study objectives and outcomes. They were assured that the collected data would be kept confidential and would be used for research purposes only, and that participation was voluntary. Furthermore, the study considered the maximum privacy level and that the students could refuse to participate in the study.

## **Sample size calculation and sampling technique**

All enrolled, full time, undergraduate, and postgraduate students at the selected universities were comprised in the sampling frame. The Raosoft Sample Size Calculator () was used to calculate the minimum sample size. The sample size calculation was based on the total enrolled students at the participating universities [33]. Therefore, the counted population size for the participating universities ( $n = 49,345$ ) included the total number of enrolled students in An-Najah National University (up to 23,345 enrolled students), Al-Zaytoonah University of Jordan (up to 8,000 enrolled students), and Girne American University (up to 18,000 enrolled students).

The estimated minimum sample size for a 95% confidence level and margin error of 5% was 1122 university students. Whereas Palestine, represented by An-Najah National University, had the largest minimum sample size ( $n = 378$ ), followed by Turkey, represented by Girne American University ( $n = 377$ ; 36%), and Jordan, represented by Al-Zaytoonah University of Jordan ( $n = 367$ ). Subsequently, a total minimum sample size of  $n = 416$  from Palestine,  $n = 414$  from Turkey, and  $n = 403$  from Jordan with a total minimum sample size of  $n = 1233$  for the study were requested to account for a non-response of 10% for each country to overcome non-response bias and to meet the research objective of the study.

A stratified random sampling method was used [34]; the students were stratified into three different universities from three different Middle East countries, then into schools or faculties, and finally into departments. The students were chosen using a student list made available by each department on request. Subsequently, random selection was made using the Statistical Package for Social Sciences (SPSS) version 20. Students were approached in lecture rooms before or after a class. The questionnaires were distributed online to the selected students. Consequently, student participation was based on their self-selection and their willingness to accept study participation. The absent students were replaced by running the SPSS again to provide an opportunity to maintain random selection of the students and achieve the required sample size.

## **Data collection**

The researchers invited all male and female students from participating universities to participate in the study. A self-administered questionnaire was distributed online. The questionnaire was the sum of questions extracted from various questionnaires used in previous studies [32, 35–37]. Therefore, the final questionnaire was based on similar questionnaires used in previous similar studies, which were modified to match the data required to meet the study objectives. The questionnaire had been translated to Arabic (i.e., the local language for Palestine and Jordan) and Turkish (the local language for Turkey) languages for better interpretation by the selected students and validated for both languages. The validity was established by conducting a pilot study. The final questionnaire was tested in a pilot, web-based study, among students of the participating universities but not enrolled in the study. All obtained data were analysed using Microsoft Excel and illustrated by histograms.

This study collected data concerning socio-demographic and economic characteristics of the study participants, the affiliated university, and the prevalence and patterns of Water pipe smoking, and attitude towards Water pipe addiction [19,

38]. The subsequent analyses focused mostly on the responses to the questions concerning Water pipe smoking status “Have you ever smoked Water pipe” and/or “Are you currently smoking Water pipe”, and/or “Do you currently smoke Water pipe daily or less than daily”.

“Has ever smoked Water pipe” was defined as the participants had smoked Water pipe, even one or two puffs, at any time before the study. A current Water pipe smoker was defined as those who had smoked Water pipe at least once during the past 30 days. Daily means smoking Water pipe at least once every day or nearly every day during the past 30 days or more [39]. The researchers carried out the survey during the period from July to September 2019. The study participants completed the self-administered questionnaire and submitted it online to the supervisor of the data collection. Completing the questionnaire took an average of 2 to 3 min.

## **Data analysis**

Before starting the data analysis process (pre-analysis phase), data were coded to maintain the participants’ privacy and confidentiality. Next, data were organized and analyzed using the SPSS program version 20. Descriptive and comparative analyses were carried out for all variables, which were expressed as frequency and percentage for categorical variables. The Chi-square test was used to establish relationships between the independent variables and the dependent variables. Binary logistic regression was used to assess statistical significance of the difference in the prevalence of Water pipe use, which includes total prevalence of Water pipe smokers, prevalence of current Water pipe smokers (i.e. daily or less than daily), and prevalence of those who never/ever smoked Water pipe according to independent variables.

## **Results**

### **General characteristics of the sample**

A total of 2030 responses to the online questionnaire were received. One-thousand and eighty (53.2%) responses were originally from An-Najah National University-Palestine; 497 (24.5%) responses were from Al-Zaytoonah University of Jordan-Jordan, and 453 (22.3%) responses were from Girne American University-Turkey. Most responses were received from An-Najah National Univrsity (n = 1080 followed by Al-Zaytoonah University of Jordan students (n = 497, and students from Girne American University in North Cyprus (n = 453). Various characteristics of the participating students are listed in Table 1.

Table 1  
Socio-demographic characteristics of the participating students.

Variable	Category	Frequency (N = 2030)	Percentage (%)
Age	17–19	220	10.8
	19–21	803	39.5
	21–23	647	31.9
	23–25	173	8.5
	More than 25	187	9.2
Sex	Male	963	47.4
	Female	1067	52.6
Monthly income (\$)	200–500	373	18.3
	500–1000	650	32
	1000–2000	607	29.9
	More than 2000	400	19.7
University- Country	An-Najah National University-Palestine	1080	53.2
	Al-Zaytoonah University of Jordan-Jordan	497	24.5
	Girne American University-Turkey	453	22.3
Faculty	Medical Sciences	1163	57.3
	Sciences	55	2.7
	Engineering	177	8.7
	Educational & social sciences	125	6.2
	Others	510	25.1
Level of study	First year – third year	1028	50.6
	Fourth year – sixth year	872	43.0
	Master degree	113	5.5
	PhD degree	17	0.9
Current Residency	With the family	1335	65.8
	Private students' dormitory	485	23.9
	Government students' dormitory	43	2.1
	Other	167	8.3

The highest percentage (39.5%) of the participating students was in ages 21–23. More than half (52.6%) of the participating students were females. More than quarter (29.9%) of the participating students was from household monthly income ranging between 1000 and 2000 \$. More than half (57.3%) of the participating students were from faculties of Medical Sciences. Furthermore, the highest percentage of the participating students was in study level ranging from first to third year followed by study level ranging from fourth year to sixth year (43%). The study revealed that the majority (65.8) of the participating students staying with their families during their university studies (Table 1).

# Prevalence and patterns of Water pipe smoking

Overall, more than quarter (n = 645, 31.8%) of the participating students were current Water pipe smokers, less than quarter (n = 440, 21.7%) reported ever smoking Water pipe, and less than half of them (n = 945, 46.5%) had never smoked Water pipe. For each country, the current, ever, and never proportions are summarised in Fig. 1. Palestinian students reported the highest rate of current Water pipe smokers (n = 438, 40.5%), followed by Jordanian (22.7%) and Turkish (20.3%) students. The overall percentage for the frequency, the event of Water pipe smoking and students' opinion of Water pipe addiction among different countries were listed in Table 2. However, house hold monthly income was considered one of the main factors affecting the prevalence of Water pipe smoking (Table 3).

Table 2  
Water pipe smoking habits and self-reported addiction among participating students.

		Country			
		Palestine	Jordan	Turkey	Total
How often do you smoke Water pipe?	Minimum once a day	47.3%	65.9%	14.7%	48.4%
	Minimum once a week	34.1%	4.9%	14.7%	25.4%
	Minimum once a month	17.4%	26.8%	44.1%	21.5%
	Not a sure	1.2%	2.4%	26.5%	4.7%
Total		100.0%	100.0%	100.0%	100.0%
When you always smoking water pipe?	During Study	7.9%	12.2%	5.9%	9.1%
	During a meeting with friends	64.6%	46.3%	50.0%	58.1%
	During social meetings	15.9%	36.6%	23.5%	20.9%
	Other	11.6%	4.9%	20.6%	11.9%
Total		100.0%	100.0%	100.0%	100.0%
Did you believe that you could become addicted to Water pipe smoking?	Yes	44.2%	58.5%	17.6%	42.9%
	No	40.0%	34.1%	58.8%	42.1%
	Maybe	15.8%	7.3%	23.5%	15.0%
Total		100.0%	100.0%	100.0%	100.0%
P-values for the questions were 0.000, 0.033, and 0.006, respectively.					

Table 3

Family monthly income versus prevalence of current, ever, and never Water pipe smokers.

Monthly Income	Are you smoking or smoked water pipe?			Total	% of current smokers
	Yes, I smoke water pipe	Yes, I had smoke water pipe	No, I never smoke water pipe		
200–500 \$	153	75	145	373	41.0%
500–1000 \$	160	153	338	650	24.60%
1000–2000 \$	227	110	270	607	37.40%
more than 2000\$	105	102	192	400	26.30%
Total	645	440	945	2030	
* % of current smokers was calculated for each category individually (example $153/373 \times 100\% = 40.93\%$ ), p-value = 0.083.					

The prevalence of Water pipe smokers by age differences and country are represented in Fig. 2. The total results showed that the highest percentage for the current Water pipe smoker students was among participating students aged over 25 years old, on which less than half of this age category were Water pipe smokers (43%) [among 187 students, 80 of them were smokers (43%)]. Variation of Water pipe prevalence according to the different faculties is shown in Table 4.

Table 4

The proportion of students within different faculties and their prevalence of current, ever, and never Water pipe smokers.

Faculty	Are you smoking or smoked water pipe?			Total	% of current smokers
	Yes, i smoke water pipe	Yes, i had smoke water pipe	No, i never smoke water pipe		
Faculty of Medical Sciences	345	180	638	1163	29.70%
Faculty of Sciences	18	0	37	55	31.80%
Faculty of Engineering	70	58	50	177	39.43%
Faculty of Educational Social Sciences	37	27	60	125	30.00%
Another of Faculty	175	175	160	510	34.31%
Total	645	440	945	2030	
* Percentage of current smokers was calculated for each category individually (example $345/1163 \times 100\% = 29.67\%$ ), the p-value was less than 0.001					

Regarding the study level and current residency, Table 5 shows that almost half of the participating students (n = 1028 students) were university students within the first to third year levels of study, and their prevalence of Water pipe smoking was close to the mean .



Table 5

Level of study and current residency versus prevalence of current, ever, and never Water pipe smokers.

		Are you smoking or smoked water pipe?			Total	% of current smokers
		Yes, i smoke water pipe	Yes, i had smoke water pipe	No, i never smoke water pipe		
Level of Study	First Year- Third Year	315	228	485	1028	30.64%
	Fourth Year- Sixth Year	273	195	405	873	31.23%
	Master Degree	53	12	48	112	46.70%
	PhD Degree	5	5	8	17	29.40%
Current Residency	With my family	413	252	670	1335	30.90%
	Private Students' Dormitory	170	103	212	485	35.10%
	Government Students' Dormitory	13	15	15	42	30.10%
	Other	50	70	48	167	29.94%
Total		258	176	378	2030	
* % of current smokers was calculated for each category individually (example $170/485 \times 100\% = 35.05\%$ ), p Values were for study level ( $P = 0.502$ ) and current residency ( $P = 0.183$ ).						

## Discussion

Water pipe has several universal components, including a water bowl, metal body, head with holes in the bottom, and flexible hose with a mouthpiece. The device works by burning charcoal that then burns a tobacco mixture, as well as heats the water. Smoking of the charcoal helps move the tobacco through the water and hose and up to the mouthpiece [40]. This study provides a general idea about the differences in the prevalence of Water pipe smoking among university students from Palestine, Jordan, and Turkey. We detected a high prevalence of Water pipe smoking among university students, and the highest prevalence was in Palestine. The available data concerning the prevalence of Water pipe smoking in the Middle East is limited [41].

These results indicate the need for a health warning for university students about the harmful effects of Water pipe. The water in Water pipe does not filter these components [40]. Nicotine is a mood-altering ingredient of Water pipe that reaches the brain of the Water pipe smokers in mere seconds and makes them feel recognized for a while. However, they become crave and tired after that effect disappears. Furthermore, Water pipe smokers are exposed to substances that can damage their lungs. Thus, Water pipe smokers are at higher risk for chronic obstructive and restrictive lung diseases, such as lung cancer, chronic obstructive pulmonary diseases (COPD), and emphysema [42].

Forced Expiratory Volume in 1 second (FEV1), Forced Vital Capacity (FVC), and FEV1/FVC Ratio are essential parameters for the diagnosis of obstructive and restrictive pulmonary diseases. Water pipe smoking results in a significant reduction in FEV1, FVC, and FEV1/FVC ratio. Furthermore, Water pipe smoking increases the probability of developing gastric cancer, even though the mechanism is still unknown. Also, Water pipe smokers are exposed to decreased production of saliva, which is a natural cleanser of the mouth. So, the Water pipe smoker's mouth is dry, and more susceptible to cavities and at higher risk for tooth decay and bad breath. The more a person smokes Water pipe, the worse their breath will smell. An

alteration in oral microbial flora was also documented among Water pipe smokers [42, 43]. Subsequently, the increase in the prevalence of Water pipe smoking among university students in Palestine and Jordan is an epidemic, which requires efforts to increase awareness of the harmful effects of Water pipe smoking among students.

The Global Youth Tobacco Survey Collaborative Group estimated that 10 to 18% of adolescents aged from 13 to 15 years use tobacco products other than cigarettes, mostly in the Eastern Mediterranean region. The high prevalence of Water pipe smoking among the Al-Zaytoonah University of Jordan deserves attention. Particularly, the students' composition of the Al-Zaytoonah University of Jordan consists of Jordanian students and a certain percentage of students from Arab countries with a high prevalence of Water pipe smoking, such as Iraq, Palestine, and Arab Gulf countries. The health care professionals and academics can be considered as role models for their students and the community in fighting Water pipe smoking and promoting smoking cessation through health awareness educational activities, including lectures, workshops, and conferences.

The study results concerning the differences of distribution of Water pipe smoking among different faculties showed that there are several potential explanations for the high prevalence of Water pipe smoking among students from faculties of Engineering, followed by students from the faculties of medical sciences. The high stress, the limited awareness that Water pipe smoking can relieve stress, and the popular belief that Water pipe smoking is less toxic than cigarettes were the main factors accounting for the relationship between the difficulty of the specialisation field and increasing prevalence of smoking in general and Water pipe smoking in particular [44, 45]. However, the majority of the students of medical faculties were knowledgeable about the harmful effects of Water pipe smoking because of their educational courses. However, Water pipe smoker students had less knowledge than Water pipe non-smoker students, with a statistically significant difference ( $p < 0.05$ ) regarding knowledge of smoking as a harmful effect on their health, and risk factor of heart diseases, cancer, pulmonary diseases, mental conditions, and addiction [46]. So, Water pipe smoker students did not take what they learned from the courses seriously to quit Water pipe smoking and develop their own health [47].

Other factors, such as curiosity and social trends, are the main reasons for Water pipe smoking [39]. However, the low exposure to education related to Water pipe hazards and cessation in medical school or postgraduate training is probably the main contributing factor for the high frequency of Water pipe smoking among university students. The study results show that the study level and current residency were not significantly associated with the prevalence of Water pipe smoking among university students. However, this study might draw attention to important points, especially that all study variables are interrelated with others. Most university students started Water pipe smoking at ages below 24 years old, and the proportion increases with age and level of study. Thus, the adolescence, which in parallel with the university life, distance from parents, and lifestyle changes might have psychological and physiological effects that lead to increased prevalence of Water pipe smoking among university students. Subsequently, there is a need to improve dominant educational style that focuses on the curriculum offered without drawing the attention of academics to the need to get closer to the students and their lifestyles during their high school and university life at a sensitive age [45].

Also, Water pipe smoking is more prevalent among university students due to severe stress, very busy schedules, the lifestyle of university hostiles, friendships between students and distance from parents, and increasing responsibilities [48]. Thus, this explains the highest percentage of Water pipe smokers among Master's students and those living in private hostiles surrounding the universities. There is a social stigma associated with Water pipe smoking [49]. Therefore, the study results in comparison with others which were in favour of Turkey had shown that the culture of the Turkish community concerning Turkish students' lifestyle is full of study and provision of work opportunities during the university life to fill their leisure time and keep them away from all health risks caused. Furthermore, Turkey might implement strategies of medical schools and residency training programs that have additional benefits of reducing the prevalence of Water pipe smoking in the general population [50].

Water pipe smoking has almost the same health risks as cigarette smoking because Water pipe smoke also requires charcoal to be burnt, which interacts with tobacco, creating fumes that can be just as toxic as cigarette smoke. The Water pipe smoker still receives nicotine, which is a highly addictive substance. However, Water pipe smoking might be more toxic than cigarette smoking. People who smoke Water pipe might be exposed to the toxins in the smoke longer than if they smoked cigarettes. They may take 200 puffs during a 1 hour-long Water pipe session, which is equal to 10-times what a person puffs on a cigarette (an average of 20 times). Furthermore, the amount of nicotine delivered through Water pipe smoking is more than 2.5-times the amount of nicotine delivered to cigarette smoking [51]. However, the lack of Water pipe smoking among some university students does not necessarily mean that those students do not smoke cigarettes. Nevertheless, the health risks associated with Water pipe smoking and limited research in the Middle East prompted us to carry out this study.

The current study is the first to provide a comparison of the prevalence of Water pipe smoking and associated factors among university students in the Middle East. Thus, the study results could provide a baseline for future studies in Middle Eastern countries. This study is the first to utilize the core factors related to Water pipe smoking among university students in three different Middle East countries, and these findings will be useful for making future local and regional comparisons. Also, the study included university students from the best universities and belonging to an age group in need of care, attention, and awareness.

However, the study did not provide information concerning the prevalence of Water pipe smoking relative to cigarette smoking, marking Water pipe smoking among university students as a potential public health concern in the Middle East and completely neglected to mention cigarette smoking. Furthermore, the study is cross-sectional; this in itself is considered as a limitation of the study. The cross-sectional design is not intended for generalisations, and hindered any attempt to make causal associations between independent and dependent variables. Also, any future study will require more public and private universities to achieve a representative sample from the university student population, so that the results can be generalised in Palestine, Jordan, and Turkey.

## Conclusion

There was a high prevalence of Water pipe smoking among university students in the Arabian countries (especially Palestine) relative to Turkey. Different factors affect the prevalence of Water pipe smoking, including age, monthly income, residency, and level of education. A high percentage of smokers reported the belief that they are addicted to Water pipe smoking. The majority of current Water pipe smokers were smoking Water pipe daily, especially in Jordan and followed by Palestine. Based on these findings, we believe that the regulation of Water pipe smoking in Turkey limits the prevalence of Water pipe smoking. Therefore, we recommend that the health ministries in Palestine and Jordan should establish regulations and restrictions for Water pipe smoking, especially among adolescents.

## Abbreviations

SPSS: Statistical Package for Social Sciences, n: number of students, IRB: Institutional Review Board.

## Declarations

### Ethics approval and Consent to Participate

We declare that all authors approve the submission of the manuscript to this journal. The authors own the copyright for the entire manuscript, including all artwork and tables. The Institutional Review Board approved the study at the Faculty of Medicine and Health Sciences of An-Najah National University, and the Ethical Research Committees of Al-Zaytoonah University of Jordan and Girne American University (date of approval: 17.06.2019). Before the students responded to the

questionnaire, they received a letter that explained the purpose of the research, that the data would only be used for research purposes by the researcher, and included the phrase “If they would like to answer, they can open the questionnaire and response, and if not, they can skip it”.

### **Consent to publish**

Not applicable.

### **Availability of data and materials**

The datasets used during the current study are available from the corresponding author upon reasonable request.

### **Competing interests**

The authors declare that they have no competing interests.

### **Funding**

The authors received no specific funding for this study.

### **Authors' contributions**

MH, RM, and AH conceptualized the research idea and methods. RM, YJ, and YH were responsible for data collection. AH and MH analyzed the data. MH and RM wrote the manuscript under the supervision of YJ. All authors read and approved the final draft of this manuscript.

### **Acknowledgements**

The authors highly appreciate all colleagues who helped in the distribution of the online questionnaire among the university students. We would like to thank all the universities that agreed to participate in the study: An-Najah National University, Al-Zaytoonah University of Jordan, Girne American University, and Cyprus International University.

## **References**

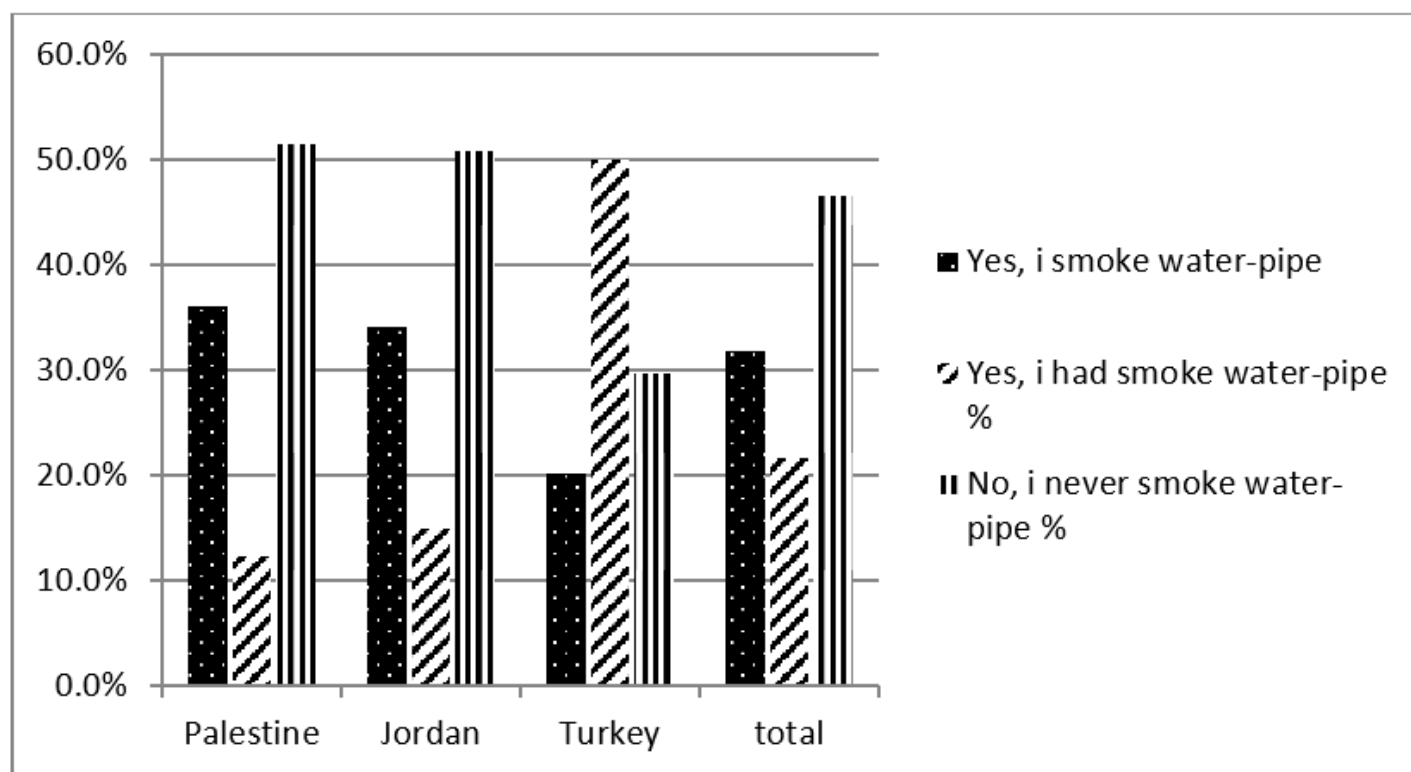
1. Hawash MM, Baytas SN. Antiproliferative Activities of Some Biologically Important Scaffolds. *FABAD J Pharm Sci.* 2018;43(1):59-77.
2. Viridis A, Giannarelli C, Fritsch Neves M, Taddei S, Ghiadoni L. Cigarette smoking and hypertension. *Current pharmaceutical design.* 2010;16(23):2518-25.
3. Mahboub B, Mohammad AB, Nahle A, Vats M, Al Assaf O, Al-Zarooni H. Analytical Determination of Nicotine and Tar Levels in Various Dokha and Shisha Tobacco Products. *J Anal Toxicol.* 2018;42(7):496-502.
4. Husain H, Al-Fadhli F, Al-Olaimi F, Al-Duraie A, Qureshi A, Al-Kandari W, et al. Is Smoking Shisha Safer than Cigarettes: Comparison of Health Effects of Shisha and Cigarette Smoking among Young Adults in Kuwait. *Med Princ Pract.* 2016;25(2):117-22.
5. Al-Belasy FA. The relationship of “shisha”(water pipe) smoking to postextraction dry socket. *Int J Oral Maxillofac Surg.* 2004;62(1):10-4.
6. El-Hakim IE, Uthman MA. Squamous cell carcinoma and keratoacanthoma of the lower lip associated with “Goza” and “Shisha” smoking. *Int J Dermatol.* 1999;38(2):108-10.
7. Maziak W, Ward K, Eissenberg T. Factors related to frequency of narghile (waterpipe) use: the first insights on tobacco dependence in narghile users. *Drug Alcohol Depend.* 2004;76(1):101-6.

8. Al-Safi SA, Ayoub NM, Mosa'b AA, Al-Doghim I, Aboul-Enein FH. Does shisha smoking affect blood pressure and heart rate? *J Public Health*. 2009;17(2):121-6.
9. Mazen A, Arabia S. The effect of Maassel water-pipe smoking versus cigarette smoking on pulmonary arterial pressure and left ventricular and right ventricular function indices in COPD patients: an echodoppler. *Sci J Al-Azhar Med Fac Girls*. 2000;21:649-86.
10. Meo S, AlShehri K, AlHarbi B, Barayyan O, Bawazir A, Alanazi O, et al. Effect of shisha (waterpipe) smoking on lung functions and fractional exhaled nitric oxide (FeNO) among Saudi young adult shisha smokers. *Int J Environ Res Public Health*. 2014;11(9):9638-48.
11. Taha AZ, Sabra AA, Al-Mustafa ZZ, Al-Awami HR, Al-Khalaf MA, Al-Momen MM. Water pipe (shisha) smoking among male students of medical colleges in the eastern region of Saudi Arabia. *Annals of Saudi medicine*. 2010;30(3):222-6.
12. Anjum Q, Ahmed F, Ashfaq T. Knowledge, attitude and perception of water pipe smoking (Shisha) among adolescents aged 14-19 years. *JPMA The Journal of the Pakistan Medical Association*. 2008;58(6):312.
13. Shafagoj YA, Mohammed FI. Levels of maximum end-expiratory carbon monoxide and certain cardiovascular parameters following hubble-bubble smoking. *Saudi medical journal*. 2002;23(8):953-8.
14. Djordjevic MV, Stellman SD, Zang E. Doses of nicotine and lung carcinogens delivered to cigarette smokers. *Journal of the National Cancer Institute*. 2000;92(2):106-11.
15. Habibullah S, Ashraf J, Javed R, Naz S, Arain GM, Akhtar T. Prevalence of Shisha smoking in college, university and Madarsa Students aged 20-25 years in Pakistan. *Pakistan Journal of Medical Research*. 2013;52(1):3.
16. Sajid KM, Akhter M, Malik GQ. Carbon monoxide fractions in cigarette and hookah (hubblebubble) smoke. *JPMA*. 1993;993:43.
17. Knishkowsky B, Amitai Y. Water-pipe (narghile) smoking: an emerging health risk behavior. *Pediatrics*. 2005;116(1):e113-e9.
18. Wolfram RM, Chehne F, Oguogho A, Sinzinger H. Narghile (water pipe) smoking influences platelet function and (iso-) eicosanoids. *Life sciences*. 2003;74(1):47-53.
19. Omotehinwa OJ, Japheths O, Damascene IJ, Habtu M. Shisha use among students in a private university in Kigali city, Rwanda: prevalence and associated factors. *BMC public health*. 2018;18(1):713.
20. Abu Shomar RT, Lubbad IK, El Ansari W, Khatib I, Alharazin HJ. Smoking, awareness of smoking-associated health risks, and knowledge of national tobacco legislation in Gaza, Palestine. 2014.
21. Tucktuck M, Ghandour R, Abu-Rmeileh NM. Waterpipe and cigarette tobacco smoking among Palestinian university students: a cross-sectional study. *BMC public health*. 2018;18(1):1.
22. Regulation WSGoTP. Advisory note: Waterpipe tobacco smoking: health effects, research needs and recommended actions for regulators. 2015.
23. Hoh A. China's Belt and Road Initiative in Central Asia and the Middle East. *Digest of Middle East Studies*. 2019.
24. Cochran JA. The Rise in Power of Crown Prince Mohammed bin Salman. *Digest of Middle East Studies*. 2019.
25. Douglas KM, Uscinski JE, Sutton RM, Cichocka A, Nefes T, Ang CS, et al. Understanding Conspiracy Theories. *Political Psychology*. 2019;40(S1):3-35.
26. Zabadi HA, Musmar S, Hassouna A, Shtaiwi Da. Cigarettes and Water Pipe Smoking Prevalence, Knowledge, and Attitudes Among the Palestinian Physicians in the West Bank. *Tobacco Use Insights*. 2018;11:1179173X18813369.
27. Burgan SZ. Smoking behavior and views of Jordanian dentists: A pilot survey. *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology and Endodontics*. 2003;95(2):163-8.
28. Nicolaou SA, Heraclides A, Markides KS, Charalambous A. Prevalence and social determinants of smoking in the adult Greek Cypriot population. *Hippokratia*. 2016;20(4):284-91.

29. Sweileh WM, Zyoud SeH, Al-Khalil S, Al-Jabi SW, Sawalha AF. Assessing the Scientific Research Productivity of the Palestinian Higher Education Institutions: A Case Study at An-Najah National University, Palestine. *SAGE Open*. 2014;4(3):2158244014544287.
30. Al-Qerem WA, Hammad AM, AlQirem RA, Ling J. Do the global lung function initiative reference equations reflect a sample of adult Middle Eastern population? *The Clinical Respiratory Journal*. 2019.
31. Saleh RN, Salameh RA, Yhya HH, Sweileh WM. Disordered eating attitudes in female students of An-Najah National University: a cross-sectional study. *J Eat Disord*. 2018;6(1):16.
32. Jarrar Y, Mosleh R, Hawash M, Jarrar Q. Knowledge And Attitudes Of Pharmacy Students Towards Pharmacogenomics Among Universities In Jordan And West Bank Of Palestine. *Pharmacogenomics and Personalized Medicine*. 2019;12:247.
33. Sturgeon LP, Garrett-Wright D, Lartey G, Jones MS, Bormann L, House S. A descriptive study of bathing practices in acute care facilities in the United States. *American Journal of Infection Control*. 2019;47(1):23-6.
34. Murray CJ, Lopez AD. Global mortality, disability, and the contribution of risk factors: Global Burden of Disease Study. *Lancet (London, England)*. 1997;349(9063):1436-42.
35. Social norms and attitudes linked to waterpipe use in the Eastern Mediterranean Region. 2013. p. 125-34.
36. Factors associated with hookah smoking among university students. 2016. p. 3403-8.
37. Pleasure and practice: a qualitative study of the individual and social underpinnings of shisha use in cafes among youth in the UK. 2018. p. e018989.
38. Mosleh RS, Jarrar Y, Zyoud SH, Morisky DE. Factors Related to Diabetes Self-Care Management Behaviors Among Patients with Type II Diabetes in Palestine. *Journal of Applied Pharmaceutical Science*. 2017;7(12):102-9.
39. Othman M, Aghamohammadi N, Nik Farid ND. Determinants of shisha use among secondary school students in Sudan. *BMC Public Health*. 2019;19(1):1390.
40. Qasim H, Alarabi AB, Alzoubi KH, Karim ZA, Alshbool FZ, Khasawneh FT. The effects of hookah/waterpipe smoking on general health and the cardiovascular system. *Environ Health Prev Med*. 2019;24(1):58-.
41. Sajid KM, Chaouachi K, Mahmood R. Hookah smoking and cancer: carcinoembryonic antigen (CEA) levels in exclusive/ever hookah smokers. *Harm Reduction Journal*. 2008;5(1):19.
42. Patil S, Awan KH, Arakeri G, Aljabab A, Ferrari M, Gomes CC, et al. The relationship of "shisha" (water pipe) smoking to the risk of head and neck cancer. *Journal of Oral Pathology & Medicine*. 2019;48(4):278-83.
43. Meo SA, AlShehri KA, AlHarbi BB, Barayyan OR, Bawazir AS, Alanazi OA, et al. Effect of shisha (waterpipe) smoking on lung functions and fractional exhaled nitric oxide (FeNO) among Saudi young adult shisha smokers. *Int J Environ Res Public Health*. 2014;11(9):9638-48.
44. Maziak W, Taleb ZB, Bahelah R, Islam F, Jaber R, Auf R, et al. The global epidemiology of waterpipe smoking. *Tobacco Control*. 2015;24(Suppl 1):i3-i12.
45. O; K, R; N, A; Z. Prevalence and reasons for smoking among upper secondary schoolboys in Hulu Langat, Malaysia. *Medicine & Health*. 2007;2(1):80-5.
46. Muzammil, Al Asmari DS, Al Rethaiaa AS, Al Mutairi AS, Al Rashidi TH, Al Rasheedi HA, et al. Prevalence and Perception of Shisha Smoking among University Students: A Cross-sectional Study. *J Int Soc Prev Community Dent*. 2019;9(3):275-81.
47. El Amin SET. School Smoking Policies and Health Science Students' Use of Cigarettes, Shisha, and Dipping Tombak in Sudan. *Frontiers in Public Health*. 2019;7(290).
48. Veeranki SP, Alzyoud S, Kheirallah KA, Pbert L. Waterpipe Use and Susceptibility to Cigarette Smoking Among Never-Smoking Youth. *American Journal of Preventive Medicine*. 2015;49(4):502-11.

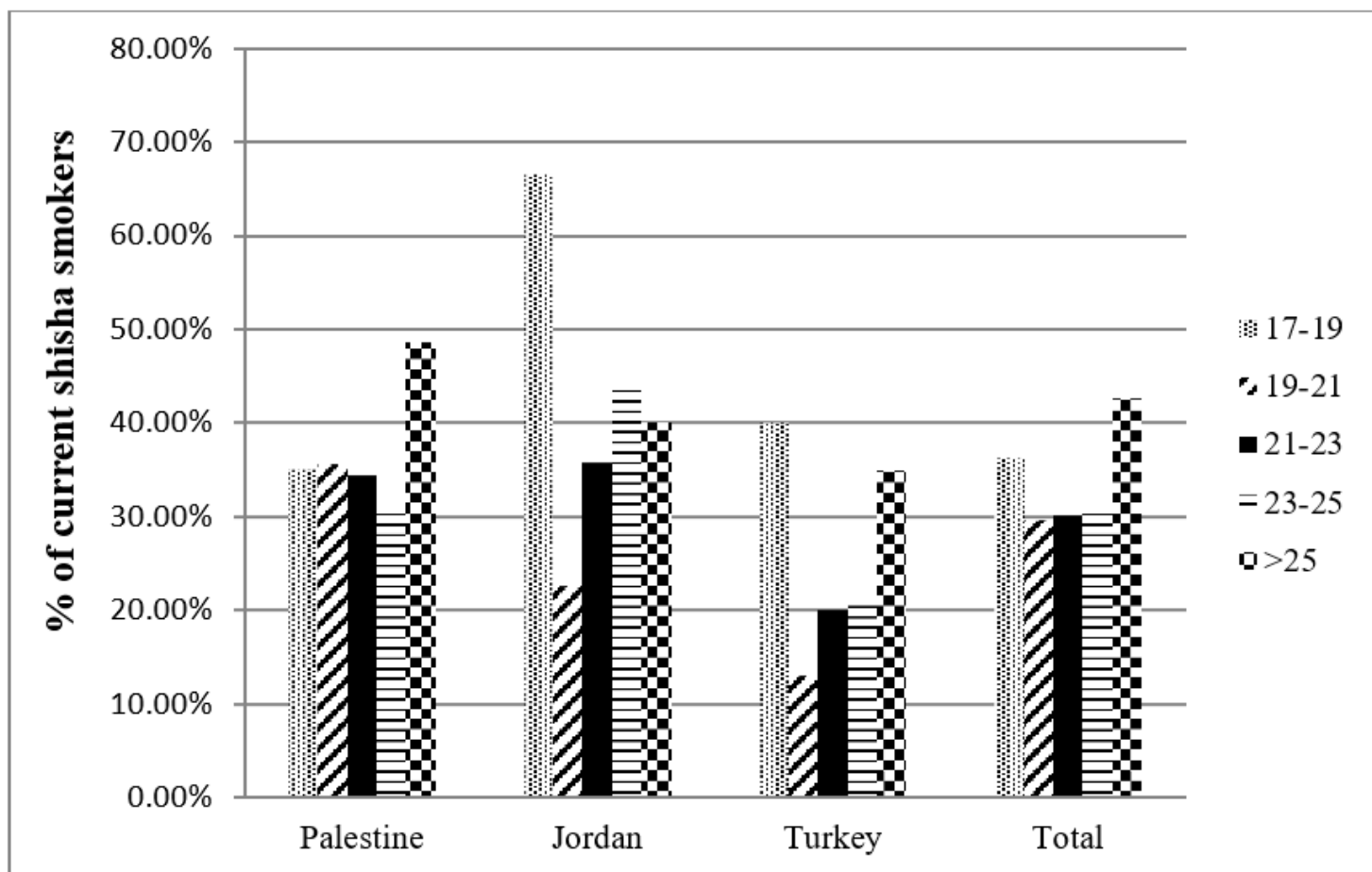
49. AlQahtani J. Knowledge, attitude and practice of tobacco smoking among health colleges&#39; students at Najran University, Saudi Arabia: A cross-sectional descriptive study. *Journal of Health Specialties*. 2017;5(1):35-41.
50. Eissenberg T. Now is the Time for Effective Regulation Regarding Tobacco Smoking Using a Waterpipe (Hookah). *Journal of Adolescent Health*. 2019;64(6):685-6.
51. Aanyu C, Kadobera D, Apolot RR, Kisakye AN, Nsubuga P, Bazeyo W, et al. Prevalence, knowledge and practices of shisha smoking among youth in Kampala City, Uganda. *The Pan African medical journal*. 2019;32:61.

## Figures



**Figure 1**

Total prevalence of Water pipe smokers and the prevalence of current, ever, and never smokers among Palestinian, Jordanian, and Turkish students.



**Figure 2**

The prevalence of smoking Water pipe in Palestine, Jordan, and Turkey according to age category (17–19, 19–21, 21–23, 23–25, and >25 years old).