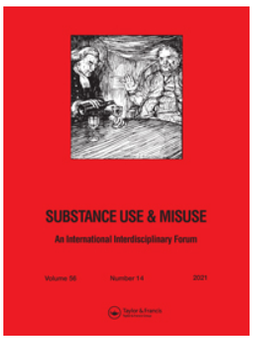

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# Factors Affecting Waterpipe Tobacco Smoking among University Students in Qatar

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**ABSTRACT**

*Background:* Recent data show an increase in the prevalence of waterpipe tobacco smoking (WTS) among university students in the Arab Gulf region alongside an attitude of social acceptability and a perception that WTS is less harmful than traditional cigarette smoking. *Objective:* This study measures the prevalence of WTS among university students and examines the individual, sociocultural, and environmental factors influencing this practice. *Methods:* Participants were selected through stratified random sampling of students in the largest national university in Qatar. Data were collected anonymously using an online questionnaire. Descriptive univariate and bivariate analyses were conducted to examine the association of WTS with participants' sociodemographic characteristics, knowledge, and attitudes. *Results:* 199 students completed the questionnaire. Among students who reported using tobacco products, waterpipe (*shisha*) was the most common product (70.6%). WTS was significantly associated with having a mother ($p = 0.015$) or a close friend ($p < 0.001$) who smoked. Compared to non-users, waterpipe tobacco users were significantly more likely to believe that waterpipe tobacco is less addictive than cigarettes ($p = 0.009$) and significantly less likely to believe that waterpipe tobacco can lead to cardiovascular diseases ($p = 0.003$) or dental problems ($p = 0.02$). More waterpipe tobacco users than non-users disagreed that parents ($p = 0.005$) or advertisements ($p = 0.002$) could influence use. More waterpipe tobacco users (70%) than non-users (37%) believed that females were more comfortable using waterpipes than cigarettes. *Conclusions and implications:* The findings shed light on factors shaping WTS and provide evidence for designing multilevel behavioral interventions to decrease the prevalence of WTS among youth.

**KEYWORDS**

Waterpipe; tobacco; university students; addiction; attitudes; gender gap

## Introduction

Waterpipe tobacco smoking (WTS) is a method of smoking that includes the inhalation of tobacco smoke, often fruit-flavored, after it passes through water (Maziak et al., 2015). WTS is linked to diseases associated with cigarette smoking, including lung cancer, oral cancer, cardiovascular disease, and respiratory disease (Akl et al., 2010; Waziry et al., 2017). Recent epidemiological data show an increase in the prevalence of WTS among youth and young adults. The National Youth Tobacco Survey among U.S. students reported an increase in the prevalence of WTS from 4.1% to 9.4% over the period 2011–2014 (Arrazola et al., 2015). Results from the Middle East reported that the highest prevalence of WTS was in Lebanon (36.9%) followed by the West Bank in the occupied Palestinian territory (32.7%) (Jawad et al., 2016).

University students are particularly vulnerable to smoking waterpipe tobacco (Maziak et al., 2015). Among university students, the prevalence of WTS reached as high as 20.0% in the U.S., 14.4% in the U.K., and 32.7% in Turkey, with an alarming increase among high school and university students in Middle Eastern countries (Akl et al., 2011). The current WTS prevalence among university students in the region has reached 23.5% in Syria, 29.5% in Lebanon, and 30.0% in Jordan (Almerie et al., 2008; Jawad et al., 2016; Jradi et al., 2013a; Khabour et al., 2012; Poyrazoğlu et al., 2010). In the Arab Gulf region, research conducted among university students in the United Arab Emirates reported WTS prevalence of 5.6% in 2005 (Mandil et al., 2007), which rose almost ten-fold to 51.5% in 2018 (Al-Rawi et al., 2018). In Saudi Arabia, the prevalence of WTS increased from 36.3% in 2010 (Al-Mohamed & Amin, 2010) to 46.6% in 2019 (Muzammil et al., 2019).

In their research in three Middle Eastern countries, Palestine, Jordan, and Egypt, Salloum et al. (2019) reported that males were more likely to report practicing WTS, with higher frequencies and larger quantities of use than their female counterparts (Salloum et al., 2019). However, studies also show that the gender gap in WTS prevalence has been decreasing (Maziak et al., 2015; Tucktuck et al., 2017).

Waterpipe smokers follow various practice patterns in terms of the frequency, duration, and location of smoking sessions (Salloum et al., 2019). Previous research has reported that both waterpipe tobacco users and non-users perceive

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waterpipe tobacco to be less harmful than cigarette smoking (Akl et al., 2015). WTS is largely perceived as an entertaining social activity involving friends in settings like cafes and restaurants. This perception was found among waterpipe tobacco users in both Arab and western societies and among university students and adolescents alike (Akl et al., 2013).

The sociocultural context plays a central role in shaping WTS. In three Middle Eastern countries, Palestine, Egypt, and Jordan, Salloum et al. (2019) found a majority of respondents from Jordan and Palestine reported that they usually smoked waterpipes with friends and/or family members, whereas the majority in Egypt reported that they usually smoked waterpipes alone. This suggests that the social context of waterpipe smoking is more dominant in Jordan and Palestine, reflecting greater social and cultural acceptability (Salloum et al., 2019). Finally, country policies, regulations, and existing tobacco laws play a major role in influencing behavior. Unfortunately, effective policies addressing waterpipe tobacco use in settings with the highest burden are absent (Jawad et al., 2015).

Qatar is a state in the Arabian Gulf with a population of 2,878,506, of whom 12% are aged 15–24 years (Al-Dahshan et al., 2019; World Health Organization, 2013; Worldometers Qatar Population, 2020). Between 2003 and 2014, smoking prevalence and cigarette accessibility and availability increased among Qatari youth (Al-Dahshan et al., 2019). According to the Global Adult Tobacco Survey (GATS) conducted in Qatar (2013), 3.4% of adults were waterpipe tobacco smokers. The prevalence of WTS among men was 4.9% compared to 1.6% among women. Among Qatari men, the WTS prevalence was 5.3% compared to 4.8% for non-Qatari men. Qatari women reported WTS use of 0.4% compared to non-Qatari women (2.4%). Approximately 11% of waterpipe tobacco smokers started smoking before the age of 18. Nearly 85% of men smoked waterpipe tobacco in a café, while almost 63% of women smoked it at home (Supreme Council of Health & Ministry of Development Planning & Statistics, 2013). Anti-tobacco legislation in Qatar prohibits smoking in enclosed public places (e.g., vehicles, schools, hospitals, government institutions, and restaurants), in agreement with the WHO Framework Convention on Tobacco Control signed in 2002 (World Health Organization, 2013).

Non-communicable diseases (NCDs), including cardiovascular diseases, are a significant morbidity and mortality burden in Qatar (Supreme Council of Health, 2013). Understanding the prevalence and patterns of all types of tobacco use is a vital component of the strategy to combat NCDs. To the best of our knowledge, no previous research has examined the various factors shaping WTS among university students in Qatar, despite the rising trend globally and in the region. The purpose of this study was to measure the prevalence of waterpipe smoking and examine the individual, sociocultural, and environmental factors influencing WTS among university students. Specifically, this study aims to examine: (1) the prevalence of WTS in a sample of university students, (2) knowledge regarding the health impacts of WTS, (3) WTS attitudes and practices, and (4) the associations of various factors (demographics, knowledge, and attitudes) with WTS.

## Methods

This survey is part of a larger study titled, "Informed by the bio-ecological model: A cross-sectional study to assess factors shaping tobacco product use among university students." The survey was conducted at Qatar University (QU), the country's largest national university. A stratified random sample of students aged ≥ 18 years with active registration in the Spring 2020 semester was selected. The sample was stratified by gender and nationality (Qatari and non-Qatari). Respondents completed a self-administered online questionnaire. The required sample size (741) was calculated using Cochran's formula (Kotrlik & Higgins, 2001) for 95% confidence level, 2.5% margin of error, and an assumed cigarette smoking prevalence of 14%. The latter was based on a study in Saudi Arabia (Qanash et al., 2019). This study was approved by the QU Institutional Review Board (Approval No. QU-IRB 1188 E-2019).

### Data collection

Data were collected anonymously using an online self-administered questionnaire, which was created using *Qualtrics* survey software (https://www.qualtrics.com/). English and Arabic versions of the questionnaire were created. The participants were selected using a stratified random sample. All QU students were grouped into four strata based on their nationality and gender (Qatari men, non-Qatari men, Qatari women, and non-Qatari women). An introductory email, which included a consent form describing the aim of the study and assuring recipients of the confidentiality of their responses, was sent to the institutional email addresses of students ($N = 9807$) from the Institutional Research and Analytics department at QU. A reminder was sent weekly. Participation was voluntary, and students were reminded that they could skip questions they did not wish to answer and withdraw their participation at any time. The survey was conducted for four weeks between March and April 2020.

### Overview of the questionnaire

Informed by the socio-ecological model, we selected the factors relevant to the study objectives and those documented in the literature related to WTS among young adults. The questionnaire was adapted from the GATS Qatar 2013 (Global Adult Tobacco Survey Collaborative Group, 2011) and validated questionnaires from previous studies (Al-Rawi et al., 2018; Salloum et al., 2019; Taha et al., 2010). The questionnaire was translated into Arabic by a research group consisting of QU public health students and faculty members. To evaluate item clarity and effectiveness, both versions were pretested on a group of public health students ($N = 20$). The questionnaire consisted of five sections: sociodemographic characteristics, smoking status, tobacco use, knowledge, attitudes, and practices of WTS. Throughout the questionnaire, the Arabic term "shisha" was added to waterpipe tobacco, since it is the familiar term used in this context.

### Study variables

Sociodemographic characteristics were used as independent variables. The dependent variable, tobacco use, was determined using the question, "*Do you currently use any tobacco product*? This includes *traditional cigarettes, e-cigarettes, and other electronic vapor products, chewable tobacco, waterpipe/shisha?*" with a "*yes/no*" response option. Smoking among family members and close friends was determined by the question "Which of the following statements is true: My father is currently a smoker; My mother is currently a smoker; One or more of my siblings is a smoker; I have at least one close friend who smokes; No one in my family is a smoker; None of my close friends is a smoker." Knowledge regarding the influence of WTS on health was assessed using 11 statements: "Shisha contains nicotine; Shisha is addictive; Shisha is less addictive than cigarettes; Shisha is less harmful to health compared to cigarettes; Shisha smoking can cause lung cancer; Shisha smoking leads to cardiovascular diseases and cerebral stokes; Shisha smoking leads to dental problems; Shisha smoking reduces weight; Shisha contains carbon monoxide; Water in shisha filters toxins; and Shisha contains tar". The response options for these statements were "agree," "disagree," and "don't know." Attitudes regarding WTS were examined using nine statements: "Having parents who smoke waterpipe/shisha make it more likely to smoke waterpipe/shisha; Having friends who smoke waterpipe/shisha make it more likely to smoke waterpipe/shisha; Advertisement can encourage waterpipe/shisha smoking; Waterpipe/shisha smoking is part of our cultural heritage; People smoking waterpipe/shisha look cool; People smoking waterpipe/shisha have more friends; Girls are more comfortable in smoking waterpipe/shisha compared to cigarettes; I smoke waterpipe/shisha because it might be less harmful to me than smoking cigarettes; and I smoke waterpipe/shisha because it might help me quit smoking cigarettes". The response options were: "strongly disagree," "disagree," "neutral," "agree," and "strongly agree."

The final set of questions was to understand the different patterns of WTS practice among students. Participants were asked: "At what age did you start waterpipe smoking?"; "During the past 30 days, how many times did you smoke the waterpipe/shisha?"; "With whom do you usually smoke shisha?"; "How long does the waterpipe/shisha smoking session last?"; "Where do you usually smoke waterpipe/shisha?" and "When do you usually smoke waterpipe/shisha?" For the last two questions, participants were given the option to choose multiple answers.

### Statistical analysis

Data were analyzed using the Statistical Package for Statistics and Data Science (Stata) version 15. Descriptive analysis was performed for the demographic variables and WTS practices based on their type. For continuous variables, mean and median (for non-normally distributed variables) were reported, and for categorical variables, frequencies and percentages were reported. To examine the association between demographics, knowledge, and attitudes with WTS, the chi-squared test ($\chi^2$) was used. Univariate analyses were also performed, and 95% confidence intervals and $p$-values were reported. Statistical significance was set at $p < 0.05$. To calculate a knowledge score, each correct answer (out of 11 total items) was given a value of 1, and each incorrect/don't know answer a value of 0. The final score, which ranged from 0 to 11, was calculated by summing the number of correct answers for all knowledge items.

## Results

### Sociodemographic characteristics of the respondents

Details of study participants have been previously described in detail (Kurdi et al., 2021). Approximately half of the respondents (48.2%) reported that they had at least one close friend who smoked, and more than one-third (33.7%) had one or more siblings who smoked (Table 1). On the other hand, less than one-third (29.6%) reported that there were no smokers among their family members or close friends. Of the respondents themselves, approximately a quarter (25.6%) reported being current smokers, with fewer females reporting smoking, although the difference was not statistically significant (32.4% and 21.6%, respectively; $p = 0.096$). Among students who reported using tobacco products, waterpipe/shisha (70.6%) was the most commonly used type.

### Waterpipe tobacco smoking (WTS)

In our sample of waterpipe smokers, the median age was 19 years, and they usually smoked with friends and family members (Table 2). Approximately 40% smoked shisha once a month, compared to 11.1% who used it daily in the past month. A quarter of the waterpipe smokers smoked waterpipes with friends or family members. Approximately 45% of the smokers had a session lasting between 30 and 60 minutes, and most of them smoked shisha in cafes (72.2%), followed by restaurants (55.6%). In addition, smokers used shisha to relieve their stress and anger, and after eating their meals (38.9%). However, almost 70% of them were smoking shisha with friends at any time, regardless of the situation.

### Association between sociodemographic characteristics, knowledge, and attitudes with WTS

It is worth noting that we found no statistically significant associations between being a waterpipe smoker and the demographic characteristics of respondents (Table 3). However, the chi-square test results showed that having a mother ($p = 0.015$) or a close friend ($p < 0.001$) who smoked was associated with waterpipe smoking. Approximately 14% of waterpipe smokers have mothers who smoke, and 80.6% of them have at least one close friend who smokes. As for the knowledge and attitude scores, the means were not statistically different between smokers and nonsmokers. On average, smokers and nonsmokers answered approximately 6 out of 11 knowledge questions correctly.

**Table 1.** Socio-demographic characteristics and tobacco use of participants ($N = 199$).

| Characteristic | *N* (%) |
|---|---|
| **Age in years** | |
| 18-19.9 | 45 (22.6) |
| 20-24.9 | 108 (54.3) |
| 25+ | 46 (23.2) |
| **Gender** | |
| Male | 74 (37.2) |
| Female | 125 (62.8) |
| **Smoking in family/friends** | |
| Father | 54 (27.1) |
| Mother | 11 (5.5) |
| Sibling | 67 (33.7) |
| Close friend | 96 (48.2) |
| No smoking family/No smoking friends | 59 (29.6) |
| **Tobacco product use** | |
| Yes | 51 (25.6) |
| No | 148 (74.4) |
| **Type of tobacco product*** | |
| Traditional Cigarettes | 31 (60.8) |
| Electronic cigarettes | 28 (54.9) |
| Chewable tobacco | 5 (9.8) |
| Waterpipe/shisha | 36 (70.6) |
| Others | 11 (21.6) |

*Responses out of the respondents who reported using any tobacco product; multiple answers allowed.

**Table 2.** Practice patterns among WTS users ($N = 36$).

| Practice | Mean(±SD) | Median(IQR) |
|---|---|---|
| **Age of starting of waterpipe smoking (n = 29)** | 20.3(±5.8) | 19 (17-21) |
| **Practice** | **Frequency** | **Percentage** |
| **During the past 30 days, how many times did you smoke waterpipe/shisha:** | | |
| Daily | 4 | 11.1 |
| Twice a week | 5 | 13.9 |
| Once per week | 2 | 5.6 |
| Biweekly | 6 | 16.7 |
| Once a month | 14 | 38.9 |
| Missing | 5 | 14.0 |
| **With whom do you usually smoke shisha?** | | |
| With friends and/or family members | 27 | 75.0 |
| Alone | 6 | 16.7 |
| Missing | 3 | 8.3 |
| **How long does the waterpipe/shisha smoking session last?** | | |
| <30 minutes | 2 | 5.6 |
| 30 to 60 minutes | 16 | 44.4 |
| >1 hour | 15 | 41.7 |
| Missing | 3 | 8.3 |
| **Where do you usually smoke waterpipe/shisha?**[a] | | |
| Café | 26 | 72.2 |
| Restaurant | 20 | 55.6 |
| Home | 13 | 36.1 |
| Someone else's home | 16 | 44.4 |
| **When do you usually smoke waterpipe/shisha?**[a] | | |
| While drinking tea/coffee | 12 | 33.3 |
| After eating | 14 | 38.9 |
| When feeling happy | 11 | 30.6 |
| When feeling angry or stressed | 14 | 38.9 |
| With friends at any time | 25 | 69.4 |

*SD = Standard deviation, IQR = Interquartile range.
[a]= multiple answers allowed.

When assessing the relationship between the different knowledge items and WTS, 4 out of 11 items were found to be significantly associated with waterpipe smoking ($p$-value < 0.05) (Table 4). Although waterpipe smokers (58.3%) and nonsmokers (79.8%) agreed that waterpipe smoking is addictive ($p < 0.001$), approximately 40% of the smokers disagreed with this. Moreover, 52.8% of waterpipe smokers believed that shisha was less addictive than cigarettes, compared to 33.7% of nonsmokers ($p = 0.009$). As for believing that waterpipe smoking can lead to cardiovascular diseases and stroke, 61.1% of waterpipe smokers and 84% of nonsmokers agreed with this statement ($p = 0.003$); on the other hand, around 40% of the smokers reported "Don't know." The same pattern was observed when we asked whether waterpipe smoking can cause dental problems, as 60% of smokers compared to 82% of nonsmokers agreed with this view ($p = 0.02$), but 40% of smokers disagreed or said "Don't know" whether waterpipe smoking can cause dental problems. In addition, almost 50% of both waterpipe

**Table 3.** Associations between socio-demographics and WTS ($N = 199$).

| | Waterpipe Smoking | | |
|---|---|---|---|
| Characteristics | No ($N = 163$) *n* (%) | Yes ($N = 36$) *n* (%) | *p*-value |
| **Knowledge Score, Mean (±SD)**[a] | 6.75 (2.4) | 6.08 (2.5) | 0.160 |
| **Age group** | | | 0.201 |
| <20 | 40 (24.5) | 4 (11.1) | |
| 20-25 | 92 (56.4) | 23 (63.9) | |
| >25 | 31 (19.0) | 9 (25.0) | |
| **Gender** | | | 0.88 |
| Male | 61 (37.4) | 13 (36.1) | |
| Female | 102 (62.6) | 23 (63.9) | |
| **Level of education** | | | 0.14 |
| undergraduate | 154 (94.5) | 31 (86.1) | |
| graduate | 9 (5.5) | 5 (13.9) | |
| **Marital status** | | | 0.53 |
| Single | 137 (84.0) | 30 (83.3) | |
| Married | 22 (13.5) | 4 (11.1) | |
| Other (Specify) | 4 (2.5) | 2 (5.6) | |
| **Nationality** | | | 0.75 |
| Qatari | 68 (41.7) | 14 (38.9) | |
| Others | 95 (58.3) | 22 (61.1) | |
| **Family total household income** | | | 0.38 |
| Less than 10,000 QR | 26 (16.5) | 2 (5.7) | |
| 10,000-19,999 QR | 42 (26.6) | 10 (28.6) | |
| 20,000-30,000 QR | 30 (19.0) | 9 (25.7) | |
| More than 30,000 QR | 60 (38.0) | 14 (40.0) | |
| **Place of living** | | | 0.09 |
| With family | 131 (94.9) | 30 (90.9) | |
| Own household | 5 (3.6) | 1 (3.0) | |
| QU Student Housing | 2 (1.4) | 0 (0.0) | |
| Others | 0 (0.0) | 2 (6.1) | |
| **Smoking in family/friends** | | | |
| Father | 41 (25.2) | 13 (36.1) | 0.18 |
| Mother | 6 (3.7) | 5 (13.9) | **0.015*** |
| Sibling | 50 (30.7) | 17 (47.2) | 0.057 |
| Close friend | 67 (41.1) | 29 (80.6) | **<0.001*** |
| No smoking family/No smoking friends | 57 (35.0) | 2 (5.6) | **<0.001*** |

[a]total knowledge score was created by summing up the eleven questions. The score ranged from 0 to 11. A higher score indicates a more positive knowledge regarding the influence of waterpipe smoking on health.

smokers and nonsmokers answered "Don't know" when asked if waterpipe smoking helped in weight reduction.

The attitude of the participants was assessed using nine items, of which three were found to be significantly associated with waterpipe smoking (Table 5). Around half of the waterpipe smokers and three-quarters of the nonsmokers believed that having parents who smoke waterpipe/shisha makes it more likely that they, too, would take to smoking it ($p = 0.005$). However, nonsmokers were more likely to be convinced that advertisements could encourage shisha smoking than smokers ($p = 0.002$). Meanwhile, smokers (70.6%) were more likely than nonsmokers (37%) to believe that females are more comfortable in smoking waterpipes than cigarettes ($p = 0.002$).

## Discussion

The current study is the first to investigate the knowledge, attitude, and practices of waterpipe tobacco smoking among university students in Qatar. Focusing on this age group is particularly important because of the age of waterpipe smoking initiation. A previous study in Qatar had reported that 37% of waterpipe smokers started between the ages of 18-22years and 22% between the ages of 13-17 years (Jaam et al., 2016). In our study, 18.1% of all respondents reported smoking the waterpipe compared to 9.3% in Yemen (Nasser & Zhang, 2019), 22.8% in Saudi Arabia (Muzammil et al., 2019), and 32.9%% in Palestine (Nazzal et al., 2020).

### *Sociodemographic characteristics of the respondents*

Age was not significantly associated with waterpipe smoking, which could be explained by the lower variability of age among smoking participants in our sample. Although a study supported similar findings (Azab et al., 2010), another study showed a significant relationship (Daradka et al., 2019). No significant difference in waterpipe smoking was observed between males and females in the current study, similar to the findings of a study conducted in Saudi Arabia (Daradka et al., 2019), as this could be due to the social acceptance of waterpipe smoking among women (Akl et al., 2013). In contrast to our findings, other studies have shown significant gender differences in WTS among students (Khabour et al., 2012). Having a mother or a close friend who smoked waterpipe was significantly associated with waterpipe smoking among students, similar to the findings of another study (Khabour et al., 2012).

### *Individual factors: knowledge of health risk and attitude toward WTS*

The present study identified some defects in knowledge, as the mean score of WTS and its harms acted as protective factors for waterpipe smoking, albeit not significantly. A considerable number of participants believed that waterpipe smoking is less addictive than traditional cigarettes, which is in agreement with

**Table 4.** Associations between Knowledge and WTS ($N = 199$).

| | Waterpipe Smoker | | |
|---|---|---|---|
| **Knowledge** | **No ($N = 163$) $n$(%)** | **Yes ($N = 36$) $n$(%)** | ***p*-value** |
| **Waterpipe/shisha contains nicotine** | | | |
| Agree | 122 (74.8) | 30 (83.3) | 0.52 |
| Disagree | 10 (6.1) | 2 (5.6) | |
| Don't Know | 31 (19.0) | 4 (11.1) | |
| **Waterpipe/shisha is addictive** | | | |
| Agree | 130 (79.8) | 21 (58.3) | **<0.001*** |
| Disagree | 16 (9.8) | 14 (38.9) | |
| Don't Know | 17 (10.4) | 1 (2.8) | |
| **Waterpipe/shisha is less addictive than cigarettes** | | | |
| Agree | 55 (33.7) | 19 (52.8) | **0.009*** |
| Disagree | 74 (45.4) | 16 (44.4) | |
| Don't Know | 34 (20.9) | 1 (2.8) | |
| **Waterpipe/shisha is less harmful to health compared to cigarettes** | | | |
| Agree | 12 (7.4) | 7 (19.4) | 0.073 |
| Disagree | 133 (81.6) | 24 (66.7) | |
| Don't Know | 18 (11.0) | 5 (13.9) | |
| **Waterpipe/shisha smoking can cause lung cancer** | | | |
| Agree | 145 (89.0) | 31 (86.1) | 0.46 |
| Disagree | 6 (3.7) | 3 (8.3) | |
| Don't Know | 12 (7.4) | 2 (5.6) | |
| **Waterpipe/shisha smoking leads to cardiovascular diseases and cerebral stokes** | | | |
| Agree | 137 (84.0) | 22 (61.1) | **0.003*** |
| Disagree | 4 (2.5) | 0 (0.0) | |
| Don't Know | 22 (13.5) | 14 (38.9) | |
| **Waterpipe/shisha smoking leads to dental problems** | | | |
| Agree | 130 (80.2) | 21 (60.0) | **0.02*** |
| Disagree | 9 (5.6) | 6 (17.1) | |
| Don't Know | 23 (14.2) | 8 (22.9) | |
| **Waterpipe/shisha smoking reduces weight** | | | |
| Agree | 41 (25.2) | 12 (33.3) | 0.51 |
| Disagree | 39 (23.9) | 6 (16.7) | |
| Don't Know | **83 (50.9)** | **18 (50.0)** | |
| **Waterpipe/shisha contains carbon monoxide** | | | |
| Agree | 74 (45.4) | 21 (58.3) | 0.31 |
| Disagree | 5 (3.1) | 1 (2.8) | |
| Don't Know | 84 (51.5) | 14 (38.9) | |
| **Water in Waterpipe/shisha filters toxins** | | | |
| Agree | 33 (20.2) | 13 (36.1) | 0.066 |
| Disagree | 50 (30.7) | 12 (33.3) | |
| Don't Know | 80 (49.1) | 11 (30.6) | |
| **Waterpipe/shisha contains tar** | | | |
| Agree | 67 (41.1) | 15 (41.7) | 0.30 |
| Disagree | 11 (6.7) | 5 (13.9) | |
| Don't Know | 85 (52.1) | 16 (44.4) | |

other research (Jackson & Aveyard, 2008). Most waterpipe smokers were aware of the harmful effects of WTS, including cardiovascular diseases and cerebral strokes; however, about 40% of smokers reported not knowing about these complications. Similarly, regarding dental problems caused by WTS, about quarter of smokers answered "Don't know." These findings reflect the need to provide health education to university students about the health hazards of WTS. Consistent with our results, previous research shows that waterpipe smokers are not aware of, or underestimate, the adverse health effects of WTS and believe it is less harmful than cigarette smoking (Jackson & Aveyard, 2008).

The vast majority of the participants in our study agree that females are more comfortable smoking waterpipes than cigarettes, as it is culturally unfavorable for women to smoke cigarettes in the Arab community (Maziak, 2002), while waterpipes are commonly used and socially acceptable for women in the Eastern Mediterranean Region (Khalil et al., 2013). Nevertheless, it should be noted that cultural acceptability of WTS for women is not uniform across the region, with some countries being more "socially liberal" than others in the region (Maziak et al., 2014). Taking WTS in public (café/smoke shop/restaurant) as an indicator of social acceptability, a study of university students in four Arab countries found a range of 35.9% to 86.2% of females reporting public WTS (Hamadeh et al., 2020).

In our current study, the majority of smokers did not perceive waterpipe smoking as "cool," a finding that does not corroborate previous research that found that most waterpipe smokers perceive WTS as "cool" (Othman et al., 2017). Both smokers and nonsmokers agreed that having parents who smoke waterpipes may motivate them to become waterpipe smokers. In support of these findings, previous research demonstrated that children who have parents who are waterpipe smokers tend to smoke waterpipes themselves (Jamil et al., 2011).

## *Behavior and lifestyle*

Our findings demonstrate that students indulge in this habit once a month. This is in keeping with Othman et al. (Othman et al., 2017), which also found that most participants smoked waterpipes once a month. Similar to previous findings, most smokers went to cafés for WTS (Obeidat et al., 2014) as this could be a way of socializing in some communities. Prior studies indicate that the increase in WTS prevalence could

**Table 5.** Associations between Attitudes and WTS ($N = 199$).

| Attitude | Waterpipe Smoker | | |
|---|---|---|---|
| **Having parents who smoke waterpipe/shisha make it more likely to smoke waterpipe/shisha** | **No ($N = 163$) $n$(%)** | **Yes ($N = 36$) $n$(%)** | ***p*-value** |
| Disagree | 16 (11.9) | 12 (34.3) | **0.005*** |
| Neutral | 16 (11.9) | 5 (14.3) | |
| Agree | 103 (76.3) | 18 (51.4) | |
| **Having friends who smoke waterpipe/shisha make it more likely to smoke waterpipe/shisha** | | | |
| Disagree | 11 ( 8.2) | 7 (20.0) | 0.110 |
| Neutral | 15 (11.2) | 5 (14.3) | |
| Agree | 108 (80.6) | 23 (65.7) | |
| **Advertisement can encourage waterpipe/shisha smoking** | | | |
| Disagree | 21 (15.6) | 15 (42.9) | **0.002*** |
| Neutral | 40 (29.6) | 10 (28.6) | |
| Agree | 74 (54.8) | 10 (28.6) | |
| **Waterpipe/shisha smoking is part of our cultural heritage.** | | | |
| Disagree | 89 (65.9) | 19 (55.9) | 0.450 |
| Neutral | 27 (20.0) | 8 (23.5) | |
| Agree | 19 (14.1) | 7 (20.6) | |
| **People smoking waterpipe/shisha look cool.** | | | |
| Disagree | 110 (82.1) | 23 (67.6) | 0.086 |
| Neutral | 15 (11.2) | 9 (26.5) | |
| Agree | 9 ( 6.7) | 2 ( 5.9) | |
| **People smoking waterpipe/shisha have more friends.** | | | |
| Disagree | 97 (71.9) | 25 (73.5) | 1.000 |
| Neutral | 30 (22.2) | 7 (20.6) | |
| Agree | 8 ( 5.9) | 2 ( 5.9) | |
| **Girls are more comfortable in smoking waterpipe/shisha compared to cigarettes.** | | | |
| Disagree | 47 (34.8) | 4 (11.8) | **0.002*** |
| Neutral | 38 (28.1) | 6 (17.6) | |
| Agree | 50 (37.0) | 24 (70.6) | |
| **I smoke waterpipe/shisha because it might be less harmful to me than smoking cigarettes.** | | | |
| Disagree | 89 (76.1) | 21 (61.8) | 0.098 |
| Neutral | 19 (16.2) | 6 (17.6) | |
| Agree | 9 ( 7.7) | 7 (20.6) | |
| **I smoke waterpipe/shisha because it might help me quit smoking cigarettes.** | | | |
| Disagree | 81 (71.1) | 27 (81.8) | 0.300 |
| Neutral | 25 (21.9) | 6 (18.2) | |
| Agree | 8 ( 7.0) | 0 ( 0.0) | |

be a result of the upsurge in accessing waterpipe products in public places (Barnett et al., 2009) and the availability of waterpipes in cafés and restaurants (Al Mulla et al., 2015). WTS with friends and/or family was common among participants and, in agreement with another study, most students preferred to smoke waterpipes with their friends (Jradi et al., 2013b). As per time preferred to smoke, our study revealed that the preferred time is after meals, similar to the finding that 24% of Arab students in Malaysia also preferred smoking after meals (Ali Anbeeh & Meer Ahmad, 2019).

## *Social networks: family and especially mothers*

Our findings shed light on the importance of family influence on waterpipe smoking behavior, as it was found to be significantly associated with waterpipe smoking among university students. Previous research supports our results, which show that WTS is significantly associated with waterpipe smoking among family members (Khabour et al., 2012). Since waterpipe smoking is seen as a social activity, and students are influenced by behaviors of their surroundings, this could explain such an association (Jawad et al., 2015). This research also established that the rate of having no family members who smoked the waterpipe was found to be significantly more among those who did not smoke the waterpipe. In support of these results, research emphasizes the important role of family WTS in influencing this behavior among students (Jawad et al., 2015). Young adults often begin WTS by sharing waterpipes among family members as it is seen more culturally acceptable than traditional smoking. Family influence could contribute to the initiation of waterpipe smoking at an early age (Maziak et al., 2004).

In this study, waterpipe-smoking mothers were significantly associated with WTS. A study in Saudi Arabia revealed that most mothers preferred waterpipe smoking to cigarette smoking, which might influence the smoking behavior of their daughters (Koura et al., 2011). In some regions, as waterpipe smoking is a tradition, mothers ask their girls to prepare the waterpipe, which can make them more curious to try it out themselves (Baheiraei et al., 2015). Other women reported that they might smoke waterpipes with their children at home to get along with them (Baheiraei et al., 2015).

## *Environmental factors: culture and media*

Waterpipe smoking is considered a traditional practice in many Middle Eastern countries (Nakkash et al., 2011). Waterpipes are deemed socially appropriate, and as more appropriate for women's use in the Middle East than cigarette smoking. The current study found smokers to be more likely to agree that women are more comfortable with smoking waterpipe/shisha than cigarettes. Waterpipe smoking is increasing among females as they are more accepting of waterpipe

smoking than males, despite the belief in the risks of waterpipe smoking relative to cigarette smoking (Nakkash et al., 2011).

Common misconceptions about water pipe tobacco smoking are enhanced or propagated through media messages. This study found that nonsmokers are more likely to agree that advertisements can encourage waterpipe smoking than smokers, consistent with the findings of a study reporting that participants perceived media promotion of waterpipes as encouraging and persuading people to smoke (Jamil et al., 2011). A qualitative study of the influence of WTS reported that the media's impact was exerted through encouraging representations of WTS scenes, especially in advertisements and TV series during the month of Ramadan. Waterpipes are often portrayed in the media as glamorous, with greater media exposure encouraging people to try it (Nakkash et al., 2011).

The main limitation of the study is the low response rate, which is common for campus studies using online surveys, especially considering that this study was conducted during the first wave of the COVID-19 pandemic in Qatar. Due to the low response rate, associations could not be examined using multivariate models. Responses may also have been affected by social desirability bias, despite the assurances of the confidentiality of responses. Despite these limitations, this is the first study to investigate WTS knowledge, attitudes, and practice among university students in Qatar. A stratified random sample was drawn from the students, which can offer a good representation of the target population.

The findings of this study have several research implications, indicating a need for further investigation of the associated factors of WTS with a larger sample of students, as well as conducting qualitative studies to clarify smoking behavior among females and assess barriers to waterpipe smoking cessation services. Implications for practice include the development and implementation of multilevel health education and promotional interventions to spread awareness, increase knowledge, and reduce exposure to related factors influencing waterpipe smoking. These interventions can include family members, especially mothers and peers, as they impact the smoking behavior of students. Additionally, according to this study, advocating policies relating to smoking waterpipes in public areas can be implemented and enforced.

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## Disclosure of interest

The authors declare that they have no conflict of interest. The authors alone are responsible for the content and writing of the article.

## Author contributions

GFA, RK, & NI: conceptualization of the study, questionnaire design, sampling design and data collection, analysis and manuscript drafting. HAR: grant writer/recipient, conceptualization of the study, questionnaire design, critical review of the manuscript, and response to reviewer comments. NA and SA: manuscript drafting.

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## Ethical approval

The study was reviewed and approved by the Qatar University Institutional Review Board (Research Ethics Approval No is QU-IRB 1188 E-2019).

## Data availability statement

Data may be shared upon reasonable request.

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