

Association Between Toileting Behaviors and Overactive Bladder Symptoms among Female University Students in Lebanon and Armenia: A Comparative Study

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Abstract

Background: Overactive bladder (OAB) is a prevalent lower urinary tract symptom syndrome among young women, with potentially modifiable behavioral risk factors including toileting behaviors. This cross-sectional study investigated the association between toileting behaviors and OAB symptoms among female university students in Lebanon and Armenia.

Methods: A total of 812 female university students (402 from Lebanon and 410 from Armenia) completed an online survey including the Toileting Behaviors–Women's Elimination Behaviors Scale (TB-WEB) and the 8-item Overactive Bladder Questionnaire (OAB-V8). Spearman correlation, chi-square tests, Mann–Whitney U tests, and descriptive statistics were used to analyze the data. Statistical significance was set at $p < 0.05$.

Results: OAB symptoms were present in 52.5% of Lebanese and 39.0% of Armenian participants. Lebanese students had higher TB-WEB scores (49.26 ± 8.77 vs. 44.82 ± 6.50) and OAB scores (8.01 ± 4.16 vs. 7.02 ± 5.48) (both $p < 0.001$). Total TB-WEB scores were positively correlated with OAB scores in both Lebanon ($\rho = 0.680$, $p < 0.001$) and Armenia ($\rho = 0.312$, $p < 0.001$). Delayed voiding showed the strongest association with OAB in Lebanon ($\rho = 0.687$, $p < 0.001$), whereas premature voiding was significantly associated with OAB only in Armenia ($\rho = 0.264$, $p < 0.001$).

Conclusion: Unhealthy toileting behaviors were significantly associated with OAB symptoms in both countries, with notable differences in behavioral patterns. These findings highlight the importance of addressing toileting behaviors as potentially modifiable factors in bladder health interventions for young women.

Introduction

Overactive bladder is a common and distressing lower urinary tract symptom syndrome in women and represents a substantial global public health burden. A 2025 systematic review and meta-analysis research of 53 studies conducted between 2000 and 2024 across 24 countries reported a pooled global prevalence of 20.0%, with a higher prevalence in women than in men (21.9% vs 16.1%) and an increase over time from 18.1% in 2000–2005 to 23.9% in 2021–2024 (Zhang et al., 2025).

In the United States, a 2019 community-based cross-sectional study conducted in 2017 found that women with overactive bladder reported more frequent unhealthy toileting behaviors than those without overactive bladder. Furthermore, among 6,562 adult women, 16.1% had overactive bladder, and convenience voiding showed the strongest association with symptom burden (Daily et al., 2019).

Additional evidence from the United States was summarized in a 2019 scoping review of 25 studies published between 2010 and 2019, which showed that women's toileting behaviors are strongly influenced by environmental access, cleanliness concerns, and situational factors. Notably, 83.0% of private college students avoided public toilets, 92.2% reported concern about public toilet cleanliness, 81.9% reported holding urine when away from home, and 25.3% to 85.1% of women across studies reported delaying urination when busy, supporting the view that bladder symptoms may be shaped not only by physiology but also by learned and adaptive behavioral patterns (Wu et al., 2019).

In Europe, a 2017 population-based study conducted in southern Sweden in 2014 among women aged 18–25 years showed that several toileting behaviors were significantly associated with lower urinary tract symptoms, suggesting that voiding habits established during adolescence and early adulthood may remain clinically relevant in young women. However, 34.2% reported urgency, 35.9% reported urine leakage, and 69.9% reported delaying voiding when busy at least sometimes or more often (Sjögren et al., 2017).

In Asia, a recent study from Kazakhstan demonstrated that overactive bladder is also measurable among female university students, reporting that 10.1% of participants screened positive for overactive bladder and showing that this condition is relevant even in young academic populations (Sharapatov et al., 2025).

In the South Caucasus region, data on bladder health among women remain scarce. A 2022 cross-sectional survey conducted among mothers residing in Yerevan, Armenia, found that 48.5% reported symptoms of urinary incontinence, with only 20.0% demonstrating high knowledge proficiency about the condition. This study highlighted that urinary incontinence represents a neglected public health concern in Armenia, where cultural stigma and limited awareness may prevent women from seeking timely care (American University of Armenia, 2022).

In the MENA region, a 2021 cross-sectional population-based survey conducted over approximately 4 months in 2018 across Algeria, Egypt, Jordan, and Lebanon showed that symptoms suggestive of overactive bladder were highly prevalent among women aged 40 years and older. Among 2,297 eligible participants, 53.8% had symptoms suggestive of overactive bladder, with country-specific prevalence estimates of 58.5% in Jordan, 57.5% in Egypt, 49.9% in Algeria, and 49.0% in Lebanon, while 91.3% of affected women also reported symptoms of urinary incontinence (Al Edwan et al., 2021).

In Palestine, a 2021 multicenter cross-sectional study showed that overactive bladder symptoms were prevalent among medical and dentistry students and were linked to poorer health-related quality of life. Among 402 participants, 60.4% reported an uncomfortable urge to urinate, 43.8% reported waking at night to urinate, and symptom burden was strongly negatively correlated with health-related quality of life (Shawahna et al., 2021).

Another 2024 cross-sectional study from Jordan showed that probable overactive bladder was common among medical students and was associated with several clinical and psychosocial factors. Among 525 medical students, 44.5% screened positive for overactive bladder, with significantly higher prevalence in younger students, those in the basic years of training, and those reporting urinary tract infection, recent trauma, high stress, or medication use (Abuorouq et al., 2024).

In Lebanon, a cross-sectional study conducted between 2017 and 2020 among healthy nulliparous female university students found that symptoms of overactive bladder were present in a notable proportion of participants and were associated with lifestyle factors including waterpipe smoking. Bothersome frequency was reported in 32.3%, nocturia in 47.5%, urgency in 25.5%, and urgency urinary incontinence in 24.7%, while urgency was significantly associated with waterpipe smoking and urgency urinary incontinence was associated with cigarette smoking and elevated body mass index (Hajjar et al., 2022). This study was limited to describing the prevalence of overactive bladder symptoms and its risk factors including waterpipe smoking.

However, the available Lebanese study was limited to describing the prevalence of overactive bladder symptoms and selected lifestyle related risk factors, and did not evaluate toileting behaviors using a validated toileting behavior instrument. Furthermore, no studies from Armenia have examined overactive bladder symptoms or toileting behaviors in young women. Therefore, this study aims to investigate the association between toileting behaviors and overactive bladder symptoms among female university students in Lebanon and Armenia. The objectives of this study are to compare toileting behavior patterns and OAB symptoms between the two countries and to determine whether unhealthy toileting behaviors are associated with greater OAB symptoms in each population.

Materials and Methods

Participants and Study Design

This study used a cross-sectional design using an online, self-administered questionnaire to investigate the association between toileting behaviors and overactive bladder symptoms among female university students in Lebanon and Armenia.

The target population included female university students enrolled in universities in Lebanon and Armenia during the academic year 2025–2026. Eligible participants were female students in Lebanon and Armenia who were currently registered in undergraduate or graduate programs in either country during the study period. Participants who did not meet the eligibility criteria or who submitted incomplete questionnaires were excluded from the final analysis.

A total of 440 participants in Lebanon and 447 participants in Armenia were recruited for the study. Participants with conditions that could independently influence bladder function or overactive bladder symptoms were excluded from the study in order to reduce potential confounding. These exclusion factors included a history of pregnancy, recurrent urinary tract infections, diabetes, hypertension, known urinary tract abnormalities, and neurologic diseases affecting bladder function. Following the application of these exclusion criteria, 38 participants were excluded in Lebanon and 37 participants were excluded in Armenia, resulting in final samples of 402 and 410 participants, respectively. Excluding these factors was intended to improve the internal validity of the study and allow a more accurate assessment.

An English questionnaire was distributed using a convenience sampling approach during the data collection period. Recruitment was carried out among university students in Lebanon and Armenia through university groups, WhatsApp groups, student platforms, social media, and email, with the aim of broadening access to the target population and maximizing participation.

All participants were informed about the objectives of the study, the voluntary nature of participation, anonymity, and confidentiality before completing the questionnaire. Electronic informed consent was obtained from all participants prior to access to the survey.

Survey Structure

The questionnaire used in this study was designed with three main sections to assess sociodemographic and health-related characteristics, toileting behaviors, and overactive bladder symptoms.

The first section collected baseline information necessary to characterize the study sample and examine possible associated factors. These variables included age, smoking status, caffeine consumption, frequency of caffeinated beverage intake, and average daily water or fluid intake.

The second section assessed toileting behaviors using the Toileting Behaviors–Women’s Elimination Behaviors Scale (TB–WEB). The TB–WEB is a 18-item instrument developed to assess women’s toileting behaviors and consists of five subscales: place preference for voiding, premature voiding, delayed voiding, straining voiding, and position preference for voiding. Items are rated on a 5-point Likert scale ranging from 1 = never to 5 = always. The scale has no cutoff point, and higher scores indicate more unhealthy toileting behaviors and the total score is calculated by summing the responses to all eighteen items, yielding a possible score from 18 to 90. Subscale scores were calculated as the mean of the item scores within each subscale, yielding a possible score from 1 to 5, with higher scores reflecting more unhealthy toileting behavior within that domain (Wang & Palmer, 2011; Parlas et al., 2023). The TB–WEB questionnaire demonstrated acceptable internal consistency in the present study, with a Cronbach’s alpha coefficient of 0.723.

The TB–WEB consists of five subscales that assess different dimensions of women’s toileting behaviors. The place preference for voiding subscale evaluates behaviors related to women’s preferences regarding where they choose to urinate. The premature voiding subscale assesses behaviors associated with urinating before experiencing a strong urge to void. The delayed voiding subscale measures behaviors related to postponing urination despite feeling the urge to void. The straining voiding subscale evaluates the use of abdominal pressure or straining during urination. The position preference for voiding subscale assesses the posture adopted during urination, including behaviors such as crouching or hovering over the toilet seat. Together, these five subscales reflect where, when, and how women empty their bladders and provide a comprehensive assessment of toileting behaviors related to urinary elimination (Wang & Palmer, 2011).

The third section assessed overactive bladder symptoms using the English version of the 8-item Overactive Bladder questionnaire (OAB–V8). The OAB–V8 is an 8-item self-reported instrument used to identify bothersome overactive bladder symptoms. Each item is rated on a 6-point Likert scale ranging from 0

("not at all") to 5 ("a very great deal"), and the total score is calculated by summing the responses to all eight items, yielding a possible score from 0 to 40. According to the original OAB-V8 instrument, a total score of 8 or greater suggests the presence of overactive bladder symptoms (Coyne et al., 2005). The OAB-V8 demonstrated acceptable internal consistency in the present study, with a Cronbach's alpha coefficient of 0.705.

Data Collection and Analysis

The survey was web-based and administered through a Google Form. The questionnaire link was circulated electronically, and participants completed the survey anonymously.

All responses were treated as strictly confidential. No names, contact details, or other directly identifying information were collected. Data were stored in files accessible only to the research team. The dataset obtained during the study will be available from the corresponding author upon reasonable request, if applicable.

Data were analyzed using SPSS version 27. Sociodemographic and clinical characteristics, toileting behavior scores, and overactive bladder symptoms scores were summarized using descriptive statistics, including frequencies, percentages, means, and standard deviations, as appropriate. The association between toileting behaviors and overactive bladder symptoms was assessed using Spearman correlation coefficients and chi-square tests. Mann–Whitney U tests were used after assessing normality. Statistical significance was set at $p < 0.05$.

Ethical Considerations

This study adhered to the ethical principles outlined in the Declaration of Helsinki, including respect for participants, voluntary participation, confidentiality, and the right to withdraw from the study at any time without consequence (World Medical Association, 2013). Participation was anonymous, and no identifying personal information was collected.

Ethical approval was obtained from two Institutional Review Boards prior to data collection: the Research Ethics Committee (REC), Human Research Protection Program (HRPP), Holy Spirit University of Kaslik (USEK), Lebanon (Reference No. HRPP/202610/FT/0150) and the Ethics Committee of Yerevan State Medical University after Mkhitar Heratsi (Approval No. N 11-2/26). Electronic informed consent was obtained from all participants before they proceeded to complete the questionnaire.

Results

Table 1
Socio-demographics, smoking, caffeine consumption, and daily fluid intake among participants in Lebanon and Armenia

Variable	Category	Lebanon, n = 402	Armenia, n = 410	P- Value
Age	-	20.26 ± 3.02	21.06 ± 2.27	< 0.001
BMI, in kg/m ²	-	21.73 ± 3.86	21.51 ± 3.62	
Smoking cigarettes/shisha/narghile	No	345 (85.8%)	394 (96.1%)	
	Yes	57 (14.2%)	16 (3.9%)	
Caffeinated beverage intake	1 cup/can per day or less	191 (47.5%)	261 (63.7%)	
	2–3 cups/cans per day	183 (45.5%)	132 (32.2%)	
	4 or more cups/cans per day	28 (7.0%)	17 (4.1%)	
Average daily water/fluid intake	Less than 1 liter	93 (23.1%)	121 (29.5%)	0.001
	1–2 liters	292 (72.6%)	253 (61.7%)	
	More than 2 liters	17 (4.2%)	36 (8.8%)	

Table 1 presents the socio-demographic and lifestyle characteristics of participants from Lebanon and Armenia. The two groups showed largely similar socio-demographic profiles. Armenian participants had slightly older age than Lebanese participants (21.06 ± 2.27 vs. 20.26 ± 3.02 years, $p < 0.001$). BMI was nearly identical between the two groups (21.51 ± 3.62 kg/m² in Armenia and 21.73 ± 3.86 kg/m² in Lebanon), indicating comparable body composition ($p < 0.001$). Regarding lifestyle characteristics, smoking was more common among participants in Lebanon ($p < 0.001$). Caffeine intake appeared higher in Lebanon, with 52.5% of Lebanese participants consuming at least 2 cups/cans per day compared with 36.3% of Armenian participants ($p < 0.001$). Regarding fluid intake, most participants in both countries reported drinking 1–2 liters per day, but this was more common in Lebanon (72.6%) than in Armenia (61.7%) ($p = 0.001$).

Table 2
Comparison of Toileting Behavior Subscale Scores Between Lebanon and Armenia

Toileting Behavior Subscales	Lebanon (Mean ± SD)	Armenia (Mean ± SD)	P- Value
Premature Voiding	1.57 ± 0.31	1.47 ± 0.53	< 0.001
Straining Voiding	2.98 ± 1.07	1.88 ± 0.79	
Place Preference for Voiding	3.78 ± 0.65	4.05 ± 0.57	
Delayed Voiding	3.14 ± 1.11	2.69 ± 0.77	
Position Preference for Voiding	2.49 ± 0.67	2.85 ± 0.48	

Table 2 presents the comparison of toileting behavior patterns between participants from Lebanon and Armenia. Differences were observed in toileting behavior patterns between participants from Lebanon and Armenia. Armenian participants reported higher scores for place preference for voiding (4.05 ± 0.57 vs. 3.78 ± 0.65 , $p < 0.001$) and position preference for voiding (2.85 ± 0.48 vs. 2.49 ± 0.67 , $p < 0.001$) compared with Lebanese participants. In contrast, Lebanese participants showed higher levels of delayed voiding (3.14 ± 1.11 vs. 2.69 ± 0.77 , $p < 0.001$) and straining during voiding (2.98 ± 1.07 vs. 1.88 ± 0.79 , $p < 0.001$). Scores for premature voiding were relatively low in both countries, although slightly higher in Lebanon (1.57 ± 0.31) than in Armenia (1.47 ± 0.53 , $p < 0.001$).

Supplementary table 1 shows participants' responses across different toileting behavior items. Public toilet cleanliness was one of the most common toileting behaviors in both countries, with 290 (72.1%) participants in Lebanon and 294 (71.7%) in Armenia answering "Always" ($p = 0.897$). Avoidance of public toilets was more frequent in Armenia, where 170 (41.5%) answered "Often" and 108 (26.3%) answered "Always," compared with 123 (30.6%) and 94 (23.4%) in Lebanon ($p < 0.001$). Armenian participants were also more likely to report emptying their bladder before leaving home compared with Lebanon ($p < 0.001$).

In contrast, delayed urination behaviors were more prominent in Lebanon. Lebanese participants more often reported postponing urination when busy ($p < 0.001$), waiting until they could no longer hold urine ($p < 0.001$), and waiting too long to urinate at university ($p < 0.001$). Straining or pushing with abdominal muscles during urination was also clearly more common in Lebanon across all related items ($p < 0.001$). Complete bladder emptying was reported more strongly in Armenia, with 215 (52.4%) answering "Always," compared with 58 (14.4%) in Lebanon ($p < 0.001$) (Supplementary Table 1).

Table 3
Overactive bladder symptom responses in Lebanon and Armenia

OAB Items	Not at all		A little bit		Somewhat		Quite a bit		A great deal		A very great deal	
	Lebanon	Armenia	Lebanon	Armenia	Lebanon	Armenia	Lebanon	Armenia	Lebanon	Armenia	Lebanon	Armenia
Q1. Frequent urination during the daytime hours	61 (15.2)	78 (19.0)	170 (42.3)	98 (23.9)	71 (17.7)	136 (33.2)	53 (13.2)	54 (13.2)	45 (11.2)	41 (10.0)	2 (0.5)	3 (0.7)
Q2. An uncomfortable urge to urinate	79 (19.7)	215 (52.4)	205 (51.0)	97 (23.7)	96 (23.9)	58 (14.1)	19 (4.7)	31 (7.6)	3 (0.7)	8 (2.0)	0 (0.0)	1 (0.2)
Q3. A sudden urge to urinate with little or no warning	328 (81.6)	248 (60.5)	32 (8.0)	95 (23.2)	23 (5.7)	40 (9.8)	16 (4.0)	18 (4.4)	3 (0.7)	8 (2.0)	0 (0.0)	1 (0.2)
Q4. Accidental loss of a small amount of urine	367 (91.3)	275 (67.1)	8 (2.0)	83 (20.2)	13 (3.2)	23 (5.6)	9 (2.2)	19 (4.6)	2 (0.5)	6 (1.5)	3 (0.7)	4 (1.0)
Q5. Nighttime urination	62 (15.4)	206 (50.2)	143 (35.6)	104 (25.4)	142 (35.3)	65 (15.9)	32 (8.0)	24 (5.9)	15 (3.7)	8 (2.0)	8 (2.0)	3 (0.7)
Q6. Waking up at night because you had to urinate	98 (24.4)	143 (34.9)	117 (29.1)	134 (32.7)	88 (21.9)	71 (17.3)	82 (20.4)	37 (9.0)	14 (3.5)	20 (4.9)	3 (0.7)	5 (1.2)
Q7. An uncontrollable urge to urinate	211 (52.5)	260 (63.4)	132 (32.8)	74 (18.0)	40 (10.0)	50 (12.2)	15 (3.7)	18 (4.4)	3 (0.7)	4 (1.0)	1 (0.2)	4 (1.0)
Q8. Urine loss associated with a strong desire to urinate	243 (60.4)	279 (68.0)	51 (12.7)	73 (17.8)	39 (9.7)	34 (8.3)	46 (11.4)	17 (4.1)	17 (4.2)	7 (1.7)	6 (1.5)	0 (0.0)

Table 3 presents the distribution of overactive bladder (OAB) symptoms among participants from Lebanon and Armenia. Frequent urination during daytime hours was reported in both countries, with similar “Not at all” responses in Lebanon 61 (15.2%) and Armenia 78 (19.0%) ($p < 0.001$). Lebanon showed more prominent nighttime-related symptoms. For nighttime urination, only 62 (15.4%) of Lebanese participants answered “Not at all,” compared with 206 (50.2%) in Armenia ($p < 0.001$). Waking up at night because of the need to urinate was also more evident in Lebanon, with 82 (20.4%) answering “Quite a bit” compared with 37 (9.0%) in Armenia ($p < 0.001$).

For uncomfortable urge, 79 (19.7%) in Lebanon answered “Not at all,” compared with 215 (52.4%) in Armenia ($p < 0.001$). For urine loss associated with a strong desire to urinate, Lebanon had higher responses in the more severe categories ($p < 0.001$).

For sudden urge, 248 (60.5%) of Armenian participants answered “Not at all,” compared with 328 (81.6%) in Lebanon ($p < 0.001$). For accidental urine loss, 275 (67.1%) in Armenia answered “Not at all,” compared with 367 (91.3%) in Lebanon ($p < 0.001$).

Table 4 Toileting behavior and OAB measures in Lebanon and Armenia			
Measure	Lebanon (n = 402)	Armenia (n = 410)	P-value
OAB score, mean ± SD	8.01 ± 4.16	7.02 ± 5.48	< 0.001
TB-WEB score, mean ± SD	49.26 ± 8.77	44.82 ± 6.50	
Positive OAB, n (%)	211 (52.5%)	160 (39.0%)	
Negative OAB, n (%)	191 (47.5%)	250 (61.0%)	

Table 4 compares OAB and toileting behavior scores between participants from Lebanon and Armenia. Lebanese participants had significantly higher mean OAB scores and TB-WEB scores than Armenian participants. In addition, the prevalence of positive OAB was significantly higher in Lebanon (52.5%) compared with Armenia (39.0%) ($p < 0.001$).

Table 5 Correlations Between Toileting Behavior and Total OAB Scores in Lebanon and Armenia		
TB - WEB	Spearman's Correlation (ρ) with OAB in Lebanon	Spearman's Correlation (ρ) with OAB in Armenia
Premature Voiding	0.027 (p = 0.584)	0.264 (p < 0.001)
Straining Voiding	0.681 (p < 0.001)	0.314 (p < 0.001)
Place Preference for Voiding	0.546 (p < 0.001)	-0.058 (p = 0.243)
Delayed Voiding	0.687 (p < 0.001)	0.162 (p = 0.001)
Position Preference for Voiding	-0.382 (p < 0.001)	0.006 (p = 0.909)
Total Toileting Behavior Score	0.680 (p < 0.001)	0.312 (p < 0.001)

Table 5 highlights notable differences in the associations between toileting behaviors and OAB symptoms among participants from Lebanon and Armenia. Compared with Armenia, Lebanon exhibited stronger correlations between OAB scores and several toileting behavior subscales. Delayed voiding showed the strongest association with OAB in Lebanon ($\rho = 0.687$, $p < 0.001$) compared with Armenia ($\rho = 0.162$, $p = 0.001$). Similarly, straining voiding was more strongly correlated with OAB in Lebanon ($\rho = 0.681$, $p < 0.001$) than in Armenia ($\rho = 0.314$, $p < 0.001$). Place preference for voiding was significantly associated with OAB in Lebanon ($\rho = 0.546$, $p < 0.001$) but not in Armenia ($\rho = -0.058$, $p = 0.243$).

In contrast, premature voiding was significantly correlated with OAB in Armenia ($\rho = 0.264$, $p < 0.001$) but not in Lebanon ($\rho = 0.027$, $p = 0.584$). A significant negative correlation between OAB and position preference for voiding was observed only in Lebanon ($\rho = -0.382$, $p < 0.001$), whereas no association was found in Armenia ($\rho = 0.006$, $p = 0.909$). The total toileting behavior score was positively associated with OAB in both countries, although the correlation was stronger in Lebanon ($\rho = 0.680$, $p < 0.001$) than in Armenia ($\rho = 0.312$, $p < 0.001$).

Discussion

Our findings showed that OAB symptoms were common in both populations, affecting 52.5% of Lebanese participants and 39.0% of Armenian participants. Lebanese participants demonstrated higher overall toileting behavior scores and higher OAB scores than Armenian participants. The higher prevalence observed in Lebanon may partly reflect the greater frequency of unhealthy toileting behaviors identified in this group, particularly delayed voiding and straining voiding. These prevalence estimates are considerably higher than those reported among female university students in Kazakhstan, where OAB was identified in 10.1% of participants (Sharapatov et al., 2025). However, our findings are comparable to those reported among university students in Jordan and Palestine, where OAB symptoms affected approximately 44–45% of participants (Abuorouq et al., 2024; Shawahna et al., 2021). Similarly, a previous Lebanese study among healthy nulliparous female university students reported a substantial burden of OAB symptoms, including urgency, nocturia, and urgency urinary incontinence (Hajjar et al., 2022).

Regarding toileting behaviors, clear differences were observed between Lebanese and Armenian participants. Lebanese students reported higher scores for delayed voiding and straining voiding, whereas Armenian students reported higher place preference for voiding and position preference for voiding scores. These findings suggest that although unhealthy toileting behaviors were present in both populations, the behavioral patterns differed considerably. Armenian

participants were more likely to avoid public toilets and empty their bladder before leaving home, whereas Lebanese participants more frequently postponed urination and reported straining during voiding. These differences may reflect variations in cultural practices, perceptions of toilet cleanliness, accessibility of public restrooms, academic schedules, and environmental influences. Similar concerns regarding public toilet cleanliness and avoidance behaviors have been reported among women internationally, where environmental and situational factors were shown to strongly influence toileting habits (Wu et al., 2019; Perlow et al., 2023).

The present study demonstrated a significant positive association between overall toileting behavior scores and OAB symptoms in both countries. However, the strength of this relationship was substantially greater in Lebanon ($p = 0.680$) than in Armenia ($p = 0.312$). These findings support previous evidence suggesting that unhealthy toileting behaviors may contribute to bladder symptom burden and reinforce observations from the United States showing that women with OAB report more unhealthy toileting behaviors than women without OAB (Daily et al., 2019). The stronger association observed in Lebanon may indicate that behavioral factors play a greater role in OAB symptoms within this population. In Armenia, where the association was weaker, other factors such as physiological predisposition, cultural attitudes toward bladder symptoms, or differing healthcare access may contribute more substantially to OAB presentation (American University of Armenia, 2022).

Among the individual toileting behavior subscales, delayed voiding demonstrated the strongest association with OAB symptoms in Lebanon ($p = 0.687$), while a weaker but still significant correlation was observed in Armenia ($p = 0.162$). Lebanese participants also reported higher delayed voiding scores overall. These findings are consistent with previous studies showing that postponing urination is one of the most common unhealthy toileting behaviors among young women and is associated with lower urinary tract symptoms (Sjögren et al., 2017; Wu et al., 2019). Repeatedly delaying urination may increase bladder distension and alter normal bladder signaling mechanisms, potentially contributing to urgency, frequency, and other OAB symptoms.

Straining voiding was also strongly associated with OAB symptoms, particularly among Lebanese participants ($p = 0.681$), compared with Armenian participants ($p = 0.314$). Furthermore, Lebanese students reported substantially higher straining scores than Armenian students. Frequent use of abdominal pressure during urination may indicate dysfunctional voiding habits and impaired bladder emptying. Over time, such behaviors may contribute to abnormal bladder function and increased urinary symptoms. Although relatively few studies have specifically examined straining behaviors in young women, our findings suggest that this toileting behavior may represent an important modifiable factor associated with OAB (Perlow et al., 2023).

Place preference for voiding was significantly associated with OAB symptoms in Lebanon ($p = 0.546$) but not in Armenia. Interestingly, Armenian participants reported higher place preference scores overall despite the absence of a significant relationship with OAB. This finding suggests that avoidance of certain toilets or strong preferences regarding where to urinate may not affect bladder symptoms equally across different populations. Previous studies have shown that women frequently avoid public toilets because of concerns regarding cleanliness, privacy, and safety (Wu et al., 2019). While such behaviors may contribute to altered voiding habits in some populations, their impact on OAB symptoms may be influenced by additional environmental or cultural factors.

Premature voiding demonstrated a different pattern. In Armenia, premature voiding was positively associated with OAB symptoms ($p = 0.264$), whereas no significant association was observed in Lebanon. Armenian participants also reported greater frequencies of behaviors such as emptying their bladder before leaving home and urinating "just in case." These findings are consistent with previous evidence indicating that convenience voiding may be associated with OAB symptoms. Daily et al. (2019) identified premature or convenience voiding as one of the toileting behaviors most strongly associated with OAB among women (Daily et al., 2019). Our findings suggest that this relationship may be particularly relevant among Armenian female university students.

An unexpected finding was the negative correlation between position preference for voiding and OAB symptoms in Lebanon ($p = -0.382$), while no association was observed in Armenia. This finding contrasts with the generally positive relationships observed between unhealthy toileting behaviors and urinary symptoms. One possible explanation is that alternative voiding positions may facilitate more complete bladder emptying in certain situations or may reflect adaptive behaviors adopted by women experiencing fewer urinary symptoms. However, because evidence regarding voiding posture and bladder symptoms remains limited and inconsistent, this finding should be interpreted cautiously and warrants further investigation.

The differences observed between Lebanon and Armenia highlight the potential influence of sociocultural and environmental factors on both toileting behaviors and bladder health. Although participants in both countries were female university students with similar age and body mass index profiles, notable differences were observed in smoking prevalence, caffeine consumption, toileting behavior patterns, and OAB symptoms. These findings suggest that bladder health is shaped not only by physiological mechanisms but also by behavioral and contextual factors that may vary across populations.

Strengths

To our knowledge, this study lies among the first to investigate the association between toileting behaviors and OAB symptoms among female university students in both Lebanon and Armenia using validated assessment tools. The inclusion of participants from two countries enabled cross-cultural comparisons of toileting behaviors and bladder symptoms. The identification of population-specific behavioral patterns associated with OAB symptoms represents a novel contribution to the literature. Furthermore, the exclusion of participants with conditions known to affect bladder function enhanced the internal validity of the findings.

Limitations

This study was based on a cross-sectional design; therefore, causal relationships between toileting behaviors and OAB symptoms cannot be established. The use of self-reported questionnaires may have introduced recall bias and reporting bias. Additionally, convenience sampling may limit the generalizability of the findings to all female university students in Lebanon and Armenia. Although several important medical conditions were excluded, other unmeasured

factors influencing bladder symptoms may still have been present. Future longitudinal studies are needed to determine whether modification of unhealthy toileting behaviors can reduce OAB symptoms and improve bladder health among young women.

Conclusion

This cross-sectional study demonstrated that unhealthy toileting behaviors are significantly associated with OAB symptoms among female university students in both Lebanon and Armenia, with notable cross-country differences in behavioral patterns and the strength of associations. Delayed voiding and straining voiding showed the strongest correlations with OAB symptoms in Lebanon, while premature voiding was more relevant in Armenia. These findings underscore the importance of toileting behaviors as potentially modifiable factors in bladder health and suggest that culturally tailored behavioral interventions may be warranted.

Healthcare providers and university health services should consider screening for unhealthy toileting behaviors and providing targeted education to promote bladder-healthy habits among young women. Future research should employ longitudinal designs to establish causal relationships and evaluate the effectiveness of behavioral interventions in reducing OAB symptoms across different cultural contexts.

Declarations

Ethics Approval and consent to participate:

Ethical approval was obtained from two Institutional Review Boards prior to data collection: the Research Ethics Committee (REC), Human Research Protection Program (HRPP), Holy Spirit University of Kaslik (USEK), Lebanon (Reference No. HRPP/202610/FT/0150) and the Ethics Committee of Yerevan State Medical University after Mkhitar Heratsi (Approval Number: N 11-2/26). Electronic informed consent was obtained from all participants before they proceeded to complete the questionnaire.

Consent for publication:

Not applicable.

Clinical Trial Number:

Not applicable

Availability of data and materials:

The datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request.

Competing interests:

The authors declare that they have no competing interests.

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Author Contributions:

All Authors have equally contributed to this manuscript. The corresponding author is Rawad Affan, and his email is: rawad.r.affan@net.usek.edu.lb

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