Nicotine & Tobacco Research, Volume 15, Number 1 (January 2013) 231–237

Original Investigation

Exposure of Pregnant Women to Waterpipe and Cigarette Smoke

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Received January 8, 2012; accepted March 27, 2012

Abstract

Introduction: Throughout the Eastern Mediterranean region, tobacco is used primarily in 2 forms: cigarette smoking and waterpipe smoking. Despite the fact that tobacco use is considered as a global public health threat, waterpipe smoking is reported to be growing in popularity, particularly among women. The objectives of this study are to determine the prevalence and patterns of cigarette, waterpipe, and passive smoking among pregnant women in Jordan, and to assess their perception of harmful effects of cigarette and waterpipe smoking.

Methods: A total of 500 pregnant women were randomly recruited from maternity clinics in North and Middle of Jordan and surveyed regarding exposure to waterpipe tobacco and cigarette smoking.

Results: The results showed that 7.9% of women were current cigarette smokers and 8.7% were current waterpipe smokers. About 82.4% of all women reported that they are exposed to cigarette smoke and 32.8% reported that they are exposed to waterpipe smoke. The most common place where women are exposed to cigarette and waterpipe smoke was their house (50.4% and 48.7%, respectively) followed by public places (31.4% and 21.4%, respectively). In addition, the husband was the main source for exposure to cigarette and waterpipe smoke (48.5% and 42.7%, respectively). Approximately, 74% of women believed that cigarette smoking is addictive, whereas only 55.1% reported that waterpipe smoking leads to addiction.

Conclusions: Exposure of pregnant women to tobacco smoke is a public health problem in Jordan that requires immediate action.

Introduction

Tobacco smoke contains many toxicants that adversely influence human health. For example, chronic tobacco-smoke exposure causes cancers of the lung, oral cavity, esophagus, stomach, pancreas, liver, kidney, and bone marrow myeloid leukemia (International Agency for Research on Cancer, 2004). Moreover, smoking increases the risk for atherosclerosis and cardiovascular disease (Glantz & Parmley, 1995; Wells, 1994). More than five million deaths each year are attributed to tobacco use (WHO, 2009).

During pregnancy, exposure to tobacco smoke is associated with fetal growth restriction (Kayemba-Kay's et al., 2010; Robinson, Moore, Owens, & McMillen, 2000), spontaneous abortion (Nakamura et al., 2004), preterm delivery (Nabet, Ancel, Burguet, & Kaminski, 2005), and birth defects (Hackshaw, Rodeck, & Boniface, 2011). In addition, children born to smoker mothers are at risk of developing non-Hodgkin lymphoma (Klimentopoulou et al., 2011), cochlear dysfunction (Durante, Ibidi, Lotufo, & Carvallo, 2011), and being overweight or obese (Durmus et al., 2011; Ino, Shibuya, Saito, & Ohtani, 2011). Similar findings were reported using experimental animal models such as mice (Esposito, Horn, Greene, & Pisano, 2008; Ng, Silverstone, Lai, & Zelikoff, 2006). The mechanisms by which tobacco smoking might cause such hazardous health effects include decrease availability of oxygen for the fetus that is caused by nicotine and carbon monoxide (CO; Rogers, 2008) and the production of high amount of free radicals in the bodies of smokers and fetus (Chelchowska, Ambroszkiewicz, Gajewska, Laskowska-Klita, & Leibschang, 2011). These free radicals are remarkably reactive and randomly attack various cellular constituents as in the case of initiation of lipid peroxidation (Frei, Forte, Ames, & Cross, 1991), protein oxidation (Reznick et al., 1992), and DNA damage (Fahn et al., 1998).

Tobacco can be consumed in several different ways including cigarette, cigar, and waterpipe (a.k.a. hookah, narghile, or shisha). The popularity of waterpipe tobacco smoking (WTS) is growing in the eastern Mediterranean and throughout the world including the United States and other western countries, especially among youth (Azab et al., 2010; Eissenberg, Ward, Smith-Simone, & Maziak, 2008; Maziak et al., 2008; Primack et al., 2008; Warren

doi:10.1093/ntr/nts119
Advance Access publication May 9, 2012

et al., 2009). In Arab countries including Jordan, WTS is reported to be growing in popularity among women, perhaps because it is more socially accepted than cigarette smoking (Nakkash, Khalil, & Afifi, 2011; Rastam, Ward, Eissenberg, & Maziak, 2004). There is also a global misperception that the waterpipe filters the smoke, rendering it less harmful and less addictive than cigarette smoking (Ghafouri et al., 2011; e.g., Kandela, 2000; Kiter, Ucan, Ceylan, & Kilinc, 2000). Pregnant women who share these misperceptions might be at high risk of exposure to waterpipe smoke. For example, a study from Lebanon revealed that women knew little about the harmful constituents in waterpipe smoke and had many misconceptions regarding how waterpipe worked or how it can produce harm (Chaaya, Jabbour, El-Roueiheb, & Chemaitelly, 2004). Though few data addressing waterpipe smoke exposure in pregnant women are available, this study was conducted to determine the prevalence and patterns of cigarette, waterpipe, and passive smoking among pregnant women in Jordan, and to assess their perception of harmful effects of smoking. Results of this study will help to establish the base for interventions that target this population.

Methods

This cross-sectional study was conducted during April to August of 2011. Pregnant women (n = 585, 20–40 years of age) were invited from randomly selected maternity clinics (n = 6). Random selection was carried out based on locations of the clinics in major cities of Jordan, the economic status of the city area, based on data from the Department of Statistics of Jordan, and type of clinic (public vs. private). Participants were approached during their wait for regular pregnancy checkup. They were offered a description of the study and its goals and were asked to participate. Those who agreed (n = 500, 85.5%) were asked to provide written informed consent and to complete a self-administered questionnaire. The study was approved by the institutional review board of the Hashemite University. Those who did not agree to participate in the study were equally distributed among clinics, and among other demographic factors such as age and economic status.

The questionnaire was prepared by the research team, reviewed by several colleagues in the field, and then pilot tested with 50 subjects to examine clarity and comprehensibility. In addition, the participants in the pilot study were asked to give feedback about the questionnaire items, and this feedback informed the final version.

The survey was divided into several parts: (a) general information about women and pregnancy history, including age, income, education, family size etc.; (b) personal smoking information for both cigarettes and waterpipe such as age of initiation and frequency of use; (c) exposure to secondhand smoke, including sources, magnitude, and places of exposure; (d) beliefs and perceptions of the addictiveness of waterpipe and cigarette smoking; and (e) awareness of harmful effects of smoking on fetal health.

Current cigarette smoking was defined as smoking cigarettes in at least one day in the past month and current waterpipe smoking was defined as smoking waterpipe at least once in the past month. Dual smoking was defined as current cigarette smoking and current waterpipe smoking.

Statistical analysis was performed using SPSS® version 17 for windows (SPSS, Inc., Chicago, IL). Demographic data and categorical variables were summarized using frequency tables. The differences in the prevalence rates of cigarette and waterpipe smoking among women according to the sociodemographic and other characteristics were analyzed using Chi-square test (χ^2 test). Binary logistic regression analysis was conducted to determine the factors associated with current cigarette and waterpipe smoking. A p value of less than .05 was considered statistically significant.

Results

Sociodemographic Characteristics

This study included a total of 500 pregnant women aged 17 years and above. About 21.1% of women aged 17–24.9 years, 30.8% aged 25–29.9 years, and 48.1% aged ≥30 years. More than two-thirds of women (69.3%) had a bachelor's degree or had received some form of higher education. The majority of women (76.6%) were living in urban areas and 23.4% in rural areas.

Pattern of Cigarette and Waterpipe Smoking

Of the total 500 pregnant women, 38.3% reported that they had ever smoked cigarettes and 35.6% had ever smoked waterpipe. About 17.2% of ever cigarette smokers and 7% of waterpipe smokers initiated smoking before they reached 18 years old. Overall, 7.9% of women were current cigarette smokers and 8.7% were current waterpipe smokers. About 2.8% reported that they currently smoke cigarettes and waterpipe (dual smoking). None of the studied sociodemographic characteristics of women were significantly associated with current cigarette or waterpipe smoking (Table 1). About one quarter (23.5%) of cigarette smokers reported daily smoking. Of the waterpipe smokers, 74.1% reported smoking waterpipe at least once per month but not weekly, 12.9% reported smoking at least once a week but not daily, and 13.0% reported daily waterpipe smoking. Almost all waterpipe smokers reported using the waterpipe once on days that they smoked. Of waterpipe smokers, the majority reported that they usually smoke waterpipe with one of the family members (59.8%) or friends (32.2%). About 58.7% of waterpipe smokers reported smoking in their houses, 20.0% in a coffee shop or a restaurant, and 13.0% in the park.

Factors Associated with Current Cigarette and Waterpipe Smoking

Table 2 shows the multivariate analysis of factors associated with current cigarette smoking and current waterpipe smoking. Level of education and residency were significantly associated with current cigarette smoking. A bachelor's degree or higher level of education was significantly associated with increased odds of current cigarette smoking (OR = 2.27, 95% CI = 1.09–5.22). Compared with women living in urban areas, those who were living in the rural areas were almost three times more likely to be current cigarette smokers (OR = 3.30, 95% CI = 1.12–8.28). On the other hand, age ≥30 years, and monthly income ≤ 500 were significantly associated with increased odds of current waterpipe smoking.

Secondhand Smoke

The husband was the main source for exposure to cigarette and waterpipe smoke (48.5% and 42.7% respectively) followed by

Table 1. Cigarette and Waterpipe Smoking Among Jordanian Pregnant Women According to Sociodemographic and Relevant Characteristics

	Current cigarette smoking			Current waterpipe smoking		
	Yes	No	*p* Value	Yes	No	*p* Value
Age (years)			.622			.119
17–24.9	6 (6.2)	91 (93.8)		14 (13.6)	89 (86.4)	
25–29.9	11 (7.4)	137 (92.6)		12 (7.9)	140 (92.1)	
≥30	21 (9.2)	207 (90.8)		16 (6.9)	217 (93.1)	
Level of education			.217			.200
High school or less	15 (10.2)	132 (89.8)		17 (11.1)	136 (88.9)	
Bachelor's degree or more	23 (6.9)	310 (93.1)		26 (7.6)	316 (92.4)	
Income (JD)			.617			.479
<300	6 (5.7)	100 (94.3)		9 (8.3)	99 (91.7)	
300–500	20 (8.6)	212 (91.4)		18 (7.5)	223 (92.5)	
>500	12 (8.5)	129 (91.5)		16 (11.0)	129 (89.0)	
Residency			.070			.589
Urban	32 (9.1)	319 (90.9)		32 (8.8)	330 (91.2)	
Rural	4 (3.7)	103 (96.3)		8 (7.2)	103 (92.8)	
Trimester			.928			.467
First	7 (8.1)	79 (91.9)		10 (11.4)	78 (88.6)	
Second	9 (8.1)	102 (91.9)		10 (8.8)	103 (91.2)	
Third	20 (7.2)	259 (92.8)		21 (7.3)	268 (92.7)	

Note. JD = Jordanian Dinars.

relatives for cigarette (21.1%) and friends for waterpipe (24.4%). The house was the most common place of exposure to cigarette and waterpipe smoke (50.4% and 48.7%, respectively), followed by public places (31.4% and 21.4%, respectively; Table 3). About 82.4% of all women reported that they were exposed to cigarette smoke and 32.8% reported that they were exposed to waterpipe smoke. Of those who were exposed to cigarette smoke, 78.8% reported daily exposure (40.5% more than 5 times/day, 20.3% between 2 and 5 times/day, 17.8% once/day). Of those who were exposed to waterpipe smoke, 46.3% reported daily exposure (18.2% more than once/day and 28.2% once/day).

Table 2. Multivariate Analysis of Factors Associated with Current Cigarette Smoking and Current Waterpipe Smoking

	Current cigarette smoking		Current waterpipe smoking	
Variable	*OR* (95% *CI*)	*p* Value	*OR* (95% *CI*)	*p* Value
Age (years)				
17–24.9	1		1	
25–29.9	0.67 (0.23, 1.99)	.472	1.70 (0.68, 4.26)	.258
≥30	0.72 (0.26, 2.00)	.528	2.47 (1.03, 5.92)	.043
Level of education				
High school or less	1		1	
Bachelor's degree or more	2.27 (1.09, 5.22)	.043	1.90 (0.85, 4.28)	.120
Income (JD)				
<300	1.55 (0.47, 5.15)	.472	2.77 (1.10, 8.29)	.045
300–500	1.19 (0.52, 2.73)	.686	2.30 (1.04, 5.09)	.041
>500	1		1	
Residency				
Urban	1			
Rural	3.30 (1.12, 8.28)	.040	1.24 (0.51, 2.98)	.633
Pregnancy trimester				
First	1.07 (0.40, 2.85)	.888	0.69 (0.28, 1.66)	.406
Second	0.82 (0.35, 1.90)	.642	0.77 (0.34, 1.75)	.532
Third	1		1	

Note. JD = Jordanian Dinars.

Perception of Harmful Effects of Cigarette and Waterpipe Smoking

The majority of women believe that cigarette smoking is addictive (74.3%) while only 55.1% reported that there is high probability for waterpipe smokers to become addicts. Regarding the direct health effects, about 43.7% of women reported that the waterpipe

Table 3. Sources and Places of Exposure to Cigarette and Waterpipe Smoke Among Jordanian Pregnant Women

Variable	Cigarette smoke (*N* = 412)	Waterpipe smoke (*N* = 164)
Sources of smoke		
Husband	48.5	42.7
Relatives	21.1	20.7
Friends	13.6	24.4
Others	16.8	12.2
Places of exposure		
Home	50.4	48.7
Relative's house	12.5	19.5
Friend's house	5.7	10.4
Public places	31.4	21.4

smokers have high probability to suffer from immediate symptoms of smoking including headache, nausea, vomiting, stomach ache, and coughing, 21.5% reported that cigarette smokers have high probability to suffer from such symptoms. To assess women's perception regarding harms of cigarette smoking to the health of the fetus, the following question was asked: In your opinion, which of the following statements apply to the effect of exposure to cigarette smoking on fetal health? Women were given the following choices: (a) cigarette smoking does not affect fetal health, (b) cigarette smoking has some negative effects on fetal health, and (c) cigarette smoking has many negative effects on fetal health. To assess women's perception about the effects of waterpipe smoking on fetal health, the same question was asked, but replacing "cigarette" with "waterpipe." The results show that comparable percentages of women believed that either waterpipe (80.8%) or cigarette (76.4%) smoking are associated with negative health effects on the fetus.

Discussion

In this study, we examined the prevalence and the pattern of cigarettes and waterpipe smoking among pregnant women in Jordan. The data indicate that approximately 15% of the pregnant women in Jordan smoke tobacco during pregnancy. Higher prevalence rates were reported in some developed and developing countries including France (36%; Lelong, Blondel, & Kaminski, 2011), United Kingdom (27%; Fleming & Blair, 2007), Lebanon (25.7%; Bachir & Chaaya, 2008), and Serbia (37.2%; Krstev, Marinkovic, Simic, Kocev, & Bondy, 2011). In other countries, different estimates were reported: United States (10.2%), Japan (8.9%) (Suzuki et al., 2010), Australia (17.4%; Thrift, Nancarrow, & Bauman, 2011), Tunisia (4%–18.8%; Fakhfakh et al., 2011), Romania (15%; Meghea, Rus, Rus, Summers Holtrop, & Roman, 2010), and Poland (8%; Perz, Gaca, Mniszak, & Wesol, 2006). In this study, about 83% of the sample reported that they were exposed to tobacco smoke from both cigarette and waterpipe (passive smoking). Reports from several countries indicated that rates of secondhand smoke exposure during pregnancy ranged between 17% and 94% (Bloch et al., 2008; Franchini et al., 2008; Kelly et al., 2011; Torres et al., 2011; Yang, Tong, Mao, & Hu, 2010). In previous studies from Jordan, exposure to secondhand cigarette smoke among Jordanian women was about 70% in a sample of patients admitted to a local hospital, using a survey that was developed by the researchers (Zmeili, 1992) while another study indicated that 60% of mothers were exposed to secondhand smoke from other family members at home using both survey instrument and biomarkers of exposure to cigarettes (nicotine and cotinine plasma levels [$n = 220$, Badran, Salhab, & Al-Jaghbir, 2009]). Recently, using a modified Pregnancy Risk Assessment Monitoring System questionnaire, it was reported that 65% of pregnant women are exposed to cigarette smoke at home ($n = 300$, Abu-Baker, Haddad, & Savage, 2010). In our study, we included exposures to waterpipe smoking, and we interviewed a relatively larger number of subjects ($n = 500$), which could explain the relatively higher percentage of exposure to tobacco smoke. Alternatively, the steady increase in tobacco use in Jordan might be responsible for the reported tobacco exposure in this study. Previous studies have also reported some inconsistency in the responses of pregnant women about their tobacco use as opposed to blood nicotine and cotinine levels (Sasaki, Braimoh, Yila, Yoshioka, & Kishi, 2011). In the case of the waterpipe, waterpipe-specific biomarkers of exposures are not available. Identifying these specific markers will be very useful for waterpipe research. Overall, tobacco-smoke exposure in utero, remains a world public health challenge and the need for action against it in Jordan and worldwide is strongly suggested.

Over the last decade, WTS has spread worldwide and is alarmingly common among adolescents and young adults. According to this study, the percentage of pregnant women that use waterpipe during pregnancy in Jordan may be equal to and perhaps slightly higher than those who smoke cigarettes. This prevalence of WTS during pregnancy could be due to the common perception that water in the waterpipe filters the smoke and renders it less harmful and not addictive. The higher percentage of pregnant women who use waterpipe could also be attributed to the lack of waterpipe-specific policy and regulations. Only two studies have examined the effects of waterpipe smoking on fetal health and found that waterpipe smoking during pregnancy is associated with low birth weight (Mirahmadizadeh & Nakhaee, 2008; Tamim, Yunis, Chemaitelly, Alameh, & Nassar, 2008). The literature shows that waterpipe smoke contains similar profile of toxicants to that of cigarette smoking. For example, it contains polycyclic aromatic hydrocarbons and aldehydes that cause cancer and lung diseases (Monzer, Sepetdjian, Saliba, & Shihadeh, 2008; Shihadeh & Saleh, 2005), CO that contributes to cardiovascular disease (El-Nachef & Hammond, 2008; Saleh & Shihadeh, 2008), and nicotine that causes dependence (Blank et al., 2011; Neergaard, Singh, Job, & Montgomery, 2007; Shihadeh, 2003). Moreover, because waterpipe users exhale 50–100 L of smoke with each use episode (e.g., Cobb, Shihadeh, Weaver, & Eissenberg, 2011), secondhand smokers are exposed to high toxicant levels (e.g., Daher et al., 2010). Finally, waterpipe smoking was shown to be more mutagenic than cigarette smoking (Khabour, Alsatari, Azab, Alzoubi, & Sadiq, 2011). Thus, relative to cigarette smoke, waterpipe smoke exposure during pregnancy might be expected to have similar or even more harmful consequences for fetal health. In fact, a study by Nuwayhid, Yamout, Azar, and Kambris (1998) showed that, similar to cigarette smoking, waterpipe smoking during pregnancy is associated with harmful effects to the fetus.

The results showed that smoking among pregnant women in Jordan is associated with level of education, living in the rural areas, age, and monthly income. Previous studies have shown similar risk factors in other populations. For example, waterpipe smoking was found to be associated with age, income, and level of education among Blacks in Minnesota (Dillon & Chase, 2010). Similarly, women's age was associated with waterpipe smoking in United Arab Emirate population (Mandil, Hussein, Omer, Turki, & Gaber, 2007). Identification of factors that contribute to smoking among pregnant women might help in interventions that target this population.

Findings of the current study emphasize the need for action against maternal tobacco smoke exposure in Jordan. Results of the current study also provide strong evidence for an end to tobacco smoking in all enclosed areas. Jordan has signed The Framework Convention on Tobacco Control treaty and now has a law that prohibits smoking in public enclosed areas. Results reported here show a considerable fraction of pregnant women are exposed to smoke in public places such as restaurants, transportation vehicles, stores, and others. Thus, the implementation and vigorous enforcement of that law that prohibits smoking in

public enclosed areas is essential. The results also showed that a Jordanian woman's husband is the main source of exposure to tobacco smoke. This finding is in accordance with previous reports (Chaaya, Awwad, Campbell, Sibai, & Kaddour, 2003; Lemola & Grob, 2008; Zolnierczuk-Kieliszek, Chemperek, & Koza, 2004). One way to limit this source of exposure is educational programs that emphasize fetal harm, which could occur as a result of both passive and active maternal smoking. These programs should target families (especially husbands) within homes of pregnant women. In summary, maternal exposure to tobacco smoke is a public health problem in Jordan and worldwide that requires immediate action.

Funding

This work was supported from the Deanship of Research at Hashemite University and the U.S. National Institutes of Health (R03-TW008371 and R01-CA120142).

Declaration of Interests

None to declare.

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