



Overactive bladder syndrome in nulliparous female university students: prevalence and risk factors including waterpipe smoking

Rima Hajjar¹ · Ibrahim Tsolakian² · Monique Chaaya³ · Alaa Daher¹ · Tony Bazi¹

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Abstract

Introduction and hypothesis The objective was to assess the prevalence of symptoms of overactive bladder syndrome (OAB) among healthy nulliparous female university students, and to evaluate the correlation of these symptoms with a variety of factors, including waterpipe (WP) smoking.

Methods This is a cross-sectional study. A questionnaire was administered to evaluate symptoms of OAB in healthy nulliparous female university students. Variables assessed included body mass index (BMI), cigarette smoking, WP smoking, consumption of alcohol, coffee, and tea with and without artificial sweeteners, soft drinks, and energy drinks. Adjusted odds ratio were calculated to determine the correlation of these variables with OAB symptoms.

Results A total of 767 out of 2,900 females responded to the questionnaire. Bothersome frequency was reported in 32.3%, and nocturia in 47.5% of the women. Urgency and urgency urinary incontinence (UUI) were present in 25.5 and 24.7% of the study participants respectively. Urgency was associated with WP smoking (p value 0.048). Bothersome frequency was associated with artificial sweeteners used with coffee and tea (p value 0.013). UUI was associated with cigarette smoking (p value 0.034) and elevated BMI (p value < 0.001). OAB symptoms were not found to be significantly associated with soft drink and energy drink consumption. A lower prevalence of nocturia (p value 0.009) and urgency was associated with alcohol consumption (p value 0.017). More than two-thirds (69.2%) of WP smokers expressed readiness to decrease WP smoking if this would improve their lower urinary tract symptoms (LUTS).

Conclusion Overactive bladder is common in healthy young nulliparous women and is associated with multiple risk factors, including WP smoking.

Keywords Smoking · Lower urinary tract symptoms · Overactive bladder · Waterpipe smoking · Artificial sweeteners · Hookah

Introduction

Overactive bladder syndrome (OAB) is a syndrome characterized by urinary urgency, usually with urinary frequency and nocturia, with or without UUI, as defined by

the International Continence Society (ICS) and International Urogynecological Association [1]. It is a common disorder prevalent in 9 to 43% in women and is marked by worsening symptom severity and prevalence with age [2]. In Lebanon, a study assessing the prevalence of pelvic floor disorder found a 35% prevalence of OAB with “at least a little bother” among a sample of 900 women of all ages attending primary care and specialty nongynecology clinics [3]. Symptoms of OAB have a considerable impact on quality of life and negative implications on the overall wellbeing of patients, including disturbances in sleep patterns, and decreased work productivity [4]. Several studies have been aimed at identifying lifestyle factors associated with this disorder. However, most of these studies included a wide age range and women of different parity [5]. The data on OAB in young nulliparous women remain scarce.

✉ Tony Bazi
tb14@aub.edu.lb

¹ Department of Obstetrics and Gynecology, American University in Beirut-Medical Center, PO Box 11-0236, Beirut, Riad El Solh 1107 2020, Lebanon

² Department of Obstetrics and Gynecology, University of Toledo College of Medicine and Life Sciences, Toledo, OH, USA

³ Department of Epidemiology and Population Health, Stanford, CA, USA

Only one study, published in 2021, investigated urinary incontinence (UI) in nulliparous university students in Turkey and concluded that the prevalence of UI is 18% in this age group [6]. The association between lower urinary tract symptoms (LUTS) and dietary factors, and nondietary behavioral factors such as cigarette smoking, alcohol, and physical activity has been assessed in many studies [5, 7–9]. Kawahara et al. recently published a large-scale study to determine a correlation between cigarette smoking and OAB in nonhospitalized participants [10]. The authors found a 30% prevalence of OAB in women in their third decade. This prevalence was higher than previously reported and the median age was found to be younger [10]. Although cigarette smoking was found to be associated with OAB symptoms, the unique toxicant profile of WP smoking may have a different impact on OAB symptoms and their severity. To our knowledge, no study has evaluated the association between OAB symptoms and waterpipe (WP) smoking, an increasingly popular smoking habit among young people.

A WP consists of a head where a tobacco preparation and charcoal is placed for combustion. The head is connected to a bowl containing water and a hose with a mouthpiece through which smoke is inhaled. WP, also known as *hookah*, *narghile*, *argileh*, *shisha*, and *goza*, has gained wide popularity over the past few years [11]. WP tobacco is sold in a wide variety of “flavors,” where mostly unregulated synthetic products are added in order to give it a pleasant taste and smell and mask the harshness and bitterness of the tobacco smoke. The cooling effect of water and the common misconception that water “filters” toxins have made WP smoking a desirable alternative to cigarette smoking [12]. Compared with cigarette smoking, WP smoking is associated with greater carbon monoxide, benzene, and high polycyclic aromatic hydrocarbon exposure [13]. In 2013, the prevalence of WP smoking among students in London (United Kingdom) was twice as common as cigarette smoking [14]. A study published in 2011 concluded that 28% of university students in Lebanon were current WP smokers and 43% had smoked WP at least once in their life [15]. It is worth noting that WP was not found to have a gender predilection, with a recent study showing that 23.4% of female students smoked WP [14]. Although less common in the US, the National Youth Tobacco Survey (NYTS) in 2016 reported that 4.8% of high school students had smoked a WP in the past 30 days [12].

Our study was aimed at assessing the prevalence of OAB symptoms among nulliparous female university students and evaluating associations of these symptoms with WP smoking and other lifestyle factors, specifically BMI, cigarette smoking, alcohol consumption, and a variety of dietary and behavioral factors, including WP smoking.

Materials and methods

This study was approved by the Institutional Review Board (IRB) at the American University of Beirut. This is a cross-sectional study conducted via the administration of a web-based questionnaire to adult healthy nulliparous female university students in Beirut, Lebanon. Data were collected between October 2017 and February 2020.

Designated personnel from four different universities were asked to select at random a percentage of nulliparous female students above 18 years of age. The questionnaire was then sent by e-mail to the participants after obtaining their consent. Exclusion criteria included a history of pelvic floor dysfunction including incontinence, irradiation, diabetes, hypertension, or cardiovascular problems, and two or more urinary infections in the past.

In order to ensure a power of 80% of detecting a significant association between OAB and WP smoking with an OR of 2, a target sample size of 440 participants was required. This was based on the prevalence of WP smoking in university students in Lebanon [15] and on the prevalence of OAB symptoms among women younger than 40 [3]. The sample size was inflated to 2,900 participants in order to account for eligibility and nonresponse.

A web-based questionnaire was developed to assess the presence, severity, and degree of bother of the following OAB symptoms: urgency, frequency, nocturia, and UII (Appendix 1). The following variables were evaluated: BMI, WP smoking, cigarette smoking, coffee, and tea consumption with and without artificial sweeteners, current alcohol consumption and consumption of soft drinks (diet and regular), as well as “energy drinks.” Finally, the participants who reported smoking WP were asked about their willingness to decrease, or stop WP smoking if it were shown to have an impact on OAB symptoms.

Exposure to WP smoking was assessed using the standardized measures and terminology proposed by Maziak et al., as follows [17]: those who have had one or two inhalations in their lifetime were considered as “ever smoking” and those who have smoked at least once in the previous month were considered as “current smokers.” “Former smoking” was used to describe someone who is not currently smoking but has smoked at least once a month for 3 consecutive months. Pattern of exposure was described as daily, weekly, or monthly. The age at smoking and whether they engage in WP “sharing” was also noted.

Symptoms of OAB were assessed using the Bristol Female Lower Urinary Tract Symptoms Questionnaire (BFLUTS), which is a validated and widely used tool to study the prevalence and impact of lower urinary tract symptoms [18]. A Likert scale was used to quantify the degree of bother.

The raw data were summarized and processed using IBM SPSS (Statistical Product and Service Solutions) Statistics (version 27). Descriptive statistics, reported as frequencies, were used to describe the cigarette smoking, WP smoking, and dietary habits of the study population. Pearson's Chi-squared test was performed to analyze the association between representative indicators of lifestyle factors and each of the following: bothersome frequency, urgency, nocturia, and UUI. Multiple logistic regression analysis was performed to determine the independent contribution of each risk factor to the previously stated symptoms of frequency, urgency, nocturia, and UUI, which were all measured as binary.

Results

A web-based questionnaire was sent to 2,900 female university students. Responses were obtained from 767 (26.4%). The mean age of the sample was 22 (± 5.06). A little less than one-third (29.5%) of the participants reported having ever smoked WP and 12.9% to have ever smoked at least 100 cigarettes. The largest proportion of surveyed female students had a normal BMI (66.8% with BMI 18.5–25) and 22.5% were overweight or obese. The majority of the sample drank coffee, with the highest proportion drinking 1–2 cups per day. Consuming soft drinks and lifetime alcohol consumption were both common (61.0% and 44.1%) (Table 1). The prevalence of OAB symptoms including urinary frequency, nocturia, urgency, and UUI is reported in Table 2. The most frequently reported symptom was nocturia (47.5%; CI 43.95–51.06) followed by bothersome urinary frequency (32.3%; CI 64.30–70.95). Urgency and urinary leakage were reported in 25.5% (CI 21.79–27.94) and 24.7% (CI 21.79–27.94) of participants respectively. Finally, 69.2% of WP smokers reported that they would at least decrease WP smoking if it were found to be linked to their urinary symptoms.

Bivariate analysis

Table 3 reports on the crude association between symptoms of OAB and BMI, WP smoking, cigarette smoking, alcohol consumption, coffee and tea consumption with and without artificial sweeteners, regular and diet soft drinks, and “energy drinks.” Bothersome frequency was only statistically significantly associated with artificial sweetener in coffee or tea consumers (OR: 1.96, CI 1.17–3.29, p value 0.010). Consuming alcohol in the previous month was associated with significantly lower odds of nocturia (OR: 0.47, CI 0.29–0.74, p value 0.001) and urgency (OR: 0.53, CI 0.30–0.94, p value 0.030). Urgency was significantly associated with smoking one or more WP per week (OR: 2.01, CI

1.01–3.96, p value 0.044). Obesity, cigarette smoking, and “energy drinks” consumption were significantly associated with experiencing urine leakage (OR: 1.87, 2.37, and 1.44 respectively).

Multivariate analysis

A multivariate binary logistic regression analysis using variables showed p value < 0.2 at the bivariate level in addition to variables that were deemed to be clinically relevant. Table 4 summarizes the adjusted results.

Women who smoked less than once per week and women who smoked once or more than once per week were compared with women who have never smoked WP. OAB symptoms were not found to be significantly associated with WP smoking in women who smoked less than once per week. However, frequent smokers, namely women who smoked WP more than once per week, were found to be twice as likely to experience urgency as women who have never smoked (adjusted OR: 2.12 CI 1.00–4.48, p value < 0.048). Current cigarette smokers were significantly more likely to experience UUI more frequently than noncigarette smokers (adjusted OR: 1.95, CI 1.05–3.65, p value < 0.034).

The BMI was found to be the strongest independent associated risk factor for UUI (adjusted OR: 2.05 CI 1.37–3.05, p value < 0.001). Overweight and obese women as a group were twice as likely to experience symptoms of urinary leakage as their normal weight counterparts.

Women who drink coffee or tea with and without artificial sweeteners were compared with women who do not drink coffee or tea. Drinking coffee or tea with an artificial sweetener was found to be significantly associated with bothersome frequency (adjusted OR: 1.95, CI 1.15–3.32, p value 0.013). The effect of alcohol consumption in the past month was found to be significantly associated with lower odds of having nocturia and urgency (adjusted OR: 0.52, CI 0.32–0.85, p value 0.009 and OR 0.48, CI 0.26–0.87, p value: 0.017 respectively). Finally, the consumption of either regular soft drinks or diet soft drinks as well as energy drinks was not found to be significantly associated with any OAB symptoms in the adjusted model.

Discussion

Our study shows that OAB symptoms are common in young healthy nulliparous women. BMI is an established risk factor for both stress urinary incontinence and UUI [6, 8]. Our findings are in agreement with a recent meta-analysis that concluded that BMI was significantly higher in women with OAB [5].

Similar to others' findings, current cigarette smoking in younger women was associated with an increased prevalence

Table 1 Distribution of a sample of female university students ($N=767$) by demographic characteristics and behavioral factors. In some categories the total is less than 767 owing to missing data

Sample profile	Total sample, $N=767$ N (%)
Demographics	
Age (mean \pm SD)	22.12 (\pm 5.06)
BMI	
Underweight (<18.5)	81 (10.56)
Normal (Between 18.5 and 25)	513 (66.88)
Overweight (between 25 and 30)	125 (16.30)
Obese (30 and upwards)	48 (6.26)
Waterpipe smoking	
Ever smoked waterpipe in your lifetime (even 1–2 inhalations)	
Yes	226 (29.47)
No	541 (70.53)
Age of initiation (or trying) of waterpipe (Mean \pm SD)	18.15 (\pm 3.42)
Ever smoked waterpipe at least once a month for 3 consecutive months	
Yes	89 (11.60)
No	137 (17.86)
Never smoked	541 (70.53)
Patterns of waterpipe smoking	
Never smoked	541 (70.72)
Less than once per week	186 (24.32)
Once or more per week	38 (4.97)
Number of waterpipe smoked in the past month (mean \pm SD)	5.73 (\pm 10.82)
Sharing waterpipe	
Yes	158 (70.22)
No	67 (29.77)
Cigarette smoking	
Ever smoked at least 100 cigarettes	
Yes	99 (12.97)
No	664 (87.02)
Ever smoked cigarettes regularly	
Yes	66 (11.51)
No	697 (91.34)
Mean age of initiation of cigarette smoking	17.65 (3.23)
Current cigarette smoking	
Yes	62 (8.13)
No	701 (71.87)
Average number of cigarettes smoked per day in the past month	10.54 (8.10)
Dietary habits	
Coffee/tea intake	
No/rarely	108 (14.19)
Sometimes – not daily	168 (22.08)
1–2 times a day	400 (52.56)
3+ times a day	85 (11.17)
Use of artificial sweetener with coffee/tea (among those who drink sometimes or more)	
Yes	244 (32.49)
No	399 (53.13)
Noncoffee/tea drinkers	108 (14.98)
Soft drink intake	
No/rarely	296 (39.0)
Sometimes – not daily	321 (42.29)
1 or more times a day	142 (18.7)
Drinking diet or regular soft drinks (among those who drink sometimes or more)	

Table 1 (continued)

Sample profile	Total sample, <i>N</i> = 767 <i>N</i> (%)
Regular	295 (38.87)
Diet	168 (22.13)
Nonsoft drink drinkers	296 (39)
Lifetime alcohol drinking	
Yes	337 (44.16)
No	426 (55.83)
Past-month alcohol drinking (among total sample)	
Yes	102 (13.36)
No/special occasion only	235 (30.79)
Never drinkers	426 (55.83)
Mean number of drinks in the past month	2.37 (1.80)
Mean number of times drank 4+ drinks in a row in the past month	2.71 (4.95)
Energy drink intake (with or without alcohol)	
Never	657 (86.22)
Yes	105 (13.77)

of UUI [10]. Kawahara et. al reported that cigarette smoking cessation was found to decrease the prevalence of UUI and urgency symptoms [10]. However, in our opinion, multiple confounding variables, in addition to recall bias, limit the relevance of this conclusion. Longitudinal studies are needed to answer this question with more certainty.

Our study shows a high prevalence of WP smoking among young female students with approximately one-third of our sample having smoked at least once in their lifetime. A comparable prevalence in the eastern Mediterranean region has been reported in the literature [16, 19]. Our study shows that young women who smoke WP were twice as likely to report symptoms of urgency. WP smoking is a social activity with sessions that often last more than 1 h. Although the peak nicotine plasma level is the same in WP and cigarette smoking, the effective exposure to nicotine, and presumably to other “toxins” could be higher owing to the longer sessions of WP smoking [20]. Furthermore, WP generates 35 times more carbon monoxide (CO) than cigarette smoking [12, 21].

The IUGA/ICS 2010 joint report on terminology of female pelvic floor dysfunction defines frequency as a complaint that micturition occurs more frequently during waking hours than previously deemed normal by the woman [1]; consequently, we used “bothered by frequency” as an outcome correlate to OAB symptoms instead of the number of micturition events per day.

Data on caffeinated beverages and OAB symptoms have been conflicting [8]. This could be due to different concentrations of caffeine in different coffees and teas, or to confounding factors often present among caffeinated beverage consumers. In spite of this, the International Consultation on Incontinence recommends caffeine reduction in women who experience urinary symptoms [23]. In our study, coffee and tea consumers had higher odds of experiencing bothersome frequency, but

this association was only significant for those who used artificial sweeteners. Caffeine is not only present in coffee and tea but is also in different foods and beverages including chocolate and sodas. In a four-way crossover trial conducted among college students in the USA in 2005, consumption of diet Coke and caffeine-free diet Coke was associated with an increase in urgency and frequency, compared with carbonated water or classic Coke. This finding suggests that the consumption of artificial sweeteners, rather than the caffeine, is the likely culprit behind OAB symptoms [23]. By the same token, it could be that the artificial sweetener in coffee and tea rather than the caffeine itself is responsible for OAB.

Alcohol use in the past month was not associated with OAB symptoms but was associated with a decrease in nocturia and urgency. Some studies have reported a positive association of alcohol with OAB, whereas others have reported an inverse association [5]. In a 2019 meta-analysis, alcohol consumption was not found to be significantly associated with OAB [5]. Shiri et al. assessed the effect of alcohol consumption on nocturia and found that men who consumed 150 g of alcohol per week were at a lower risk of nocturia than abstainers [24]. The effect of alcohol consumption on nocturia needs to be elucidated in further studies.

Although in a recent meta-analysis, carbonated drinks, especially diet beverages containing artificial sweeteners, were found to increase OAB symptoms [7], we could not determine any significant association between “energy drink” intake, soft drink intake, and any of the OAB symptoms. Özgür Yeniel et al. concluded that consumption of carbonated beverages was associated with OAB symptoms only when consumed in “excessive amounts” [21]. It is also important to mention that soft drinks include a

Table 2 Distribution of a sample of female university students ($N=767$) by reporting of overactive bladder symptoms. In some categories the total is less than 767 owing to missing data

Bladder symptoms	<i>N</i> (%)	95% confidence interval (%)
Frequency of passing urine during the day		
Every 4 h or more	438 (57.48)	53.93–60.95
Every 3 h	198 (25.98)	22.99–29.22
Every 2 h	85 (11.15)	9.10–13.60
Hourly	41 (5.38)	3.98–7.23
Bothered by this frequency		
Yes	246 (32.28)	64.30–70.95
No	516 (67.2)	29.05–35.70
Nocturia: number of times getting up to urinate during the night, on average		
Once or less	398 (52.51)	48.94–56.05
Two or more times	360 (47.49)	43.95–51.06
Bothered by nocturia		
Yes	170 (58.41)	33.04–44.24
No	121 (41.58)	55.76–66.96
Having experienced urgency?		
Never/occasionally	565 (74.44)	71.21–77.42
Sometimes/most of the time/all of the time	194 (25.55)	22.58–28.79
Ever experienced urine leakage		
Never	572 (75.26)	72.06–78.21
Yes	188 (24.73)	21.79–27.94
Amount of urine lost each time urine leaks		
Drops or a little	137 (75.69)	68.85–81.44
More than drops or a little	44 (24.31)	18.56–31.15
Bothered by this incontinence		
Yes	49 (26.63)	20.69–33.55
No	135 (73.36)	66.45–79.31
Willingness to change waterpipe smoking behavior if proved to be linked to urinary symptoms		
Discontinue smoking waterpipe	64 (35.16)	28.52–42.44
Decrease waterpipe smoking	62 (34.07)	27.49–41.32
Continue smoking waterpipe the same as before	21 (11.54)	7.61–17.11
Do not know	35 (19.23)	14.10–25.67

variety of brands that vary in their composition and in the concentration of their ingredients. This could theoretically explain the inconsistent effects, in different studies, of the consumption of soft drinks on the symptoms of OAB.

Our study has many limitations. This was a web-based questionnaire, which limited the response rate to 26%. However, this response rate is typical of e-mail-based surveys [25]. Our results are applicable in the geographic context where the study was conducted and cannot be generalized, especially in view of the established genetic and environmental aspects of OAB. Whether or not WP smokers and cigarette smokers were more inclined to participate in the study is a possibility. Therefore, selection bias cannot be absolutely ruled out. Furthermore, the cross-sectional design of this study does not allow determination of a cause–effect

relationship between the variables but rather only allows inference of a possible correlation between the variables.

In our analysis, we included the frequency but not the duration of WP smoking “sessions.” These sessions are variable, and could last from minutes to hours, with a large variability in the quantity of inhaled smoke. Future studies should include, in addition to the frequency of WP smoking, the duration of the WP smoking session. Our questionnaire did not differentiate between carbonated and noncarbonated drinks, as the question addressed the consumption of “soft drinks.” Consequently, it is difficult to compare our results with those of most studies that specifically evaluated the effect of carbonated drinks on OAB. Similarly, the question regarding “energy drinks” lumped together drinks with and without alcohol. Ideally, the composition and concentration of different ingredients in these

Table 3 Unadjusted odds ratios and 95% confidence intervals of occurrence of urinary symptoms and BMI, waterpipe and cigarette smoking patterns, alcohol drinking, energy drinks, artificial sweeteners, and diet/regular soft drink intake

	Bothersome frequency (yes vs no)			Nocturia (twice or more vs less)			Urgency (yes vs no)			Experienced urine leakage (vs never)		
	OR	95% CI	p	OR	95% CI	p	OR	95% CI	p	OR	95% CI	p
BMI												
Normal/underweight (reference)	1.00	0.69–1.44	0.982	0.89	0.36–1.25	0.515	1.22	0.83–1.79	0.292	1.87	1.29–2.72	0.001*
Overweight/obese												
Patterns of WP smoking												
Never smoked WP (reference)	1.32	0.93–1.88	0.114	0.86	0.61–1.20	0.387	1.05	0.71–1.55	0.774	1.29	0.88–1.89	0.179
Less than once per week												
One or more per week	1.03	0.51–2.10	0.918	0.80	0.41–1.58	0.536	2.01	1.01–3.96	0.044*	1.52	0.74–3.12	0.242
Current cigarette smoking												
No (reference)	1.62	0.95–2.76	0.075	0.75	0.44–1.27	0.291	1.03	0.57–1.88	0.901	2.37	1.37–4.08	0.002*
Yes												
Use of artificial sweeteners with coffee/tea												
Does not drink coffee/tea (reference)	1.96	1.17–3.29	0.010*	1.30	0.82–2.05	0.257	0.95	0.56–1.62	0.864	0.73	0.44–1.22	0.235
Drink coffee/tea with artificial sweeteners												
Drink coffee/tea without artificial sweeteners	1.56	0.95–2.56	0.077	1.03	0.67–1.58	0.879	1.16	0.71–1.91	0.544	0.72	0.45–1.16	0.183
Alcohol drinking in the past month												
No (reference)	0.88	0.55–1.40	0.592	0.47	0.29–0.74	0.001*	0.53	0.30–0.94	0.030*	1.46	0.91–2.34	0.109
Yes												
Energy drink intake (with/without alcohol)												
No (reference)	1.13	0.83–1.52	0.420	1.28	0.92–1.78	0.141	1.20	0.88–1.63	0.237	1.44	1.02–2.02	0.034*
Yes												
Drinking diet or regular soft drinks												
Does not drink soft drinks (reference)	0.79	0.52–1.19	0.262	0.71	0.48–1.05	0.090	1.07	0.69–1.67	0.732	1.15	0.74–1.79	0.516
Diet												
Regular	0.78	0.55–1.11	0.177	1.29	0.93–1.79	0.116	1.15	0.79–1.67	0.449	1.05	0.72–1.53	0.790

* denotes statistical significance

Table 4 Adjusted odds ratios and 95% confidence intervals of urinary symptoms and selected associated behavioral factors (BMI, waterpipe and cigarette smoking patterns, alcohol drinking, energy drinks and artificial sweeteners, and diet/regular soft drink intake)

	Bothered by frequency (vs not)			Nocturia (twice or more vs less)			Urgency			Experienced urine leakage (vs never)		
	OR	95% CI	p	OR	95% CI	p	OR	95% CI	p	OR	95% CI	p
BMI												
Normal/underweight (reference)												
Overweight/obese	1.04	0.70–1.53	0.841	0.90	0.62–1.30	0.578	1.18	0.78–1.77	0.419	2.05	1.37–3.05	<0.001*
Patterns of WP smoking												
Never smoked (reference)												
Less than once per week	1.21	0.82–1.76	0.322	0.95	0.65–1.37	0.792	1.06	0.69–1.61	0.775	1.14	0.75–1.73	0.531
One or more per week	0.90	0.41–1.95	0.800	0.75	0.35–1.60	0.470	2.12	1.00–4.48	0.048*	0.92	0.41–2.09	0.859
Current cigarette smoking												
No (reference)												
Yes	1.59	0.87–2.90	0.124	0.80	0.43–1.47	0.475	0.90	0.45–1.79	0.773	1.95	1.05–3.65	0.034*
Use of artificial sweeteners with coffee/tea												
Does not drink coffee/tea (reference)												
Drink coffee/tea with artificial sweetener	1.95	1.15–3.32	0.013*	1.35	0.84–2.17	0.201	0.86	0.50–1.50	0.617	0.64	0.38–1.10	0.110
Drink coffee/tea without artificial sweetener	1.49	0.90–2.48	0.119	1.16	0.75–1.82	0.489	1.16	0.70–1.93	0.550	0.64	0.39–1.05	0.081
Alcohol drinking in the past month												
No (reference)												
Yes	0.77	0.47–1.26	0.299	0.52	0.32–0.85	0.009*	0.48	0.26–0.87	0.017*	1.37	0.83–2.28	0.213
Energy drink intake (with/without alcohol)												
No (reference)												
Yes	1.18	0.82–1.71	0.357	1.21	0.84–1.75	0.300	1.13	0.92–1.96	0.126	1.22	0.81–1.84	0.320
Drinking diet or regular soft drinks												
No (reference)												
Diet	0.74	0.48–1.14	0.176	0.70	0.46–1.06	0.094	1.17	0.74–1.86	0.492	1.04	0.66–1.65	0.851
Regular	0.75	0.52–1.08	0.130	1.15	0.82–1.61	0.413	1.16	0.78–1.72	0.451	1.02	0.68–1.54	0.894

* and bold text denote statistical significance

beverages should be known in order to estimate their effect on the symptoms of OAB. This, however, entails including a very large number of participants who are regular consumers of specific brands.

In conclusion, symptoms of OAB are common among young nulliparous women. UUI has the strongest correlation with elevated BMI. Urgency is associated with WP smoking, and bothersome frequency with artificial sweeteners used

with coffee and tea. Soft drinks and “energy drinks” were not found to be significantly associated with OAB symptoms. Our results could help to establish the path for larger studies to evaluate behavioral factors associated with OAB in this specific population of nulliparous young women. Finally, our results highlight the need for more awareness campaigns regarding the toxic effect of WP smoking and its association with OAB.

Appendix 1

Structured questionnaire

Structured Questionnaire

Faculty: FAS

FAFS

FHS

FM

FEA

OSB

Level: grad/undergrad

Marital status:

Age: _____ years

Height: _____ cm

Weight: _____ kg

I- Waterpipe smoking:

1- Ever smoking: Have you ever smoked waterpipe (even one or 2 inhalations)?

No Go to Part II Yes

2- Current Smoking: Do you currently smoke waterpipe (at least once in the previous month)?

No Yes

3- Former Smoking: Did you smoke waterpipe at least once a month for 3 consecutive months in the past?

No Yes

4- Patterns of use (exposure): Which of the following choices best describes your waterpipe smoking?

Usually, I smoke waterpipe monthly (at least once a month but less than weekly): go to 5

Usually, I smoke waterpipe weekly (at least once a week but less than daily): go to 53.

Usually, I smoke waterpipe daily (at least once a day, or on most days of the month): go to 6

5- Approximately how many waterpipe (headful, nafas) did you smoke in the previous month? _____

6- On average, how many waterpipe (headful, nafas) do you smoke daily? _____

7- At what age did you start waterpipe smoking? _____ years

8- Do you usually share the same waterpipe with others?

No Yes

II- Cigarette smoker:**i. Have you smoked at least 100 cigarettes in your entire life?**

No Go to part III Yes

ii. How old were you when you first started to smoke cigarettes regularly?

Enter Age -----

Not regularly smoking Go to part III

iii. Do you now smoke cigarettes?

Every day Some days Not at all Go to Question 5

4- During the past 30 days, on the days that you smoked, how many cigarettes did you smoke per day? -----

cigarettes----- Go to section III

5- How long has it been since you quit smoking cigarettes?

-----Weeks

-----Months

-----Years

III- Nonalcoholic beverages

1-How often do you drink coffee/tea**Coffee/tea**

- No/rarely Go to question #3
- Sometimes, but not daily
- Once a day
- Twice a day
- Three or more times a day

2- Do you add artificial sweeteners to coffee/tea?

- No Yes

3- How often do you drink Soft drinks/carbonated beverages (exp: pepsi, 7up, Perrier, ice tea...)?

- No/rarely Go to part IV
- Sometimes, but not daily
- Once a day
- Twice a day
- Three or more times a day

4- If yes, which type do you predominantly consume?

- Regular Diet/light

IV- Alcoholic beverages:

1. During the past 30 days, how many days per week or per month did you have at least one drink of any alcoholic beverage?

__ Days per week

__ Days in past 30 days

No drinks in past 30 days [Go to section V]

Don't know / Not sure [Go to section V]

2. During the past 30 days, on the days when you drank, about how many drinks did you consume on the average? _____

3. Considering all types of alcoholic beverages, how many times during the past 30 days did you have 4 or more drinks on one occasion? _____

V- How often do you consume Energy drinks: alcoholic and nonalcoholic (ex: redbull, Gatorade, XXL, AMP...)

No

Occasional/once per week

1-3/week

- 3-6/week
- Once a day
- Twice a day
- Three or more times a day

VI- Urine urgency incontinence:

OAB related questions, with corresponding scores:

During the night, how many times do you have to get up to urinate, on average?

- None
- 1
- 2
- 3
- 4 or more

Does this bother you?

- Not at all
- Somewhat
- Significantly

Do you have to rush to the toilet to urinate?

- Never
- Occasionally
- Sometimes
- Most of the time
- All of the time

Does this bother you?

- Not at all Somewhat Significantly

Does urine leak before you can get to the toilet?

- Never Less than once a month One or several times a month One or several times a week Everyday and/or night

How much urine do you lose each time?

- Drops or little More

Does this bother you?

- Not at all Somewhat Significantly

How often do you pass urine during the day?

- Every 4 hours or more Every 3 hours Every 2 hours Hourly

Are you bothered by this frequency of urination?

- Not at all Somewhat a lot

For waterpipe smokers, please answer the following:

If there was evidence that Waterpipe increases your urinary symptoms (such as going often to the toilet, getting up at night to the toilet, leaking urine before you get to the toilet or rushing to get to the toilet), would you:

- Discontinue smoking waterpipe
- Decrease waterpipe smoking
- Continue smoking waterpipe same as before
- Don't know

To learn more about the harmful effects of waterpipe smoking click on the following link:

https://www.cdc.gov/tobacco/data_statistics/fact_sheets/tobacco_industry/hookahs

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Declarations

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References

1. Haylen BT, de Ridder D, Freeman RM, et al. An International Urogynecological Association (IUGA)/International Continence Society (ICS) joint report on the terminology for female pelvic floor dysfunction. *Neurourol Urodyn*. 2010;29(1):4–20. <https://doi.org/10.1002/nau.20798>.
2. Gormley EA, Lightner DJ, Burgio KL, et al. Diagnosis and treatment of overactive bladder (non-neurogenic) in adults: AUA/SUFU guideline. *J Urol*. 2012;188(6 Suppl):2455–63. <https://doi.org/10.1016/j.juro.2012.09.079>.
3. Ghandour L, Minassian V, Al-Badr A, Abou Ghaida R, Geagea S, Bazi T. Prevalence and degree of bother of pelvic floor disorder symptoms among women from primary care and specialty clinics in Lebanon: an exploratory study. *Int Urogynecol J*. 2017;28(1):105–18. <https://doi.org/10.1007/s00192-016-3080-y>.
4. Sexton CC, Coyne KS, Vats V, Kopp ZS, Irwin DE, Wagner TH. Impact of overactive bladder on work productivity in the United States: results from EpiLUTS. *Am J Manag Care*. 2009;15(4 Suppl):S98–S107.
5. Zhu J, Hu X, Dong X, Li L. Associations between risk factors and overactive bladder: a meta-analysis. *Female Pelvic Med Reconstr Surg*. 2019;25(3):238–46. <https://doi.org/10.1097/spv.0000000000000531>.
6. Ural ÜM, Gücük S, Ekici A, Topçuoğlu A. Urinary incontinence in female university students. *Int Urogynecol J*. 2021;32(2):367–73. <https://doi.org/10.1007/s00192-020-04360-y>.
7. Robinson D, Hanna-Mitchell A, Rantell A, Thiagamorthy G, Cardozo L. Are we justified in suggesting change to caffeine, alcohol, and carbonated drink intake in lower urinary tract disease? Report from the ICI-RS 2015. *Neurourol Urodyn*. 2017;36(4):876–81. <https://doi.org/10.1002/nau.23149>.
8. Robinson D, Giarenis I, Cardozo L. You are what you eat: the impact of diet on overactive bladder and lower urinary tract symptoms. *Maturitas*. 2014;79(1):8–13. <https://doi.org/10.1016/j.maturitas.2014.06.009>.
9. Dallosso HM, McGrother CW, Matthews RJ, Donaldson MM. The association of diet and other lifestyle factors with overactive bladder and stress incontinence: a longitudinal study in women. *BJU Int*. 2003;92(1):69–77. <https://doi.org/10.1046/j.1464-410x.2003.04271.x>.
10. Kawahara T, Ito H, Yao M, Uemura H. Impact of smoking habit on overactive bladder symptoms and incontinence in women. *Int J Urol*. 2020;27(12):1078–86. <https://doi.org/10.1111/iju.14357>.
11. Drope JSN, Cahn Z, Drope J, et al. The tobacco atlas. Atlanta: American Cancer Society and Vital Strategies; 2018.
12. Bhatnagar A, Maziak W, Eissenberg T, et al. Water pipe (hookah) smoking and cardiovascular disease risk: a scientific statement from the American Heart Association. *Circulation*. 2019;139(19):e917–36. <https://doi.org/10.1161/cir.0000000000000671>.
13. Jacob P 3rd, Abu Raddaha AH, Dempsey D, et al. Comparison of nicotine and carcinogen exposure with water pipe and cigarette smoking. *Cancer Epidemiol Biomark Prev*. 2013;22(5):765–72. <https://doi.org/10.1158/1055-9965.Epi-12-1422>.
14. Jawad M, Wilson A, Lee JT, Jawad S, Hamilton FL, Millett C. Prevalence and predictors of water pipe and cigarette smoking

- among secondary school students in London. *Nicotine Tob Res.* 2013;15(12):2069–75. <https://doi.org/10.1093/ntr/ntt103>.
15. Akl EA, Gunukula SK, Aleem S, et al. The prevalence of waterpipe tobacco smoking among the general and specific populations: a systematic review. *BMC Public Health.* 2011;11:244. <https://doi.org/10.1186/1471-2458-11-244>.
 16. Dar-Odeh NS, Abu-Hammad OA. The changing trends in tobacco smoking for young Arab women; narghile, an old habit with a liberal attitude. *Harm Reduct J.* 2011;8:24. <https://doi.org/10.1186/1477-7517-8-24>.
 17. Maziak W, Ward KD, Afifi Soweid RA, Eissenberg T. Standardizing questionnaire items for the assessment of waterpipe tobacco use in epidemiological studies. *Public Health.* 2005;119(5):400–4. <https://doi.org/10.1016/j.puhe.2004.08.002>.
 18. Jackson S, Donovan J, Brookes S, Eckford S, Swithinbank L, Abrams P. The Bristol female lower urinary tract symptoms questionnaire: development and psychometric testing. *Br J Urol.* 1996;77(6):805–12. <https://doi.org/10.1046/j.1464-410x.1996.00186.x>.
 19. Hamadeh RR, Lee J, Abu-Rmeileh NME, et al. Gender differences in waterpipe tobacco smoking among university students in four eastern Mediterranean countries. *Tob Induc Dis.* 2020;18:100. <https://doi.org/10.18332/tid/129266>.
 20. Eissenberg T, Shihadeh A. Waterpipe tobacco and cigarette smoking: direct comparison of toxicant exposure. *Am J Prev Med.* 2009;37(6):518–23. <https://doi.org/10.1016/j.amepre.2009.07.014>.
 21. Özgür Yenieli A, Mete Ergenoglu A, Meseri R, Hadimli A, Askar N, Mete Itil I. The prevalence of probable overactive bladder, associated risk factors and its effect on quality of life among Turkish midwifery students. *Eur J Obstet Gynecol Reprod Biol.* 2012;164(1):105–9. <https://doi.org/10.1016/j.ejogrb.2012.06.006>.
 22. Abrams P, Andersson KE, Birder L, et al. Fourth international consultation on incontinence recommendations of the international scientific committee: evaluation and treatment of urinary incontinence, pelvic organ prolapse, and fecal incontinence. *Neurourol Urodyn.* 2010;29(1):213–40. <https://doi.org/10.1002/nau.20870>.
 23. Cartwright R, Srikrishna S, Cardozo L, Gonzalez J. Does diet coke cause overactive bladder? A 4-way crossover trial, investigating the effect of carbonated soft drinks on overactive bladder symptoms in normal volunteers. *Neurourol Urodyn* 2007;26:626–627.
 24. Shiri R, Hakama M, Häkkinen J, et al. The effects of lifestyle factors on the incidence of nocturia. *J Urol.* 2008;180(5):2059–62. <https://doi.org/10.1016/j.juro.2008.07.042>.
 25. Fincham JE. Response rates and responsiveness for surveys, standards, and the journal. *Am J Pharm Educ.* 2008;72(2):43. <https://doi.org/10.5688/aj720243>.

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