



The effect of school toileting behaviors and environment on the development of bowel and bladder dysfunction symptoms in children aged 5-10 years

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Abstract:

BACKGROUND: Bladder and bowel dysfunction (BBD), a common condition affecting school-age children, is characterized by lower urinary tract symptoms, recurrent urinary tract infections, and bowel elimination issues. Toileting habits are often overlooked in clinical assessment as a contributor, leading to frequent clinic visits without properly addressing the problem.

MATERIALS AND METHODS: This study assessed school toileting behaviors in children and the prevalence of symptoms suggestive of BBD. Study population comprised of children between 5 and 10 years old, attending schools regularly across the cities of Al Khobar, Dammam, and Al Qatif. Data were collected between December 2023 and March 2024 through an invitation to participate in a web-based questionnaire distributed through social media platforms (WhatsApp groups and "X"), open only to parents reporting having children within our age limits and cities of assessment. Using both the Dysfunctional Voiding Scoring System and school toileting behavior and environment questionnaire, a multivariate regression model was used to assess the predictive factors for BBD.

RESULTS: A total of 290 participants were included in the study, and they were evenly distributed across various age groups. There were slightly more females (56%) than males. Most children (98.3%) were Saudi nationals and reported attending government-funded schools (62.1%). Data analysis showed that 111 (38%) children had symptoms suggestive of BBD of which 68% were females. Age, type of school attended, and satisfaction with cleanliness of toilet did not emerge as significant predictors of BBD in our study group ($P > 0.05$).

CONCLUSION: While BBD symptoms were prevalent in our study population, most reported satisfaction with their school toilet environment. Further studies across other regions of Saudi Arabia can provide more insight and guide school officials accordingly. Fostering a supportive, safe, and hygienic school toileting environment will promote an overall healthy elimination habit of children.

Keywords:

Bowel and bladder dysfunction, constipation, dysfunctional voiding, urinary incontinence, urinary tract infections

Introduction

Bladder and bowel dysfunction (BBD) – previously known as dysfunctional elimination syndrome – is a

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common condition in children characterized by lower urinary tract symptoms (LUTS) and bowel elimination issues.^[1] BBD has an estimated prevalence of up to 15%–20%.^[2] The prevalence in patients diagnosed with urinary tract infections (UTIs) was reported

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at 41%.^[3] BBD represents a broad spectrum of symptoms and is, therefore, often unrecognized. Its detection requires a detailed medical history that includes an assessment of the voiding habits of the child throughout the day. Most children are diagnosed only after a referral to a urologist for bothersome urinary incontinence or recurrent UTIs. It has been reported that BBD makes up approximately 40% of referrals to pediatric urology clinics.^[1,4] Symptoms suggestive of BBD include dysuria, urgency, frequency, daytime urinary incontinence, nocturnal enuresis, constipation, or encopresis.^[3,5]

Several factors are thought to be involved in the development of BBD in school-aged children with access to proper facilities, elimination habits or habitual toilet postponement at school, continuing through the day among them.^[6,7] This can lead to an overall gradual disturbance of the urinary bladder dynamics and development of high-pressure voiding or postvoid residuals, vesicoureteral reflux, and possibility of renal scarring.^[4,5,8]

In this study, our goal was to draw attention to the importance of a detailed assessment of toileting habits and perceived environment at school as well as at home of a child presenting with symptoms suggestive of BBD so that healthcare providers can provide proper behavioral therapeutic advice and education as needed.

Materials and Methods

The present study aimed to assess the relationship between toileting behavior at school and its perceived environment and the prevalence of BBD symptoms. Our study population consisted of children aged 5–10 years attending schools in the cities of Al Khobar, Dammam, and Al Qatif in the Eastern Province of Saudi Arabia through a quota sampling method. Our sample size was 246, calculated on consensus reports on the population in these cities with a margin of error set at 5% at a confidence interval (CI) of 95% and population proportion of 20%.^[2] Data were collected between December 2023 and March 2024. We distributed an invitation to participate and a link to a 10-min web-based questionnaire. The questions were only digitally accessible to parents who answered “yes” to having children within our age range and cities of assessment. Links to the survey were distributed through engaging posts through social media, namely, WhatsApp groups and “X” platforms. Any participant who came across the link and answered “yes” to having a child in our age range/cities mentioned was then able to digitally access the questionnaire. Otherwise, he/she would be locked out. Only questionnaires that were answered completely were included in our study. Ethical approval was obtained from the Institutional Review Board, vide Letter No. IRB-2023-01-535, dated 28/11/2023, and

written informed consent was taken from the parents of all participants in the study.

The study population consisted of 290 fully toilet-trained children between the ages of 5- and 10-years attending school regularly. Parents were instructed to record their child’s answers to each element in the questionnaire. The exclusion criteria included children aged under 5 years or over the age of 10 years, home-schooled, those with known urogenital anatomical or congenital anomalies, and children diagnosed with behavioral or neuropsychiatric disorders. Data reported on toileting behavior at school and its perceived environment of the participating children was collected and correlated with the prevalence of symptoms suggestive of BBD in the same group using both the Dysfunctional Voiding Scoring System (DVSS)^[9] and the school toileting behavior and environment questionnaire.^[6]

The DVSS is a 10-item quantitative frequency assessment tool that provides a numerical score to the main symptoms that define the urinary and bowel symptoms of BBD developed to address

Table 1: Sociodemographic characteristics of 5-10 year old children attending schools in AlKhobar, Dammam, and Qatif, 2024 (n=290)

Characteristics	N (%)
Age (years)	
5	40 (13.8)
6	53 (18.3)
7	48 (16.6)
8	51 (17.6)
9	44 (15.2)
10	54 (18.6)
Gender	
Female	163 (56.2)
Male	127 (43.8)
Monthly family income (Saudi Riyals)	
<3000	8 (2.7)
3000–4999	30 (10.2)
5000–6999	20 (6.8)
7000–9999	52 (17.6)
10,000–14,999	59 (20)
15,000–19,999	41 (13.9)
20,000–29,999	43 (14.6)
≥30,000	42 (14.2)
Nationality	
Saudi	285 (98.3)
Non-Saudi	5 (1.7)
Type of school	
Governmental	180 (62.1)
Private	110 (37.9)
Chronic disease	
None	276 (95.3)
Asthma	13 (4.4)
Cardiac anomalies	1 (0.3)

Table 2: The relationship between bladder and bowel dysfunction and toileting behavior and environment among 5-10 year old children attending schools in AlKhobar, Dammam, and Qatif, 2024 (n=290)

Area of assessment	BBD			P-value
	Absent N (%)	Present N (%)	Total N (%)	
The school toilets are clean and in good condition				
Never	63 (35.2)	38 (34.2)	101 (34.8)	0.164
Most of the time	72 (40.2)	55 (49.6)	127 (43.8)	
Always	44 (24.6)	18 (16.2)	62 (21.4)	
The toilets provide me with complete privacy				
No	16 (8.9)	9 (8)	25 (8.6)	0.139
Sometimes	32 (17.9)	32 (28.8)	64 (22.1)	
Yes	116 (64.8)	59 (53.2)	175 (60.3)	
I do not know	15 (8.4)	11 (10)	26 (9)	
Toilets have a working bidet/toilet paper				
No	19 (10.6)	16 (14.4)	35 (12)	0.618
Sometimes	40 (22.4)	26 (23.4)	66 (22.8)	
Yes	109 (60.9)	60 (54.1)	169 (58.3)	
I do not know	11 (6.1)	9 (8.1)	20 (6.9)	
Restrooms contain water and soap for washing hands				
No	28 (15.6)	15 (13.5)	43 (14.8)	0.117
Sometimes	30 (16.8)	29 (26.1)	59 (20.3)	
Yes	110 (61.4)	56 (50.5)	166 (57.3)	
I do not know	11 (6.2)	11 (9.9)	22 (7.6)	
Toilets have hand dryers or towels				
No	86 (48.0)	59 (53.1)	145 (50)	0.014
Sometimes	15 (8.4)	20 (18.0)	35 (12.1)	
Yes	59 (33.0)	21 (19.0)	80 (27.6)	
I do not know	19 (10.6)	11 (9.9)	30 (10.3)	
The restrooms are always busy (there is always a queue)				
No	82 (45.8)	49 (44.1)	131 (45.2)	0.948
Sometimes	51 (28.5)	34 (30.6)	85 (29.3)	
Yes	25 (14.0)	15 (13.5)	40 (13.8)	
I do not know	21 (11.7)	13 (11.7)	34 (11.7)	
I am afraid I will be bullied in the toilet				
No	109 (61.0)	56 (50.5)	165 (56.9)	0.337
Sometimes	23 (12.8)	19 (17.1)	42 (14.5)	
Yes	26 (14.5)	22 (19.8)	48 (16.5)	
I do not know	21 (11.7)	14 (12.6)	35 (12.1)	
I am afraid of insects in the school toilets				
No	84 (47.0)	44 (39.7)	128 (44.1)	0.384
Sometimes	33 (18.4)	20 (18.0)	53 (18.3)	
Yes	62 (34.6)	47 (42.3)	109 (37.6)	
How often do you use the toilet while at school?				
I do not use it at all	24 (13.4)	17 (15.3)	41 (14.1)	0.128
Once	81 (45.3)	52 (46.8)	133 (45.8)	
Two to three times	70 (39.1)	34 (30.6)	104 (35.9)	
More than three times	4 (2.2)	8 (7.2)	12 (4.2)	
Do you reduce drinking fluids at school to avoid the need to use the toilet?				
Completely abstain from drinking at school	4 (2.2)	8 (7.2)	12 (4.2)	0.096
Yes, I reduce it	78 (43.6)	50 (45.0)	128 (44.1)	
I do not abstain	97 (54.2)	53 (47.7)	150 (51.7)	
Are you allowed to leave classes to relieve yourself?				
I am rarely allowed	6 (3.3)	6 (5.4)	12 (4.2)	0.017
Sometimes, I am allowed	62 (34.6)	50 (45)	112 (38.6)	
Yes, I am always allowed	111 (62)	55 (49.5)	166 (57.2)	
Do you deliberately hold in your urine at school until you arrive home to urinate?				

Contd...

Table 2: Contd...

Area of assessment	BBD			P-value
	Absent N (%)	Present N (%)	Total N (%)	
I do not do that	79 (44.1)	27 (24.3)	106 (36.6)	0.003
Sometimes	63 (35.2)	54 (48.7)	117 (40.3)	
Yes	37 (20.7)	30 (27.0)	67 (23.1)	
Does a parent ask you not to use the school toilet?				0.782
No	163 (56.2)	100 (34.5)	263 (90.7)	
Yes	16 (5.5)	11 (3.8)	27 (9.3)	
Do accidents involving wet underwear happen frequently while you are at school?				0.010
It does not happen	147 (82.1)	75 (67.6)	222 (76.6)	
Sometimes	30 (16.8)	31 (27.9)	61 (21.0)	
Yes	2 (1.1)	5 (4.5)	7 (2.4)	0.138
How satisfied are you with the cleanliness of the toilets in your school in general?				
Not satisfied	65 (36.3)	39 (35.1)	104 (35.9)	
Fairly satisfied	66 (36.9)	52 (46.9)	118 (40.7)	
Satisfied	48 (26.8)	20 (18.0)	68 (23.4)	

BBD=Bladder and bowel dysfunction

the lack of standardization in reporting bowel and bladder elimination issues. Areas of assessment include the presence of daytime self-wetting, urine withholding maneuvers, frequency of voiding, and bowel movement-related issues. It also assesses the presence of stressful life conditions such as school/home relocations, recent trauma or injury or other external stressors. The total possible score was 30. A score at or above six for females (sensitivity 92% and specificity 87%) and nine for males (sensitivity 80% and specificity 91%) indicates the presence of BBD.^[9]

The school toileting behavior and environment questionnaire is a structured frequency Likert scale questionnaire that was modified to our cohort. It asks about toilet cleanliness, toilet accessibility, availability of amenities, and safety and privacy. It also investigates the toileting behavior while at school (regular use or urine withholding) and their opinion on the overall quality of the facilities available.

Our data were collected, coded, and analyzed using SPSS version 29 statistical software (IBM SPSS Statistics, IBM Corp., Armonk, NY, USA). All the statistical analyses were performed using two-tailed tests. Descriptive statistics were employed to characterize the study cohort and summarize variables, including sociodemographic factors as well as BBD indicators. Relationships between BBD and sociodemographic variables, as well as toilet habits and environment, were examined using Pearson's Chi-square and exact probability tests. A multivariate regression model was used to identify predictive factors associated with BBD. The statistical significance was defined at a threshold of $P < 0.05$.

Results

Out of a total of 362 questionnaire respondents, 290 met our inclusion criteria, making up our study population, with sociodemographic characteristics indicating an even distribution across various age groups, with a mean age of 7.6 years [Table 1]. Gender distribution revealed a slight predominance of females (56%) over males. In terms of monthly family income, the lowest bracket, <3000 Saudi Riyals, was the least represented, constituting around 3% of the participants. Conversely, the highest income bracket, 10,000–14,999 SAR, was the most prevalent, encompassing nearly 20% of the participants. Most children were Saudi nationals, comprising 98% of the sample. About 62% of participants reported attending government-funded schools compared to 38% in private schools. The majority (95.3%) reported no known chronic medical conditions. Of those with chronic medical illnesses, asthma and cardiac congenital anomalies were the most prevalent, affecting 4% and 0.3% of the sample, respectively.

The analysis revealed that 111 children in our cohort were identified with symptoms suggestive of BBD, resulting in a prevalence rate of 38.3%. Notably, the prevalence of BBD was significantly higher in females (67.6%) than in males (32.4%), with $P = 0.002$ [Figure 1].

Table 2 presents participant responses to school toileting behavior and environment questionnaire items, analyzed in relation to the presence or absence of BBD. A considerable proportion of students perceived the school toilets as being in good condition, approximately 65% of respondents rating them as clean and in good condition either most of the time (43.8%) or always (21.4%). We found that symptoms suggestive of BBD in

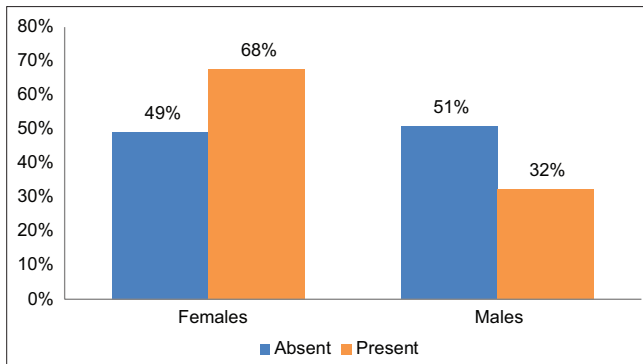


Figure 1: The prevalence of bladder and bowel dysfunction among 5-10 year old children by gender

our participants were least prevalent in those reporting toilet condition as “always” clean (16.2%). In addition, most students (82.4%) affirmed that the toilets provided adequate privacy. Regarding the presence of amenities such as bidets or toilet paper, approximately 58% reported them as available most of the time. Concern about bullying was reported by 31% of participants, and 37.6% of the study participants were anxious about encountering insects. About 75.7% of children with BBD symptoms reported holding their bladders until they got home after school (sometimes or yes) compared to children who did not have symptoms of BBD (55.9%) ($P = 0.003$).

Interestingly, the prevalence of BBD symptoms in relation to amenities available, including hand dryers or towels, was higher in children who reported their absence in school toilets (53%, $P = 0.014$). Incidents involving wet underwear while at school were found in 32.4% of participants in our study group with BBD ($P = 0.010$). No other perceptions or practices showed a significant relationship with BBD ($P > 0.05$).

A multivariate logistic regression analysis was conducted to investigate various factors potentially associated with BBD in children, as shown in Table 3. The results indicated that gender played a significant role. Females exhibited notably higher odds of dysfunction than males (odds ratio [OR] = 2.72, 95% CI [1.32–4.19], $P = 0.001$). In addition, children from households with monthly incomes below 3000 Saudi Riyals showed significantly increased odds of BBD (OR = 4.95, 95% CI [1.21–29.54], $P = 0.027$) compared to those from higher income households. However, other variables such as age, type of school attended, and chronic diseases – including asthma and cardiac anomalies – did not emerge as significant predictors of BBD ($P > 0.05$). Interestingly, we found that satisfaction with the cleanliness of the toilets did not reach statistical significance to show any association with BBD within our study population ($P > 0.05$).

Table 3: Multivariate regression analysis for predictive factors for bladder and bowel dysfunction in children

Factors	(95% CI for OR)	P-value
Age (years)		
5	0.79 (0.31–1.85)	0.549
6	1.09 (0.55–2.12)	0.719
7	1.05 (0.34–2.13)	0.809
8	0.86 (0.40–2.12)	0.791
9	1.18 (0.56–3.06)	0.632
10	Reference	
Gender		
Female	2.72 (1.32–4.19)	0.001
Male	Reference	
Monthly income		
<3000	4.95 (1.21–29.54)	0.027
3000–4999	0.45 (0.21–1.89)	0.419
5000–6999	0.57 (0.18–1.80)	0.321
7000–9999	1.71 (0.65–4.53)	0.245
10,000–14,999	0.92 (0.38–2.24)	0.831
15,000–19,999	0.67 (0.27–1.71)	0.391
20,000–29,999	0.84 (0.33–2.14)	0.649
≥30,000	Reference	
Nationality		
Saudi	0.41 (0.14–2.96)	0.328
Non-Saudi	Reference	
Type of school attended		
Governmental	0.60 (0.33–1.10)	0.192
Private	Reference	
Chronic disease		
Asthma	1.11 (0.42–3.52)	0.921
Cardiac anomaly	0.93 (0.20–1.51)	0.983
No chronic disease	Reference	
Satisfied with the cleanliness of toilets		
No	1.29 (0.43–2.03)	0.941
Yes	Reference	

BBD=Bladder and bowel dysfunction, CI=Confidence interval, OR=Odds ratio

Discussion

BBD describes a group of LUTS along with bowel elimination issues that can occur at any age and can have a significant impact on the quality of life.^[1,5,10] Dysfunctional voiding (DV) is one aspect of BBD that has been estimated to affect between 7% and 11% of school-aged girls.^[11] The literature has shown that girls have a higher prevalence of DV than boys, which could be attributed to anatomical differences or gender-specific toileting behaviors.^[5,12,13] DV is characterized by the habitual contraction of the external urethral sphincter during urination; that may have developed as a result of inappropriate toilet training or as a response to urine postponement, urgency, or pelvic discomfort causing a staccato or interrupted urinary flow, urinary incontinence, high postvoid residuals, and therefore, recurrent UTIs.^[13] It is often linked to constipation or encopresis and improves with dietary adjustment

and laxative use as needed. The interaction between bladder and bowel function has been well described in the literature when constipation aggravates the urinary symptoms present.^[4,14]

DV development in children has been linked in the literature to elimination habits that can be affected by a combination of physical, functional, environmental, and psychological factors.^[13,15] For this reason, several studies have assessed the toilet environment in schools where children spend lengthy periods. However, we found no similar studies in the literature assessing this association in Saudi Arabia. One study by Jørgensen *et al.*, in Danish schools reported findings similar to ours as regards the condition of the toilets and their cleanliness, with 34% reporting them as “never clean,”^[6] while other studies in the UK and Sweden reported much higher rates of inadequate toilet cleanliness, 83% and 77%, respectively.^[16] These studies also reported lower rates of satisfaction with privacy in the toilets than was reported by our study group, with up to 63% of students in Newcastle, England, reporting a need for greater privacy.^[16] Ensuring adequate privacy is important to encourage the students to use the facilities. The fear of bullying can also deter children from using the toilets while at school. Concerns about bullying reported by our participants were lower than what was reported by similar studies.^[12,16] A study by Zhao *et al.*, found bullying to be significantly greater in children presenting with LUTS.^[17] Interestingly, our group’s satisfaction with the cleanliness of the toilets did not show a significant statistical association with BBD symptoms among our participants, unlike similar studies carried out across larger populations.^[6,7,12,16,17] These studies reported that inadequate toilet cleanliness, lack of privacy, and the fear of bullying can reduce the likelihood of using school toilets and development of habits of urine postponements that can continue through the day. Therefore, larger population studies on school toilet environment and habits across Saudi Arabia are needed on account of the possible variation in school conditions from city to city. This will better reflect the impact that these elements can have on the development of BBD in our region.

Diagnosis of BBD typically involves a combination of approaches, including a medical history that also addresses voiding habits throughout the day, physical examination, and other diagnostic tools.^[18] Often overlooked are toileting behaviors as contributory factors when managing a child with recurrent UTIs or other LUTS with issues of bowel elimination, which leads to frequent clinic visits and antibiotic overuse. Up to 50% of patients with BBD will improve with urotherapy or behavioral advice and constipation management only.^[5] To guide effective management decisions, it is crucial to assess the influence of a child’s perception of the conditions of the school toilet on the development of BBD

and the resulting impact on the health-related quality of life for both the affected child and their family.^[13,14] A multidisciplinary approach involving healthcare professionals, teachers, parents as well as the child in question is needed to achieve the best overall outcome.^[11]

The majority of other studies that have examined factors leading to BBD development in school-aged children, were focused on Western populations with limited representation in literature from Middle Eastern cohorts.^[5,10] Our aim was to conduct a population-specific investigation for this purpose. Limitations of our study include the small sample size from a specific region of Saudi Arabia, as well as the limitation of recall from self-reporting participants. Larger scale studies in schools in other regions of Saudi Arabia can provide further insight into the relationship between toileting behaviors in children and the development of symptoms of BBD and, therefore, help guide healthcare workers on how to address such clinical presentations they encounter in our population effectively.

Conclusion

Our study examined the relationship between school toileting behavior and symptoms suggestive of BBD in school-age children in our region. While BBD symptoms were prevalent in our study group, most reported satisfaction with their school toilet cleanliness, a finding that differs from similar studies investigating this association in Western cohorts. Further studies on toilet conditions and usage habits across other regions of Saudi Arabia can provide more insight into this association locally and guide school officials to make changes where needed. Nevertheless, addressing the toileting habits in a child presenting with symptoms of BBD remains an important factor in its management. The creation of a supportive, safe, and hygienic school toileting environment can help promote an overall healthy elimination habit in children.

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Conflicts of interest

There are no conflicts of interest.

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