

## RESEARCH COMMUNICATION

# Harm Perception, Attitudes and Predictors of Waterpipe (Shisha) Smoking among Secondary School Adolescents in Al-Hassa, Saudi Arabia

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### Abstract

**Objectives:** This study aimed to determine the prevalence and social determinants of waterpipe (WP) smoking among secondary school students in Al-Hassa, Saudi Arabia and to assess their health related knowledge and attitudes toward WP. **Subjects and Methods:** A cross-sectional study was conducted with 1,652 Saudi secondary school students of both genders aged between 15-19 years selected by multistage sampling method. A self-administered anonymous Arabic version of Global Youth Tobacco Survey modified with items dedicated to WP smoking and to assess perception of health related hazards and attitudes towards WP was employed for data collection. **Results:** Prevalence of current smokers 'all forms' was 30.3% among males (C.I= 27.5- 33.2%) and 8.5% in females (C.I= 6.6-10.9%). WP was used by 53.9% of the current tobacco users, significantly higher among older age students. Of the regular WP smokers, 20.7% smoked WP on daily basis, 23.8% weekly, 64.2% stated using flavored "Muassel" tobacco. Primary motives for WP smoking were outings with friends, company, boredom and wasting time. Of the total, 49.7% of students stated that WP smoking is less harmful than cigarettes, 60.5% believed that harmful substances were purified through water filtration, with non-addictive properties in 67.8%. Knowledge about health hazards of WP smoking was low, irrespective of student's smoking status. WP smoking is more socially acceptable than cigarettes (52.1%), represents a good opportunity for gathering of friends and family (33.8%), and smoking of WP can relieve stress and tensions (37.8%). Hierarchical regression analysis showed that socializing motives, cigarette smoking, smoking among close family and friends, male gender and increasing age were positive predictors for WP smoking. **Conclusion:** Social acceptability, poor knowledge of WP health related hazards and certain socio demographics are favoring the increasing current trend of WP use among adolescents in Al Hassa, Saudi Arabia.

**Keywords:** Waterpipe Shisha smoking - smoking predictors - adolescents - knowledge - Saudi Arabia

*Asian Pacific J Cancer Prev*, **11**, 293-301

### Introduction

The World Health Organization (WHO) attributes 4.9 million deaths a year to tobacco use, a figure expected to rise to >10 million by 2030 if the current trend continues (Peto and Lopez, 2001). Almost 70% of these premature deaths will be in developing countries, one-third (~250 million) of which will be children (WHO, 1999) making tobacco use a global epidemic. Despite the fact that the main burden of this epidemic is taking place in the developing countries, most research and management efforts addressed developed nations (Jha and Chaloupa, 2000). These researches also tend to focus on prevalent methods of tobacco use in these countries, namely cigarettes and smokeless tobacco use, and in most of instances did not consider those prevalent in developing countries such as waterpipe (WP) (Wart et al., 2005),

despite the fact that as many as 100 million people use such type of method for tobacco use (Wolfram et al., 2003).

Waterpipe "Shisha, Muasel, Hookha, Nargilha" smoking has gained popularity in most countries of the Middle East and become a common practice in the Arabian Peninsula, Turkey, India, Pakistan, Bangladesh and China (Knishkowsky and Amitai 2005), especially attracting young population. Factors promote such popularity may include its social acceptance as a part of cultural heritage, easy availability, attractive designs, and flavored aromatic tobacco "called Muassel" (Maziak et al., 2004a).

In some Arab countries WP smoking is less stigmatizing than cigarette smoking, with less gender differential (Kandela, 2000; Tamim et al., 2001; Maziak et al., 2004b). In Syria, among university students, it was found that 62.6% of men and 29.8% of women had ever smoked

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WP (Maziak et al 2004b). Another survey among Kuwaiti employees found that 57% of men and 69% of women had ever used WP (Memon et al., 2000). In many European countries and United States, there has been an upsurge of WP use in the past several years with anticipation that this popular form of smoking will increase due to globalization and immigration to these countries (Ward et al., 2007).

WP is perceived by many adolescents, the general public, and even health professionals as being less dangerous than cigarette smoking (Maziak et al., 2004a), for example, nicotine content is lower than that of cigarettes, water filters out all noxious chemicals, including carbon monoxide, tar and nicotine, it is less irritating and thus less harmful to the throat and respiratory system, Muassel "Narghile tobacco contains fruit, making them a healthy choice" (Ward et al., 2007).

Although individuals of college age seem to be the group most vulnerable to WP use, secondary school students are also prone due to the increasing popularity of this form of tobacco use (Saeed et al., 1993; Al Damegh et al., 2004), which is primarily social in nature. To address gap in the current literature on WP tobacco smoking among Saudi adolescents, we hypothesized that: socio-demographic variables including age, gender, smoking behavior among close relatives and friends, history of cigarettes smoking, the presence of poor knowledge towards health related hazards, social acceptability may increase the likelihood for being current WP user. To the best of our knowledge, this study is the first to define social predictors to WP smoking among secondary school adolescents in Saudi Arabia. The objectives of this study were to define the prevalence, pattern of WP smoking among secondary school adolescents in al Hassa, KSA, assess their health related knowledge and attitudes toward WP smoking and to determine the possible predictors for adoption of WP smoking among them.

## Subjects and Methods

### *Setting and design*

A cross-sectional descriptive study carried out in Al-Hassa Governorate, located in the Eastern Province of Saudi Arabia, 350 Km from Riyadh, populated with nearly one million Saudis. Al-Hassa is comprised of three areas; urban, populated by about 60% of total population, rural, consisted of 23 villages, occupied by 35 % and Hegar "Bedouin scattered communities" represented 5% "nearest Hegar is about 65 Km distance".

### *Population and sampling*

Total students enrolled in the secondary schools in Al Hassa were 50,399, of which 24,466 were males (according to local Directorate of Education 2008). The number of male schools were 42 including 13,909 students in urban and 10,557 in rural. Female secondary schools were 43 with a total enrolled population of 25,933; 16,027 in urban and 9,906 in rural areas. Considering the prevalence of smoking of 30% (Saeed et al., 1993; Al Damegh et al 2004), with the worst acceptable frequency of 28%, using a confidence level of 95% and power of 80%, the minimum sample size would be around 1502 subjects.

An additional 30% increment was considered for the possible non-response; hence, the total sample size would be 1953 students. Sub-sampling was carried out using an appropriate sampling fraction for gender and urban-rural distribution. Secondary schools were randomly assigned using an updated sampling frame, where 10 urban (5 males and 5 females) and 8 rural schools (4 male and 4 females) were selected. Proportionate sample size was assigned according to the number of enrolled students in selected schools. In the final phase we employed a systematic technique using the academic number from school files to randomly select Saudi students. Selected students were approached either personally in case of males or through their teachers (in case of female students) with covering letter and consent form to their legal guardians for their approval.

### *Data collection and measures*

An anonymous self-administered questionnaire was used for data collection included the following parts:

a- The Arabic version of the Global Youth Tobacco Survey 2001 (GYTS) (GYTS core questionnaire, accessed 2009) developed by Centers for Diseases Control (CDC, Atlanta, Georgia, USA) for smoking survey among youth was used to determine pattern and prevalence of smoking, similar questions were used to assess WP smoking including: frequency in relation to weekday/weekend use, age at initiation, place of smoking, time spent in smoking sessions, costs, type of flavors preferred in shisha /Muassel used (if any), smoking of shisha among close friends and family members, primary motives for smoking and quitting attempts, their frequency in the last year, quitting desire in the near future. In Saudi community, terms that commonly used in WP smoking description included a) Shisha: method of smoking without any aromatic or essence added. b) Muassel: was used to signify the use of flavored tobacco with aromatic essences 'fruits mostly', which is the most common form of tobacco using WP smoking among this age group. Those who had not smoked in the previous 12 months or longer were asked to consider themselves as former smokers.

b- The second part of the questionnaire comprised of ten questions related to knowledge about health hazards and myths of WP tobacco use derived from the available literature (Anjam et al., 2008; Jawid et al., 2008; Smith-Simone et al., 2008), correct answer received a score of one and incorrect and do not know received 0.

c- The third part comprised 10 items to measure the attitudes towards WP smoking with responses ranged from strongly agree, agree to strongly disagree, disagree and undecided. Selection of these items was carried out by a panel of scientists affiliated to College of education, Medicine and Local School Health Directorate. Field pre-testing was carried out to finalize these parts with calculation of reliability coefficient before administration.

d- Enquiries dedicated to regular WP smokers regarding frequency in relation to weekday/weekend use, age at initiation, place of smoking, time spent in smoking sessions, costs, type of flavors (if any) preferred, smoking of WP among close friends and family members, primary motives for smoking and quitting attempts and frequency

in the last year. Those who had not smoked in the previous 12 months or longer were asked to consider themselves as former smokers.

#### *Questionnaire administration*

School visits were carried out for the purpose of orientation of teachers and selected students regarding the objectives, contents and confidentiality of data. In female schools, female teachers were assigned for procedures of orientation, and data collection under the supervision of the investigators in response to the conservative nature of Saudi community. Questionnaire administration was conducted in computer laboratory or the school library after reading the questionnaire loudly, while administration was anonymous and solicited.

#### *Pilot testing and reliability analysis*

Initial questionnaire was tested on 102 students beyond the sample size, at a nearby school for convenience. During this phase we categorized the different responses for primary motives and conducted the reliability analysis of different tools used. For the knowledge section with 10 items, a reliability coefficient (Cronbach's  $\alpha$ ) of 0.85 was obtained, while for the 10 attitude items, the reliability coefficient was 0.71.

#### *Data processing and analysis*

Questionnaires with missing of more than two elements were discarded (71 forms). The overall response rate was 84.6%: with a response rate of only 66.8% among urban female secondary schools. A pre-designed SPSS version 16.0 (SPSS Inc. Chicago IL.) file was used for data entry and data analysis. For categorical data: frequency, proportion and percentage were used for expression, univariate analysis with estimation of Odds ratio and 95% confidence intervals, Chi square, Fisher exact and Z test for proportions tests of significance were used for comparisons. For continuous data, data were presented using mean, standard deviation and median, t-test and Mann Whitney tests of significance were used for comparisons. Knowledge scores were classified into poor (< 4 out of 10), medium knowledge (4-6 points) and high knowledge (> 6 points). Hierarchical logistic regression analysis was generated to determine whether socio-demographic variables (age, gender), exposure to tobacco (smoking among close relatives and friends), form of smoking, and motives.

Predictors were entered in three steps according to a specified hierarchy (Jarallah et al., 1996; DeCoster, 2006) through:

1. Forced entry of socio-demographic variables (gender, age in years).
2. Followed by entry of smoking behavior among close family members and close friends.
3. Form of smoking (cigarettes) and knowledge scores.
4. The last step entailed entry of motives; motives for current smoking status (socializing, outing, meeting friends and family vs. relieving stress, pleasure and happiness).

This procedure for constructing hierarchy was recommended by DeCoster (2006) to reduce potential

problems with multicollinearity. Odds ratio with 95% confidence intervals, change in  $\chi^2$  were evaluated at the final step of the regression equation when all variables were entered. Because there are no agreed-upon measures for R2 contributions to date in multilevel logistic regression, we analyzed the data as a single level model to obtain the Nagelkerke R2 statistic (Nagelkerke 1991), which compares the null model and fitted model likelihood functions as a proportion of the maximum possible R2 value. The R2s for all predictors and Chi-square statistic with its significance were reported for the single-level logistic regression, since there are no agreed-upon measures in hierarchical logistic multivariate analysis. Dummy codes were applied to dichotomous variables Gender (1=male, 0=female), WP smoking among family members (1= yes 0= no), WP among close friends (1= All or most of them, 0= some or none), current cigarettes smoking (1=yes, 0=no), knowledge level (1= scores > 4, 0=scores  $\leq$  4), motives (1= socializing, imitation, outing, 0= relieve of stress, pleasure), in generation of hierarchical regression. Probability used for inclusion in the regression model was 0.05 and for removal was set at P = 0.10. Statistical significance was set at 0.05.

#### *Ethical considerations*

Research protocols as well as tools used for data collection were approved by our institution and Local Education Directorate. Proper orientation of the selected students was carried out to explain the objectives of the study with emphasis on the right of non participation. Those with consent form with guardians' approval were included in the data collection phase. Data confidentiality was preserved according to the Helsinki declaration of bioethics.

## **Results**

The total population included was 1,652 secondary school students; of which 60.4% were males with a ratio of 1.5:1 female. Age ranged from 15 to 19 years with a mean of 17.5 $\pm$  1.0 years (males aged 17.4 $\pm$ 1.1 and females 17.4 $\pm$ 1.0 years). Urban students represented 57.5%.

Current smokers (both genders) were 358 (21.7%: confidence intervals 'CI' = 19.8- 23.7%). Among males the prevalence of current smokers was 30.3% (C.I= 27.5-33.2%) while for females it was 8.5% (C.I= 6.6-10.9%). Ever smokers constituted 419 (25.4% among both genders, CI=23.3-27.5%) as 43 males and 18 females reported as being former smokers. Ever smokers among males were 34.6%, CI=31.7-37.6, vs. 11.3%, CI= 9.1-14.0% for females. Never smokers constituted 1,233 (74.6% CI= 72.5-76.7%, males = 65.4%, CI=62.4-68.3%, females =88.7% CI= 86.0-90.4%). Among current smokers; cigarettes was used by 224/358 (62.6% of all smokers), as the only type of smoking in 175/224 or with WP in 59/224 (13.6 %, CI=12.0-15.3%).

WP was used by 193 (53.9%) of the current tobacco users (134/285 were using it solely, prevalence of 11.7%, CI=10.2-13.3%), and both cigarettes and WP were used by 59 students (3.6% CI= 2.8-4.6%). Occasional and/or experimentation of WP smokers were 251 (15.2%); 76.1%

**Table 1. Socio-demographics of Secondary School Students according to their Current Smoking Status**

Socio-demographics	Total (N=1,652)	Smokers† (N=358)	Odds ratio (95% C.I.)
Gender			
Males	997(60.4)	302(30.3)	4.65(3.93-6.38)**
Females	655(39.6)	56 (8.5)	Reference
Residence			
Urban	950(57.5)	203(21.4)	1.26(0.98-1.63)
Rural	702(42.5)	155(22.1)	Reference
School grades			
1 <sup>st</sup>	454(27.5)	79(17.4)	0.69(0.52-0.92)*
2 <sup>nd</sup>	629(30.1)	118(18.8)	0.75(0.58-0.97)*
3 <sup>rd</sup>	569(34.4)	161(28.3)	Reference
Age “years”			
16	364(22.0)	61(16.8)	0.67(0.49-0.92)*
17	481(29.1)	83(17.3)	0.70(0.52-0.92)*
18	494(29.9)	105(21.3)	1.16(0.89-1.51)
19	313(19.0)	109(34.8)	Reference
Mother’s education			
Illiterate/read and write	475(28.8)	104(21.9)	1.02(0.78-1.33)
Primary /intermediate	493(29.8)	109(22.1)	1.03(0.79-1.34)
Secondary	415(25.1)	79(19.0)	0.81(0.60-1.08)
University /higher	269(16.3)	66(24.5)	Reference
Father’s education			
Illiterate/read and write	391(23.7)	99(25.3)	1.31(1.00-1.73)*
Primary /intermediate	561(34.0)	129(23.0)	1.12(0.87-1.45)
Secondary	441(26.7)	86(19.5)	0.84(0.63-1.11)
University /higher	259(15.7)	44(17.0)	Reference
Smoking among close family			
Father	296(17.9)	92(31.1)	1.85(1.38-2.74)**
Brothers	185(11.2)	59(31.9)	1.83(1.29-2.59)**
Father and brothers	151 (9.1)	43(28.5)	1.50(1.01-2.21)**
Others	110 (6.7)	23(20.9)	0.95(0.58-1.57)
None	910(55.1)	141(15.5)	Reference
Smoking close friends			
All of them	131 (7.9)	116(88.5)	9.06(6.41-12.83)**
Most of them	139 (8.4)	100(71.9)	5.25(3.78-7.28)**
Some of them	425(25.7)	78(18.4)	0.76(0.57-1.01)
None	957(57.9)	64(6.7)	Reference

†: Current smokers; CI: Confidence Intervals; \*P<0.05; \*\*P<0.001

were males (tried or smoke WP during the last year without being regular smokers during family gathering, wedding and other parties). Smoking of family member and close friends was significantly higher among current smokers compared to non smokers.

Table 1 demonstrates that male gender (Odds ratio ‘OR’ = 4.65), higher grades at secondary school (3<sup>rd</sup> grade, OR= 1.77, P=0.001), older age of students (> 18 years, OR =2.34, P=0.001). Table 2 displays characteristics of the current smokers ‘cigarettes and WP’ in relation to gender. Cigarettes’ smoking was the chief method used among females, while males showed more frequent usage of WP with/without cigarettes. The age at initiation of cigarettes was significantly lower compared to those smoked WP or both cigarettes and WP (17.5% of cigarettes smokers started at the age of ≤ 10 years vs. 3.7% and 11.9% of WP or cigarettes and WP respectively). Age at initiation of cigarette was significantly lower among males (P=0.022), compared to age at initiation of WP with or without cigarettes. The number of cigarettes /day and shisha bowls /week was significantly higher among males (P=0.001).

Table 3 demonstrates some characteristics of the current WP smokers, those of older age (≥ 18 years) showed a prevalence of 65.8% vs. a prevalence of 34.2%

among those < 18 years of age (P=0.001). Of the regular current WP smokers, 20.7% smoked WP on daily basis, 23.8% weekly basis and 51.4% on every two weeks or monthly, 64.2% stated using the flavored “Muassel” tobacco. Current WP users showed higher prevalence of WP smoking among close friends and relatives. The main places for WP smoking as mentioned by respondents were café, Estraha (rest ups found at the periphery of main towns); in house and Mazraa (another form of rest up houses within farms). Monthly costs for smoking were higher for those smoking both WP and cigarettes compared to WP alone. Quitting attempts were significantly higher among WP users only compared to those using WP and cigarettes.

Primary motives mentioned for current WP or cigarettes and WP smokers: Outing with friends and company, boredom and wasting time, meeting friends and family members were the main stated motives in more than 70% of the responses, negligence by the family, imitation of friends, fathers and big brothers followed by emotional were stated in > 50% of the responses, while the presence of emotional and family problems, as a method to relieve stress and tensions stated by about 20% and finally to seek pleasure and happiness in < 10% of responses.

**Table 2. Pattern of Smoking among Current Tobacco using Students in Relation to Gender**

Smoking characteristics	Gender			Pvalue
	Males(N=302)	Females(N= 56)	Total(N=358)	
Smoking type (regular smokers)				
Cigarettes only	116(38.4)	49(87.5)	165(46.1)	
Shisha (waterpipe/ Muassel) only	133(44.0)	1 (1.8)	134(37.4)	0.010 <sup>a</sup>
Cigarettes and Shisha	53(17.5)	6(10.7)	59(16.5)	
Age at initiation				
Cigarettes				
≤ 10 years	29(25.0)	--	29(17.5)	
11- < 14 years	50(43.1)	8(16.3)	58(35.2)	0.001 <sup>a</sup>
≥ 14 years	37(31.9)	41(83.7)	78(47.3)	
Mean ±SD (median)	12.7±2.8(13.0)	13.9±3.6(14.0)	13.2±2.9(13.0)	0.022 <sup>†</sup>
Shisha "Muassel"				
≤ 10 years	5 (3.8)	--	5 (3.7)	
11- < 14 years	43(32.3)	--	43(32.1)	
≥ 14 years	85(63.9)	1(100.0)	86(64.2)	
Mean ±SD (median)	15.1±2.1(15.0)	--	--	
Cigarettes / Shisha				
≤ 10 years	7(13.2)	--	7(11.9)	
11- < 14 years	23(43.4)	--	23(39.0)	
≥ 14 years	23(43.4)	6(100.0)	29(49.1)	
Mean ±SD (median)	14.7±3.3(15.0)	16.4±1.7(16.0)	15.4±2.7(15.0)	0.231 <sup>†</sup>
Number of cigarettes /day				
Mean ±SD (median)	11.3±6.3(10.0)	2.8±1.6(2.0)	8.8±6.7(7.0)	0.001 <sup>c</sup>
Shisha bowl /week				
Mean ±SD (median)	8.3±2.2(7.0)	1.6±1.0(2.0)	4.3±1.9(2.0)	0.001 <sup>c</sup>
Quitting trials: Yes	126(41.7)	18(32.1)	144(40.2)	0.179 <sup>b</sup>
Number of quitting attempts				
Mean ±SD	1.5±0.5	2.6±1.0	1.5±1.4	0.010 <sup>c</sup>
Median	2.0	4.0	3.0	
Smokers close friends				
All of them	116(38.4)	0 –	116(32.4)	
Most of them	100(33.1)	0 –	100(27.9)	0.001 <sup>a</sup>
Some of them	58(19.2)	20(35.7)	78(21.8)	
None	28 (9.3)	36(64.3)	64(17.9)	

<sup>a</sup>Fisher exact; <sup>b</sup>Chi-square test; <sup>c</sup>Mann Whitney; †: t-test for independence

Table 4 displays the correct responses towards health related hazards of WP in relation to type of smoking behavior (ever smokers vs. never smokers). Of the total, 49.7% of students have the misconception that WP smoking is less harmful than cigarettes, and this was more among the ever smokers (P= 0.001), 60.5% believed that harmful substances were purified through water filtration, 67.8% mentioned that WP has non- addictive property, significantly more among ever smokers (P=0.001). WP smoking does not cause lung cancer as mentioned by 56.4%, nor irritation of the respiratory system in 31.1% of responses (more among ever smokers).

Those with knowledge scores < 4 represented 594 (48.2%) in never smokers and 236 (56.3%) among the ever smokers (P=0.004). knowledge scores of 4-6 achieved in 319 (25.9%) in never smokers compared to 106 (25.3%) in the ever smokers, while those attained scores of > 6 were 271 (22.0%) among never smokers vs. 67(16.0%) of ever smokers (P=0.010).

Overall the state of knowledge about the health hazards of WP smoking was low among the included students irrespective of their smoking status. Gender wise difference in knowledge scores was significantly more among males compared to females (4.8±3.9 for males vs. 4.3±3.4, P=0.009), no significant difference in relation to gender within the group of current smokers although the scores were higher among males (5.1±3.4 vs. 4.4±3.1 among female smokers, P=0.152).

Table 5 displays responses of attitude items towards WP smoking among the included secondary school students. Of the included students, 52.1% agreed that WP smoking is more socially acceptable than cigarettes, 33.8% believed that smoking of WP represents a good opportunity for gathering of friends and family, 29.8% mentioned that their parents would not object their WP use, 37.8% believed that smoking of WP can relieve stress and tensions, 38.5% will prefer WP if they were to smoke because of less harm and addictive properties compared to cigarettes.

Table 6 shows the results of the generated hierarchical regression analysis of possible predictors of WP smoking among the included secondary school students. Current WP status could be explained in 13.3% by being male gender and with increasing age of adolescent (Nagelkerk R<sup>2</sup>= .153,  $\chi^2=26.44$ , P=0.001). In model 2, WP smoking could be attributed in 19.5% to the smoking status among the close family members and friends with positive association on the adoption of WP smoking (Nagelkerk R<sup>2</sup>= .195,  $\chi^2=28.17$ , P=0.003); the effect of smoking among family members was attenuated in the final model. Cigarettes' smoking was a significant positive predictor for shisha smoking in model 3 (Nagelkerk R<sup>2</sup>= .266,  $\chi^2=31.32$ , P=0.005), while higher knowledge level lacks its influence as a negative predictor in the final model. Primary motives in the form of outing, meeting friends and passing time were positive predictors for current

**Table 3. Characteristics of Waterpipe Smoking among Regular Users of Secondary School Students**

Variables	Regular Waterpipe "Shisha" smoking			P value
	Waterpipe only (N=134)	Waterpipe/ Cigarettes (N=59)	Total (N=193)	
Age in years: < 18	47(35.1)	19(32.2)	66(34.2)	0.698 <sup>β</sup>
≥18	87(64.9)	40(67.8)	127(65.8)	
Waterpipe (Shisha) smoking frequency:				0.300 <sup>β</sup>
Daily	29(21.6)	11(18.6)	40(20.7)	
Weekly	33(24.6)	13(22.0)	46(23.8)	
Every two weeks	41(30.6)	26(44.1)	67(34.7)	
Monthly	31(23.1)	9(15.3)	40(20.7)	
Place of waterpipe smoking:				0.856 <sup>a</sup>
Café	57(42.5)	28(47.5)	85(44.0)	
Estraha (rest up) /Mazraa (farm)	61(45.5)	23(39.0)	84(43.5)	
Hous	16(11.9)	8(13.5)	24(12.4)	
Type of tobacco used:				0.001 <sup>β</sup>
With flavors 'Muassel'	102(76.1)	22(37.3)	124(64.2)	
Ordinary 'non flavoured'	32(23.9)	37(62.7)	69(35.8)	
Waterpipe smokers in immediate family:				0.447 <sup>β</sup>
Father	61(45.5)	21(35.6)	82(42.5)	
Brothers	34(25.4)	15(25.4)	49(25.4)	
Father/brothers	22(16.4)	11(18.6)	33(17.1)	
None	17(12.7)	12(20.3)	29(15.0)	
Waterpipe smoking among close friends:				0.179 <sup>a</sup>
All of them	43(32.1)	22(37.3)	65(33.7)	
Most of them	54(40.3)	29(49.1)	83(43.0)	
Some of them	34(25.4)	8(13.6)	42(21.8)	
None	3 (2.2)	0 –	3(1.5)	
Monthly costs for smoking in Riyals:				0.004 <sup>†</sup>
Mean ± SD (median)	112.0±43.1(100.0)	143.6±78.8(120.0)	115.7±65.4(100.0)	
Time / session of smoking "minutes":				0.279 <sup>†</sup>
Mean ± SD (median)	96.7±49.8(90.0)	107.5±54.6(100.0)	102±50.3(95.0)	
Quitting trials: Yes				0.007 <sup>β</sup>
Quitting trials/last year: mean ±SD	51(38.1)	11(18.6)	62(32.1)	
Primary motives for smoking *:				0.023 <sup>†</sup>
Meeting friends and family	1.6±0.7	1.3±1.1	1.5±0.9	
Outing with friends and company	102(76.1)	43(72.9)	145(75.1)	
Boredom / passing of time	117(87.3)	40(67.8)	157(81.3)	
Negligence by the family	105(78.4)	42(71.2)	147(76.2)	
Imitations of father and brothers	98(73.1)	43(72.9)	141(73.1)	
Relieve of tension and stresses	84(62.7)	23(39.0)	107(55.4)	
Emotional and family problems	24(17.9)	16(27.1)	40(20.8)	
Pleasure and happiness	21(15.6)	11(18.6)	33(17.1)	
	13 (9.7)	4(6.8)	17(8.8)	

†Mann Whiteny; <sup>β</sup>Chi-square test; <sup>a</sup>Fisher Exact test; \*Not mutually exclusive

**Table 4. Knowledge regarding Health Hazards of Waterpipe Smoking in relation to Current Smoking Status**

Knowledge items	Correct responses		Total (N=1652)	P value
	Never smokers (N=1233)	Ever smokers (N=419)		
Shisha *smoking is less harmful compared to cigarettes. ( <b>False</b> )	671(54.4)	160(38.2)	831(50.3)	0.001 <sup>*</sup>
Shisha is purified of harmful substances as passing through water filter. ( <b>False</b> )	498(40.4)	155(37.0)	653(39.5)	0.249
Shisha smoking does not irritate the bronchi as it contains natural flavors and less nicotine and tar. ( <b>False</b> )	682(55.3)	172(41.1)	854(51.7)	0.002 <sup>*</sup>
Shsisha smoking is easier to quit and causing no addiction. ( <b>False</b> )	433(35.1)	110(26.3)	543(32.9)	0.001 <sup>*</sup>
Shsisha smoking does not cause lung cancer. ( <b>False</b> )	550(44.6)	170(40.6)	720(43.6)	0.202
Shisha smoking causes damage to the respiratory system. ( <b>True</b> )	880(71.4)	258(61.6)	1138(68.9)	0.002 <sup>*</sup>
Shisha smoking may transmit hepatitis infection. ( <b>True</b> )	279(22.6)	79(18.9)	358(21.7)	0.106
Shisha smoking is a leading cause of pharyngeal cancer. ( <b>True</b> )	483(39.2)	163(38.9)	646(39.1)	0.772
Infection that causes gastric ulcer can be transmitted through Shisha smoking. ( <b>True</b> )	407(33.0)	142(33.9)	549(33.2)	0.740
Shisha smoking does not cause coronary heart as cigarettes. ( <b>False</b> )	371(30.1)	128(30.5)	499(30.2)	0.970
Total score: Mean ±SD	4.3±3.7	3.9±3.9	4.2±3.7	0.061 <sup>**</sup>
Median	4.2	3.5	4.0	

†Includes both current and former smokers; \*Chi-square; \*\*Mann Whitney test; \*The terms Muassel, and waterpipe were used in addition

**Table 5. Attitudes towards Waterpipe Smoking among Secondary School Students**

Items	Responses		
	Agree*	Disagree**	Not decided
Shisha †smoking is acceptable by the society compared to cigarettes.	861(52.1)	551(33.4)	240(14.5)
Shisha smoking represents a good opportunity to meet friends and family.	558(33.8)	1030(62.3)	64 (3.9)
My parents would not object my smoking of Shisha compared to cigarettes.	492(29.8)	1103(66.8)	57 (3.4)
My parents would allow me to smoke Shisha at home but not cigarettes.	421(25.5)	1190(72.0)	41 (2.5)
Shisha smoking is a sign of maturity.	357(21.6)	1215(73.6)	80 (4.8)
Smoking of Shisha relieves stress and tension.	624(37.8)	967(58.5)	61 (3.7)
If I have to smoke, I would use Shisha because it is less harmful and less addictive compared to cigarettes.	636(38.5)	949(57.4)	67 (4.1)
Shisha smokers have more friends than non-smokers.	651(39.4)	821(49.8)	179(10.8)
Women smoking Shisha are not odds as those smoking cigarettes.	638(38.6)	768(46.5)	246(14.9)
Movie stars smoking Shisha are less offensive than those smoking cigarettes.	717(43.4)	796(48.2)	139 (8.4)

†Includes Waterpipe and Muassel; \*Both agree and strongly agree; \*\*Both disagree and strongly disagree

**Table 6. Hierarchical Regression Analysis for Predictors of Waterpipe Smoking among Secondary School Smoking Adolescents**

Steps	Variables entered	Odds ratio (95% confidence intervals)			
		Model 1	Model 2	Model 3	Model 4
Socio-demographics	Age	2.88(1.73-4.79)**	1.62(1.13-2.32)**	1.60(1.33-2.02)**	1.41(1.23-1.76)*
	Gender	3.4(1.46-8.35)***	2.71(1.61-4.56)***	1.79(1.17-2.74)**	1.54(1.31-1.93)*
Waterpipe smoking	Among family members		3.30(2.10-5.17)***	2.09(1.22-3.58)**	1.83(1.24-2.70)*
	Close friends		3.11(2.04-4.93)***	2.78(1.28-6.07)**	1.92(1.23-2.94)**
Cigarettes smoking and knowledge	Cigarettes smoking			3.8(2.52-5.84)***	1.98(1.34-2.93)**
	Knowledge level			0.56(0.34-0.93)*	0.67(0.41-1.09)
Motives	Socializing/outing				2.18(1.42-3.34)**
Constant		14.35	14.08	13.25	12.37
R2!		.153	.195	.266	.294
Δχ <sup>2</sup>		26.44	28.17	31.32	33.84
Significance		0.001	0.003	0.005	0.011

Gender (1=male, 0=female), age in years, waterpipe smoking among family members (1= yes 0= no), waterpipe smoking among close friends (1= All or most of them, 0= some or none), current or former cigarettes smoking (1=yes, 0=no), knowledge level (1= scores > 4, 0=scores ≤ 4), motives (1= socializing, imitation, outing, 0= relieve of stress, pleasure); R2!: using Nagelkerke likelihood ratio; \*P<0.05; \*\*P<0.01; \*\*\*P<0.001

shisha smoking behavior. In the final model WP smoking behavior could be explained in 29.7% of cases by the age (older), male gender, exposed to environmental exposure in the form of smoking close family and friends, smoking of cigarettes and driven by socializing and outing motives.

## Discussion

This study is one of the few from the Middle East that focuses on the predictors of WP smoking in secondary school adolescents. It was found that more than a third of the included students (44% males, 1.8% females) were regular users of WP which is higher than those reported among the corresponding adolescents at Al Hada and Taif, Saudi Arabia (Abou-Zeid et al., 2009) and the Global Youth Tobacco Survey in Saudi Arabia 2001-2004 (GYTS) (Mo'd et al., 2008). However, the prevalence was much lower than that found in male and female medical students in Riyadh (Al Turki, 2008; Al Turki and Al-Rowais, 2008) which may be due to the fact that Al-Hassa, is less urbanized and people in this region constituted a traditional society which tolerate female smoking to a lesser degree and in addition, the access to places used for smoking WP is limited.

There was an influence of gender on the use of WP from our study. WP originated in Asia and its use for many decades was dominated by males. However, re-emergence

of this habit in modern age among young adults in the Middle East is spreading among females (Tamim et al., 2003; Maziak et al., 2004) due to social acceptability even in traditionally conservative societies. Previous studies in the US showed a large variation in participation of WP users according to gender (Kandela, 1997; Jackson and Averyard., 2008).

In an earlier study in Riyadh City, Saeed et al. (1993) found that the overall smoking prevalence was 22%. Cigarettes were virtually the only form of tobacco used. The rise in WP popularity is thought to be attributable, at least partially, to the introduction of Muassel, a new form of tobacco that came on the market in the 1990s. In Egypt, for example, Muassel is used exclusively by the vast majority of WP users (Primack et al 2007). Muassel is moist and pliable, making it easier to use than other WP tobaccos, and it has a pleasant taste and aroma thus recruiting new smokeless tobacco users. More importantly, the widespread attention focused on the dangers of cigarette smoking and increasing efforts to discourage cigarette smoking might unintentionally encourage WP smoking, since WP smoking is viewed as a less dangerous alternative (Mohammed et al., 2006). Finally, increasing attention to Arab identity possibly contributes to an increase in WP smoking. Shisha (WP) has traditionally been a unique Middle-Eastern practice, associated with socializing, relaxing, the company of friends and the

esthetics associated with the beauty of the water pipes themselves (Bilir et al., 1997). Kandela (2000) postulated that WP use is a cultural form of hospitality among adulthood of Middle East and as youth approach adulthood this behavior becomes more and more acceptable.

WP smoking is usually practiced in groups, with "rites" associated with preparation of the instrument and with the smoking itself. The water pipe is the center of a social activity of conversation and passing time. The hose is passed from person to person, and the same mouthpiece is usually used by all participants. Most smoking sessions last 45 to 60 minutes but may also continue for several hours (Knishkowsky and Amitai, 2005).

The strong association of the WP behavior among our students with the finding that most WP smoking occurred outside home at cafés, Estraha (rest ups found at the periphery of main towns), and Mazraa (another form of rest up houses within farms). This association is emphasized further by the positive significant influence of the positive socializing motives for smoking on susceptibility of being WP user; adolescent maintains smoking to help outing with his family and relieve boredom in social gatherings in more than 70% of the responses. Data showed that the proportion of adolescents who smoke increases with age (Rend et al 1995) and adolescents who start to smoke early are more likely to continue smoking as adults (Aboufotouh et al 1997).

In the present study, we found a positive association between smoking status and age which support the first statement. Also, the mean age at initiation of smoking cigarettes was 13 years; the mean age for WP and cigarettes initiation was 15 years. These results were lower than those obtained from similar study in Saudi Arabia where about 59% started smoking at or above the age of 18 years (WHO 2005), whereas in another study in secondary schools 83.7% of the current smokers started at age 15 years or below (Al Demegh et al 2004).

From this study, it appears that WP smokers are more likely to be cigarettes smokers (62.6%). This was also found in other studies from United States; the cigarette smoking to WP users varied widely, from 63% in Richmond (Ward et al., 2005) to 58% in Pittsburg (Mohammed et al., 2006) and 35% in Memphis (Ward et al., 2005). This may reflect the difference in sampling from web-based and volunteer study subjects to WP café users compared to random secondary school students sample in our study. A study from the United Kingdom found that cigarette smoking was the most important predictor among those who ever tried WP to become regular WP users (Al Turki and Al Rawais, 2008).

Consistent with previous report (WHO, 2005; Anjam et al., 2008; Jawid et al., 2008), most WP users believed that its use was neither as harmful nor as addictive as cigarette. These perceptions of reduced risk may help explain why some individuals who do not smoke cigarettes are willing to engage in WP use. Unfortunately, higher knowledge level lacks its influence as a negative predictor in the final hierarchical regression model. Because of the lag of three to four decades between the rise in smoking prevalence and the rise in the smoking-attributable mortality (Lopez et al., 1994) there is lack of understanding about the risks

associated with smoking in Saudi Arabia. Moreover, despite that in many Saudi studies have shown a high level of knowledge about the hazards of smoking, that knowledge did not affect smoking behavior (Al Faris et al., 1994).

One of the most potent environmental forces is the influence of friends or peers (Al Faris et al., 1994; Merdad et al., 2007), our results, endorsing the results reported from other studies of smoking behavior, in regard the influence of friends. These results suggest that educational interventions aimed at reducing perceived peer acceptability and popularity may be effective. Studies comparing the association between peer-adolescent and parent-child intervention have generally found that the peer-adolescent interaction better predicted adolescent smoking (Krosnick and Judd, 1982; Merdad et al., 2007). Understanding the dynamics of friendship patterns (both male and female) has been a focus of western social scientists for some time, but friendship patterns have not been studied as extensively among Middle Eastern youth (Bilir et al., 1997). It is not possible, therefore, to assume that friendship patterns among Middle Eastern youth are the same as those in the western countries. There is a need for studies on this topic, if effective programs to discourage smoking among young people are to be developed.

Results of this study are based on cross-sectional data, so causal inferences cannot be determined. To develop a better understanding of the conditions under which these variables operate as causal factors, more longitudinal study designs are required. Another limitation of this study is the lack of information on the smoking behavior of the non-responders particularly in females and those adolescents outside schools. It is possible that non-responders had higher smoking prevalence than those surveyed. This may have caused an underestimation of the smoking prevalence rates in this study.

This study is based on random sampling of schools and students in Al-Hassa, Saudi Arabia, and cannot be generalized to the rest of Saudi adolescents. Risk factors associated with adolescents' smoking behavior in Al-Hasa may differ for Saudi adolescents living in the capital city of Riyadh, or in the more traditional Saudi suburban cities.

In conclusion, a worrying trend of emerging use of WP and the belief that it is less harmful than cigarette use was found in this study. Both current smokers and nonsmokers had comparable views and therefore there is a risk that WP will become a new outlet for tobacco use for never smokers. Socializing motives, cigarette smoking, smoking among close family members and friends, male gender and increasing age were positive predictors for WP smoking among our sample of secondary school adolescents. A nationwide surveillance should be implemented to identify the extent of waterpipe's spread and gauge the effectiveness of interventions designed to reduce it. Future studies in Saudi Arabia should assess prevalence of WP in nationally representative samples, potential health-damaging and dependence-producing effects and whether WP use among youth serves as a "gateway" for use of other tobacco products or psychoactive substances.



## Acknowledgment

The authors would like to thank Salman Al Bakhit, College of Medicine, King Faisal University for his invaluable assistance during the data collection phase of this study.

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