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Prevalence of Water-pipe Smoking among Arab Students in Malaysia - and Its Associated Factors

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Authors' contributions

This work was carried out in collaboration between both authors. Author AAAI designed the study, performed the statistical analysis, wrote the protocol, wrote the original research in a thesis and approved the final-version of this article to be published. Author MAAM helped in the re-tabulation/ re-analyses and the discussion of the data, revisiting the said Thesis critically for valuable intellectual content and final approval of the version to be published. Both authors read and approved the final manuscript.

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ABSTRACT

Background: The prevalence of water-pipe smoking has been rapidly increasing among youths throughout the world.
According to WHO, more than 100 million people use water-pipe regularly.
Objective: The purpose of this Study is to estimate the prevalence of water-pipe smoking among Arab-students in Kuala Lumpur and Selangor, Malaysia, and its association with socio-demographic factors, besides assessing their knowledge on the health-outcomes of water-pipe smoking, and relate such knowledge with the same socio-demographic factors. The Aim is also to identify the main attractants to water-pipe smoking, besides the participants' stand on banning such activity.
Method: This Study was conducted among Arab-students at convenient places in Kuala Lumpur and Selangor in 2017. The students were above 18 and studying in universities. A community-

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based cross-sectional study among 243 students (selected using a non-probability snowball sampling method) was conducted. The data was collected using a pre-tested, self-administered Questionnaire.

Results: The Study showed high prevalence of Water-pipe smoking of 33.7%. Male students had a higher prevalence than female (37.1%; 29% respectively). Age was found to be significantly associated (p = 0.01). Those with poor knowledge about water-pipe smoking were found to be 38.3%. Slightly more than half of the water-pipe smokers (51.2%) had started smoking before the age of 18.

Conclusion: This Study proves that water-pipe smoking among Arab-students remains a significant public health concern. Thus, there is an urgent need for the Malaysian authorities to implement new regulations on water-pipe smoking. Further studies should be done among different migrant-populations and locals in Malaysia.

Keywords: Water-pipe smoking; prevalence; age start smoking; migrant-populations; tobacco-toxicants.

1. INTRODUCTION

According to the National Health and Morbidity Survey of Malaysia, diseases related to smoking such as cancer and cardiovascular diseases are known to be the main causes of premature-death in Malaysia - smoking kills about 20,000 Malaysians every year and it is expected to rise to 30,000 by the year 2020 [1].

According to WHO, water-pipe causes serious health-effects, and it has a number of toxicants known to cause cancer, heart diseases and other diseases [2].

Although the water absorbs the nicotine in *hookahs*, smokers are still exposed to a sufficient dose of nicotine that causes addiction [2–5].

Reducing the amount of nicotine is good for health, but the reduced amount could lead to inhalation of higher amounts of smoke that can cause cancer and other respiratory diseases [2–5].

Sharing of water-pipe mouthpieces pose a serious risk of communicable-disease transmission among such smokers [2–5].

Water-pipe tobacco is usually flavoured and sweetened with the aim of attracting youths by providing a better taste, which probably explains why some youths do not use other forms of tobacco but only in *hookah* [2–5].

In India, where water-pipe smoking originated, it is known as *hookah*, while in many Arab-countries such as Egypt, Saudi Arabia, Tunisia, Yemen, Sudan and Somalia it is known by the name of *shisha*. In yet different countries like Libya, Syria, Iraq, Turkey and Greece, it is named *argeela*; while in Croatia, Bosnia and Albania it is known as *lulava*. Despite the different names, water-pipes have the same design and structure - they all have a bowl-part, which differs in size and shape while being filled with water at the base [2].

A hose-pipe is connected to the bowl at one end and the opposite end is connected to a mouthpiece - through which piece the smoker can inhale the smoke emitted by the tobacco heated by a charcoal-burner, which is located on the top and is connected to the bowl of water. The smoke that is inhaled goes through the water in the bowl (See Fig. 1). The type of tobacco used in water-pipe smoking is called *maasel*. It contains 30% tobacco and 70% of honey, besides added flavour which could be mint, mango, apple, or banana [2].

There are regional and cultural differences in some water-pipe design-features such as head or water-bowl size, number of mouth-pieces, etc., but all contain water through which smoke passes before reaching the user [2].

They are now being marketed as portable, with the introduction of carrying-cases with shoulder-straps. Some accessories are sold with claims of reducing the harmfulness of the smoke such as mouth-pieces that contain activated-charcoal or cotton, chemical-additives for the water-bowl and plastic-mesh fittings to cause smaller bubbles [2].

Socio-demographic characteristics like gender seem to have effects on water-pipe smoking. In general, there is higher prevalence among

males than females. A research conducted among 2,328 students in the U.S. estimates higher prevalence among males than females (11.9%, 8.2% respectively) [2]. Another research determined higher prevalence among males (3.6%), compared to 1.8% among females [6].

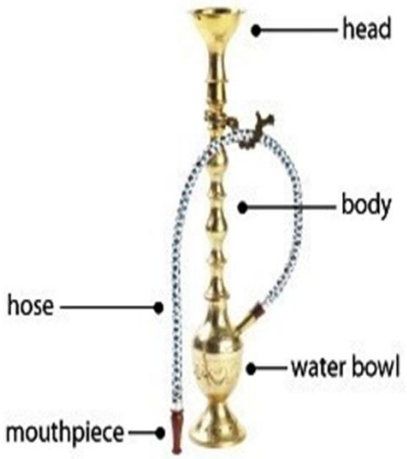

Fig. 1. Picture of water-pipe

One more study saw greater prevalence among males (7.3%), than females at 5.5% [7]. Gender was significantly associated with water-pipe smoking in Saudi Arabia with greater prevalence among males than females (22.3%, 10.2% respectively) [8].

Young age was significantly associated with water-pipe smoking. 63.8% of medical students in Saudi Arabia started shisha-smoking at age 16 to 18 years [9]. Another research found 32.2% of water-pipe smokers to be above 18 years old [5].

Water-pipe smoking prevalence is high in Arabian countries as it is a part of Arab-culture. A study conducted in Saudi Arabia found the overall prevalence of shisha-smoking to be 12.6% [10]. Another study in Saudi Arabia determined the prevalence of water-pipe smoking to be 16.9% [11].

Waked M, Salameh P and Aoun Z 2009 did a study to assess the demographic and social-characteristics of water-pipe smokers, the association with cigarette-smoking and chronic respiratory diseases and the dependence profile on 4 groups: exclusive WP smokers, exclusive cigarette smokers, mixed smokers and absolute non-smokers. Cigarette-smoking was statistically significantly higher in water-pipe smokers than non; 36.5% of exclusive water-pipe smokers smoked > or =7 water-pipes/week. Chronic respiratory disease and chronic bronchitis were reported more frequently in exclusive water-pipe smokers than absolute non-smokers. Water-pipe smoking was found to be as great a risk factor as cigarette smoking for chronic respiratory disease [12].

Hallit S et al. 2017 showed that among Lebanese current cigarette-smokers, current water-pipe smoking increases adverse lipid-profiles more than cigarette smoking alone [13].

One study conducted among 300 students in Kuala Lumpur, Malaysia found the prevalence to be 20% [10]. Malays had a high prevalence at 47% in Petaling Jaya, Selangor [11].

The prevalence of water-pipe use among youth in New Jersey was 9.7% [14]. But, other researchers in Canada found the prevalence at 2.7% [6]. A study carried out in US among college-students found 9.9% prevalence [5].

Another study in America found that the prevalence of water-pipe smoking among middle-school students was 2.1%, and to be higher among high-school students at 5.4% [7]. The prevalence was high among American first-year students at 20% [15]. But in Turkey, the prevalence of current users is 32.7% in Erciys University [16].

A study showed the prevalence of water pipe smoking among Arab-Americans was 3.6%, which is less compared to non-Middle-eastern White adults at 1%. A study in the U.S. reported the prevalence among Arabs was less than 30%. The prevalence among Arab-Yemeni in the U.S. is 17.1%.

A number of people in one study in Malaysia claimed that water-pipe smoking is not harmful to health and does not harm passive-smokers. A number of them felt that *shisha* does not contain nicotine, although the vast majority of them concurred that disease-causing contamination can be caused by sharing the shisha-pipe [11].

Some researchers though claim that most of the participants were aware of it being a hazard-factor for oral cancer and periodontal disease,

besides tooth and oral-tissue discoloration [8]. One more research estimated higher mean-score of knowledge, attitude, and hazard perception for non-smokers than smokers [17].

Meanwhile, 90.5% of participants in a different research considered water-pipe smoking to be harmful to health [18]. Yet in one more, 91.5% of participants claimed *shisha* was a risk for health [19].

In general, people consider water-pipe smoking less harmful than cigarette. In one research in Malaysia, the vast majority of participants claimed that water-pipe is not as harmful as cigarette-smoking [11]. Yet in one more research conducted in San Diego and California, a large number of water-pipe users (58.3%) believed that water-pipe smoking is less harmful than cigarette [20]. Participants in a study conducted in the U.S. also thought water-pipe smoking was less harmful [15].

Many researchers said that half of participants thought water-pipe was less harmful than cigarette [16]. Furthermore in the U.S., about 33.1% of the participants in a research trusted water-pipe smoking to be less harmful than cigarette smoking - while over half (52.1%) felt that water-pipe smoking was less addictive than cigarette smoking. And, about 36.4% considered water-pipe smoking as more socially acceptable [7].

In one research conducted in Turkey, 9.1% of the participants said they smoked for relaxation while 7.3%, because they enjoyed the taste [21].

In a research conducted in Lebanon among pregnant women, the majority of the participants (75.6%) supported banning water-pipe smoking in minors (<18 years old) [22].

A study was conducted to assess the carcinogenic-PAH (polycyclic aromatic hydrocarbons) content of three charcoal products commonly used in Lebanon for water-pipe smoking. It was found that the charcoal contained a large number of PAH, including benzo (a) pyrene (grouped as a carcinogen) [23].

An additional study compared water-pipe smoking to cigarette-smoking. It was found that water-pipe smoking had higher exposure to benzene, and greater amounts of PAH [24]. One more study showed an increase in carbon-monoxide at 23.9 ppm in water-pipe use, compared with 2.7 ppm for cigarette-smoking. There was no difference in the nicotine level, but total puff-value was 48.6 L in water-pipe smoking compared with 1 L for cigarette [25].

Yet one more study showed that the average of ultrafine side-stream particle-emissions in four repeated water-pipe smoking-sessions was 3.99, while in four repeated cigarette-trials it was only 0.638. Concerning expired-air carbon-monoxide (CO), in cigarette-smoking the mean (±SEM) pre-smoking CO level was 5.1±0.5 ppm which increased to 7.8±0.6 after smoking; for water-pipe though, mean pre-smoking CO level was 4.7±0.5 ppm, which increased to 28.7±3.5 after smoking. The higher post-smoking CO associated with water-pipe tobacco smoking was significant ($P < 0.001$) [26].

The general objective of our Study was to estimate the prevalence of water pipe smoking and determine its associated factors among Arab students.

The specific objectives were:

- To estimate the prevalence of water-pipe smoking (WP) among Arab students in Kuala Lumpur and Selangor.
- To determine the association between socio-demographic characteristics (SDCs) and the prevalence of water-pipe smoking.
- To determine the awareness of water-pipe smoking health-outcomes among such students.
- To determine the association between socio-demographic characteristics (SDCs) and the knowledge of the participants about water-smoking health-outcomes.
- To determine the main attraction of water-pipe smoking among such students, and
- To determine their stand on banning water-pipe smoking

2. METHODS

2.1 Design

A community-based, cross-sectional survey was conducted among Arab-students in Kuala Lumpur and Selangor, Malaysia. A quantitative approach was used. The Study was conducted

from March to June 2017 using a convenience-sample of 243 students, all 18 years of age and older. The data was collected using an anonymous, pre-tested, self-administered Questionnaire. The Questionnaire was distributed in three universities: GEOMATIKA University in Kuala Lumpur, besides SEGI and MAHSA universities in Selangor, during the weekdays – and in addition, in restaurants and cafes during the weekends. Total confidentiality was ensured.

2.2 Research Instrument, Its Validity and Reliability

The research-instrument was a pre-tested questionnaire. A review of questionnaires from previous articles was performed in a manner to overview the main parts that had to be in a questionnaire assessing prevalence of water-pipe smoking. The Questionnaire was constructed and modified in terms of content and culture-appropriateness based on existing-literature and experts' opinions.

The final version of the Questionnaire was translated into the Arabic-language which is the mother-language of the participants. But, an English-version was given to those who were more comfortable with the English language.

Concerning validity and reliability, the research instrument is valid as it covers the entire domain related to the construct it was designed to measure and it was pre-tested before being distributed (pre-testing study was conducted). The instrument is similar to other instruments used in previous similar studies elsewhere. The instrument measures one construct.

Most of the questions were 'yes' or 'no' questions, which made it easier to measure and analyze the data. A few questions were in Likert Scale (degree of agreement) which is a universally accepted method in survey studies.

Alpha Cronbach Test was done – and, the Questionnaire was found to have a strong α coefficient of 0.65. Thus, the Questionnaire is acceptable and reliable.

Then, the questionnaire was revised by a specialist in the Arabic language to ensure that the meaning of all of the questions remained unchanged after translation. The Questionnaire was pre-tested on a group of 30 Arab-students who had the same inclusion-criteria as the study-population. Subsequently, these respondents were excluded from the study-population.

2.3 Sampling and Sample-size Calculation

A non-probability sampling method was used - this type being snowball-sampling in which existing subjects select further subjects from among their associates. Using this kind of sampling-method, it was possible to collect the data from a sufficient number of male and female students to carry out the comparative study.

The sample-size was calculated separately for each variable, and then the most appropriate sample-size was selected from these.

Previous studies done elsewhere in which prevalence of water-pipe smoking, socio-demographic factors and prevalence of cigarette-smoking among water-pipe users was used to determine the sample-size, which was calculated based on a two-tailed α at 95% confidence interval (CI) - Z α was made equal to 1.96 at 80% power, β = 0.2 and Z β = 0.84.

For example, to calculate sample-size in estimating the prevalence of water-pipe smoking among Arab-students in selected universities in Kuala Lumpur and Selangor:

Two-tailed α was used with P = 0.05 at 95% Confidence Interval (CI), so Zα = 1.96, β = 0.2 at 80% power, using the Calculation-equation:

$$\mathbf{n=\frac{Z^2pq}{d^2}}$$

where, n = Sample size.

P= Prevalence of water pipe smoking estimated from a previous study conducted in Saudi Arabia, which was 0.17 (Al-Nomay and Ahmed, 2015).

p= 0.17, q= 1-p, d= 0.05, Z= 1.96

$$\mathbf{n=\frac{1.96^2*0.17*0.83}{0.05^2}}$$

n=217.

Therefore, 217 participants were needed to determine the prevalence of water-pipe

smoking in Kuala Lumpur and Selangor with a 5% precision and a 95% CI.

2.4 Determining Knowledge of Participants as Defined

Three questions in the Questionnaire were used to determine knowledge of the participants concerning the harmful-nature of water-pipe smoking and its health-outcomes.

Participant's level of knowledge was determined using a list of health-outcomes that may or may not be caused by water-pipe smoking, and the participants recognizing the items in the list as correct or wrong.

Knowledge concerning the harmful-nature of water-pipe smoking and its health-outcomes was determined in the students by using the following questions:

1 - Do you think water-pipe smoking is harmful?
2 - A list of health-outcomes that may or may not be cause by water-pipe smoking, and:

a) Lung diseases including lung cancer.
b) Heart diseases.
c) Gum and mouth diseases.
d) Infectious diseases.

3 - Comparing water pipe to cigarette smoking.

In this part, a comparison between water-pipe smoking and cigarette-smoking was asked of the participants in an opinion whether they considered water-pipe smoking as less, equally or more harmful than cigarettes.

All answers provided were transformed into numerical variables. Correct and wrong answers were given the score of 1 and 0 respectively. If a respondent selected (No, Don't know, Less) response, the answer was treated as a wrong answer and was given 0 score. A scoring-system was applied in which the sum of all correct responses was calculated - the maximum value for knowledge thus being 10, and the minimum, 0. To determine the final level of knowledge of the participants and then make comparisons, a pre-determined cut-off point (70%) was used to grade as 'good' or 'poor' based on the cut-off point Thabit et al. 2014.

2.5 Determining the Attitude and Practices (as Defined) in Relation to Water-pipe Smoking

Attitude and practice toward water-pipe smoking was determined by examining the frequency of smoking, age started smoking, place of smoking, influence by others, main-attraction, and smoking-surround.

Participants' opinion on whether they agree to banning water-pipe smoking by minors was ascertained, besides whether there should be banning at restaurants and bars.

Socio-demographic factors of relevance were course-of-study, educational-level, gender, age, nationality and marital status.

2.6 Ethical Considerations

A written informed-consent to participate in the Study was obtained from each participant.

The Study was approved by the Ethics Committee of the Faculty of Medicine, MAHSA University, Malaysia.

2.7 Data Management

Data-cleaning for identifying and removing errors from the data in enhancing the quality of the data was done. In this Study, errors appeared as missing-information or invalid-data. Double-scan was done to verify for completeness, and then data-cleaning was conducted for all missing data. Unfinished-questionnaires were excluded from date-entry. After that, the data was entered into a database by using the Statistical Package for the Social Sciences (SPSS) software Version 19. Data-cleaning was actualized to correct possible errors and missing-data prior to statistical analysis of valid-data.

2.8 Data Analyses

Hypothesis-testing of all applicable variables was done using Chi-squared Test to determine the presence of any association between each variable within socio-demographic characteristics and the prevalence of water-pipe smoking, and then the knowledge separately. And then, Odds Ratio was measured together with the 95% Confidence Interval.

Chi-square Test and Simple Logistic Regression Tests were used to determine the association between the socio-demographic characteristics and the prevalence of water-pipe smoking.

Chi-square test and Simple Logistic Regression Tests were used to determine the association between the socio-demographic characteristics and "knowledge on water-pipe smoking health outcomes".

3. RESULTS

Table 1 summarizes the relevant prevalences.

Table 2 summarizes the socio-demographic characteristics of the participants.

Nationality was significantly associated with the prevalence of water-pipe smoking (P = 0.037, OR=2.07) - there was a significant difference between Yemeni and Libyan students, Yemeni having the highest prevalence of 'current-use' and 'ever-use' (39.5%; 57% respectively), while Libyan-students have the lowest prevalence (24% for 'current-use' and 48% for 'ever-used'). Male-students had a higher-prevalence of 'current-use' and 'ever-use' of water-pipe smoking - 62.2% of male-students had tried water-pipe previously, while 37.1% were 'current-users'; 37% of female-students had tried water-pipe previously and 29% were 'current-users'.

The highest prevalence of water-pipe smoking was found in the age-group 18-22 - more than half (55.2%) had 'ever-used' water-pipe and 39.7% were 'current-users'. Nearly half (51.6) of the students aged 23 to 26 had previously tried water-pipe and 32.3% were 'current-users'. The age-group 27-30 also had high-prevalence (37.9%). But, the age-groups of 31-40 and >40 were found to have slightly lower prevalence i.e. 11.5%; 20% respectively.

Table 1. Prevalence of water-pipe (WP) smoking

	Prevalence of water-pipe smoking	95% CI lower limit - upper limit
Currently using WP	33.7%	28.01 - 39.87%
Ex-users of WP	18.2%	13.2 - 22.9%
Ever used WP	51.9%	45.57 - 58.09%
Non-users	48.1%	41.9 - 54.4%

Table 2. Socio-demographic characteristics of the participants

SD characteristics	Frequency	Percentage
Course:		
Medical	77	31.7%
Non-medical	166	68.35%
Educational level:		
Degree	167	68.7%
Postgraduate	76	31.3%
Gender:		
Male	143	58.8%
Female	100	41.2%
Age group:		
18-22	116	47.7%
23-26	62	25.5%
27-30	29	11.9%
31-40	26	10.7%
>40	10	4.1%
Nationalities:		
Libyan	75	30.9%
Yemeni	86	35.4%
Other Arabian nationalities	82	33.7%
Marital status:		
Single	183	75.3%
Married	56	23%
Divorced	4	1.6%

The total number of 'current-use' and 'ever-use' of water-pipe smoking was found to be higher among undergraduate-students i.e. 37.1%; 54.5% respectively, while only 26.3% of postgraduate-students were 'current-users' and 46.2% were 'ever-used'.

Medical-students were found to have a higher prevalence of 'current use' than non-medical students (35.1% cf. 33.1%). But, 53.6% of the non-medical students had 'ever-used' compared with less than half (48.1%) of medical-students had 'ever-used' it.

Table 3 summarizes the association between socio-demographic characteristics and prevalence of water-pipe smoking.

Table 4 summarizes Knowledge of Participants on water-pipe smoking health-outcomes.

Table 5 summarizes the analyses involving the factors that influence the knowledge of the participants.

As is seen, Yemeni-students have increased-odds of being water-pipe smokers by 2.071 times than Libyan students.

Male students have increased-odds by 1.442 times than female students.

Degree students have increased-odds by 1.653 times than postgraduate students.

Students who are single have increased-odds by 1.692 times than students who are married.

The vast majority of the participants stated they were influenced by their friends to smoke water-pipe i.e. a total of 111 (88.8%). Only 4.8% and 6.4% said they were influenced by their family or relatives respectively.

Restaurants and cafes were the favourite smoking-spots of 76% of the smokers and only 24% said that they smoke at home. 20% of the smokers were heavy-smokers since they smoked daily, while 38.4% said that they smoke weekly and 31.6% said that they smoke once in a while.

It was also found that slightly more than half of the smokers (51.2%) had started smoking before the age of 18. 11.2% had started between the age of 12 to 15 and 40% had started between the age of 16 to 18. Prevalence of cigarette-smoking among participants was 24.3% (35.7% male; 8% female).

Table 3. Association between socio-demographic characteristics and prevalence of water pipe smoking

Variables	Current use (%)n	p value	Odds ratio (95%CI)
Nationalities			
Libyan	(24) 18		Ref.
Yemeni	(39.5) 34	**0.037**	2.071(1.045-4.103)
Gender			
Male	(27.1) 52		Ref.
Female	(29) 29	0.19	1.442(0.832-2.496)
Age group			
18-22	(39.7) 46		Ref.
23-26	(32.3) 20	0.235	0.38(0.77-1.872)
27-30	(37.9) 11	0.441	0.525(0.102-2.702)
31-40	(11.5) 3	0.309	0.409(0.73-2.288)
>40	(20) 2	0.516	1.917(0.27-3.631)
Educational level			
Postgraduate	(26.3) 20		Ref.
Degree	(37.1) 62	0.1	1.653(0.908-3.011)
Course			
Medical	(35.1) 27		Ref.
Non-medical	(33.1) 55	0.7	1.090(0.617-1.925)
Marital status			
Married	(25) 14		Ref.
Single	(36.1) 66	0.127	10692(0.861-3.327)

Table 4. Knowledge of participants on water pipe smoking health outcomes

	Frequency	Percentage
Water pipe is harmful		
Yes	208	85.6%
No	34	14.4%
Lung diseases including cancer		
Yes	183	75.3%
No	12	4.9%
Don't know	48	19.8%
Heart diseases		
Yes	148	60.9%
No	28	11.5%
Don't know	67	27.6%
Gum and mouth diseases		
Yes	140	57.6%
No	31	12.8%
Don't know	72	29.6%
Infectious diseases		
Yes	107	44%
No	31	20.6%
Don't know	86	35.4%

Table 5. Association of the factors that influence the knowledge of the participants

Variables	Poor knowledge	Good knowledge	Total no.	p value	Odds ratio (CI95%)
Nationalities					
Yemeni	(40.7) 35	(59.3) 51	86		Ref.
Libyan	(37.3) 28	(62.7) 47	75	0.923	0.868(0.46-1.639)
Other	(36.6) 30	(63.4) 52	82	0.584	1.033(0.54-1.966)
Gender					
Male	(30.8) 44	(69.2) 99	143		Ref.
Female	(49) 49	(51) 51	100	**0.004**	2.162(1.274-3.669)
Age group					
18-22	(42.4) 49	(57.8) 67	116		Ref.
23-26	(40.3) 25	(59.7) 37	62	0.89	1.082(0.578-2.026)
27-30	(26.9) 8	(72.4) 21	29	0.98	1.92(0.785-4.693)
31-40	(26.9) 7	(73.1) 19	26	0.466	1.985(0.774-5.09)
>40	(40) 4	(60) 6	10	0.48	1.097(0.294-4.097)
Educational level					
Degree	(41.9) 70	(58.1) 97	167		Ref.
Postgraduate	(30.3) 23	(69.7) 53	75	0.085	1.663(0.933-2.964)
Course					
Medical	(40.3) 31	(59.7) 46	77		Ref.
Non-medical	(37.3) 62	(62.7) 104	166	0.664	1.13(0.650-1.966)
Marital status					
Single	(37.7) 69	(69.3) 114	183		Ref.
Married	(37.5) 21	(62.5) 35	56	0.978	1.009(0.544-1.872)
Use of WP					
Smokers	38 (46.3)	44 (53.7)	82		Ref.
Non-smokers	55 (34.2)	106 (65.8)	161	0.6	1.664(0.967-2.864)

In this Study, a high percentage of respondents (60%) said the flavoured-taste was the main-attraction for them and 18.4% said the nice-smell attracted them - while 11.2% of respondents said they smoked water-pipe because they had heard it was helpful in reducing weight. Concerning smoking-circumstances, 32.8% of participants said they smoked when they are relaxed, while 27% during social-gatherings and 24% after meals. 35.7% of water-pipe users were current cigarette-smokers in addition.

Table 6. Odds Ratio, with 95% CI, of the factors that influence the knowledge of the participants

Variables	Crude OR (CI)	Adjusted OR (CI)	p value
Gender			
Female	Ref.	Ref.	
Male	2.162(1.274-3.669)	2.35(1.366-3.792)	0.004
Educational level			
Degree	Ref.	Ref.	
Postgraduate	1.663(0.933-2.964)	1.647(0.966-3.141)	0.085
Use of WP			
Smokers	Ref.	Ref.	
Non-smokers	1.664(0.967-2.864)	1.753(0.997-3.082)	0.6

Table. 7. "Ban minors smoking water pipe"

	Frequency	Percentage
Strongly oppose	13	5.3%
Somewhat oppose	24	9.9%
Somewhat support	38	15.6%
Strongly support	168	69.1%

Table 8. "Ban smoking water pipe in restaurants and bars"

	Frequency	Percentage
Strongly oppose	44	18.1%
Somewhat oppose	72	29.6%
Somewhat support	49	20.2%
Strongly support	78	32.1%

Concerning knowledge of participants about water-pipe smoking, 14.4% of respondents answered that "water-pipe smoking has no harm to health at all", and 18.9% indicated that "WP smoking was less harmful than cigarettes". About 19.8% of respondents had no idea if it causes lung diseases, and 4.9% said it was safe to the lungs.

Most of the participants (75.3%) were aware that water-pipe smoking could lead to heart disease, but only 44% said it could be a source of infection through contamination. 57.6% of respondents answered that it could cause gum and mouth disease.

Concerning association between socio-demographic characteristics and knowledge in this Study, people with poor-knowledge concerning water-pipe smoking were found to be 38.3% of the study-sample. Chi-square test was conducted to assess the association between the socio-demographic characteristics as independent variables and knowledge as a dependent variable, all in a categorical format.

Gender was found to be significantly associated with good knowledge on water-pipe smoking ($p < 0.05$ and OR 02.162; 95%CI: 1.274-3.669), since it was found that male-students had better knowledge than female students.

Educational-level was found to be associated with knowledge - students with higher-level of education had higher scores. The remaining socio-demographic characteristics such as age, course (medical or non-medical), nationality and marital state were not associated.

From the results of the Simple Logistic Regression, the only independent variable that had the p-value < 0.05 in this Study was gender – thus, was significantly associated.

Male students have increased odds of having good knowledge of water-pipe smoking by 2.164 times than female students.

Students who had a higher-level of education (postgraduate) had increased odds of having good knowledge by 1.663 times than degree students.

Students who were not 'current users' of water-pipe were found to have increased-odds of having good knowledge by 1.664 times than current-users.

Tables 7 and 8 summarize the participants stand on banning water-pipe use by minors and in restaurants/bars.

4. DISCUSSIONS

Concerning prevalence of water-pipe smoking, in this Study the prevalence of water-pipe smoking among Arab students in Kuala Lumpur and Selangor was 33.7%, while the prevalence among Malaysian-students in a previous study in 2012 was found to be 20%. One other research conducted in Malaysia also showed that the prevalence in Shah Alam, Selangor was much less at 5.9% [27].

Why do Arabs have a higher prevalence? [10] First of all, water-pipe smoking is a part of the Arabian culture.

The second possibility is that, most of Arab-students study in Malaysia without the supervision of their families, thus making it more difficult to control their habits and their life-styles.

The third reason could be the higher amount of money that Arab-students receive from their parents each month for their living-expenses, compared to Malaysian-students.

The prevalence found in this Study is close to that in a study conducted among students in Lebanon, where the current prevalence of water-pipe smoking was 29.6% among 28,378 students [28].

Concerning association between socio-demographic characteristics and prevalence of water-pipe smoking, Yemeni-students were found to have the highest prevalence of water-pipe smoking at 39.5%; Libyan at 24% and other Arabian nationalities at 36.5%.

Male students were found to have a higher-prevalence of water-pipe smoking at 37.1%, while females only 29%. A study by Jordan and Delnevo (2010) also showed male-preponderance [14].

But, one different study conducted in the U.S. reported higher 'ever-use' among females than males (64.8%, 35.2% respectively) [29].

It is generally observed that where cigarette-smoking is a well-entrenched practice such as in many developed-countries, female-preponderance in water-pipe smoking is observed, or at least equal in proportion.

The male-preponderance seen in our Study, as in more studies among developed-countries, is probably attributable to traditions and culture in the communities countries where activities such as cigarette-smoking and similarly water-pipe smoking are considered more robust masculine-behaviour.

This Study found that 51.2% of water-pipe users started smoking before 18 years of age, while in a previous study in Malaysia showed 47.3% [30].

Concerning attitude towards water-pipe smoking and its attraction, the vast majority of the water-pipe user-respondents (88.8%) indicated they were influenced by their friends to smoke water-pipe. Restaurants were favourite smoking-spots compared with smoking at home.

Frequency of smoking was determined to be a daily- and weekly-habit in 20% and 38.4% respectively.

Finding out the main-attractions of water-pipe smoking should be seen as a fundamental step in preventing and reducing such smoking. In this Study, the majority of the users (60%) said they had chosen water-pipe smoking because of its flavored-taste, which is similar to the finding of one different research conducted among Malaysian students [31].

Concerning the circumstances of smoking water-pipe, 32.8% of the users said they smoked when they were relaxed, whereas in one different research only 7.3% of the smokers were smoking water-pipe to feel relaxed [21].

Concerning knowledge on health-outcomes of water-pipe smoking, in this Study 14.4% of the participants had the opinion that water-pipe smoking is not harmful at all, which is similar to a previous study conducted in Malaysia [22].

18.9% of the respondents stated that water pipe-smoking was less harmful than cigarette-smoking, which is consistent with a previous research in Malaysia where 14.6% of respondents said the same [22].

In this Study, 49.8% of the participants considered water-pipe smoking to be more harmful to passive-smokers. Meanwhile in Turkey, 41% of the participants had said the same [16].

The majority of the respondents said that water-pipe smoking can cause lung diseases and cancer, but only 44% of the participants said water-pipe could be a source of infection - while slightly more than half of them said it could cause heart and mouth diseases.

Concerning social-acceptance of water-pipe smoking, 35.4% of the respondents said it was more socially-acceptable than cigarettes, which is consistent with a study done in the U.S [29].

In this Study, 33.3% of the participants said water-pipe is less addictive than cigarettes, whereas less than that (21.7%) noted in one different research done in Malaysia [32].

In this Study, 38.3% of the respondents were found to have poor knowledge on water pipe-smoking, while 61.7% had good knowledge. Although more than half of Arab-students have adequate knowledge, prevalence of water-pipe smoking is still high. This could be due to the influence of friends and acquaintances, or it could be because of its attractions.

Gender was significantly associated with knowledge about water-pipe smoking health-outcomes (p=0.004 and OR=0.642). 69.2% of male-students had significantly good knowledge, while only 49% of female-students had good knowledge.

Banning water-pipe smoking in public places, and by minors, can bring about a reduction in the prevalence of water-pipe smoking. More than half of respondents in this Study had started water-pipe smoking before the age of 18 since there are no regulations that ban minors smoking water-pipe – *sishas* could be purchased and is accessible at many restaurants and cafes.

A majority of respondents (69.1%) had strongly agreed to banning minors (< 18) smoking water-pipes, while only 5.3% disagreed. This is consistent with a study conducted in Lebanon, where the majority of the participants (75.6%) supported such banning [20]. In contrast, one more study conducted in Lebanon also, showed only 16.4% of respondents supported such banning on minors [26]. 32.1% of respondents in this Study had strongly agreed to banning in bars and restaurants, while some respondents were 'strongly' and 'somewhat' opposed (18.1% and 29.6% respectively).

Water-pipe smoking has become a worldwide-phenomenon, especially among youth. Why has it become so wide spread, and what are the main reasons it has become more attractive?

To our knowledge, this Study is the first one to estimate the prevalence of water-pipe smoking and assess the knowledge of Arab-students in Malaysia. And, the results should motivate more researchers to explore the field and encourage more interventional studies. This Study gives all of us a hunch concerning the main attractions.

The high-prevalence of water-pipe smoking among Arab-students appears to be alarming, and it may need intervention by the Malaysian authorities.

Our study provides evidence that Regulations and Rules should ban minors from smoking water-pipe, besides all water-pipe smoking in public places.

Our present work contributes to increasing the awareness to water-pipe smoking situation. We also hope that this will motivate the participants, and their friends and colleagues, to search for more information, leading to quit-smoking.

Our Study creates a need to justify a request to the Malaysian authorities to develop Health-awareness Programs on water-pipe smoking and its health-outcomes.

There is a need also to encourage researchers to conduct more studies not just on water-pipe smoking, but the different forms of tobacco-use too.

Since the 1990s, water-pipe smoking appears to be spreading among new populations such as college-students and young people in the US, Brazil, and European countries. Such appears to be given impetus by unfounded-safety claims in comparison with cigarettes, besides the social-nature of the activity. Commercial-marketing, frequently with implicit or explicit safety-related claims, could also contribute to the spread [2].

Water-pipe smoking has not been researched as thoroughly as cigarette-smoking. But,

preliminary-research on patterns of smoking, the chemical-contents of the smoke-inhaled and the health-outcomes gives the impression that the risks are the same, and that there may be, in addition, unique health-risks associated with water-pipe smoking. There isn't proof yet that any device or accessory can make it safer [2].

There is surprisingly little research addressing water-pipe smoking while considering there are many millions of water-pipe smokers across the globe. A more thorough understanding of this activity, risks and health-outcomes is required world-wide – and, areas of concern has been identified by the WHO [2].

The WHO Study Group on Tobacco Product Regulation (TobReg) recommends the following [2]:

1. Water-pipes and water-pipe tobacco must be regulated in the same manner as cigarettes and similar tobacco-products.
2. These should carry strong health-warnings.
3. Claims of harm-reduction and safety must be prohibited – including misleading labelling such as "contains 0 mg of tar".
4. Water-pipes must be included in comprehensive tobacco-control efforts, including prevention-strategies and cessation-interventions.
5. Concerning smoking in public-places in a concern for the environment and secondary-smoke, water-pipe smoking must be similarly regulated.
6. Education of health-professionals, regulators and the public-at-large is in urgent need.
7. That the WHO thoroughly evaluate the health-outcomes of water-pipe smoking and develop recommendations.

5. CONCLUSIONS

This Study indicates a high-prevalence of water-pipe smoking. Male students were found to have a higher prevalence than females. People with poor knowledge regarding water-pipe smoking were conspicuously seen.

In our knowledge, this Study is the first cross-sectional study estimating the prevalence of water-pipe smoking among Arab-students in Malaysia. The high prevalence in this Study indicates the need to provide better Regulations on water-pipe smoking, especially concerning minors smoking.

There is a need to encourage authorities to ban water-pipe smoking in public places and ban minors from smoking water-pipes. We should also encourage researchers to conduct more studies in this important field to obtain more information among different population-groups.

CONSENT

A written informed-consent to participate in the Study was obtained from each participant.

ETHICAL APPROVAL

The Study was approved by the Ethics Committee of the Faculty of Medicine, MAHSA University, Malaysia.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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