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## Increased fluid intake is associated with bothersome bowel symptoms among women with urinary incontinence

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### Abstract

**Objectives**—To determine the association between the type and volume of fluid intake and bowel symptoms in women with urinary incontinence. We hypothesize that a lower volume of fluid intake would be associated with greater straining with bowel movements in women with urinary incontinence.

**Methods**—We performed a cross sectional study of 256 women presenting with complaints of urinary incontinence from 2009 to 2010. Data on fluid intake, fluid intake behavior, urinary and bowel symptoms was collected using validated questionnaires. The relationship between quartiles of total daily fluid intake and bowel symptoms was analyzed.

**Results**—The behavior of restricting fluid intake was reported by 32% women. Increasing quartiles of total daily fluid intake was significantly associated with greater bother from straining with bowel movements ( $p=0.04$ ). Women with no bother from straining with bowel movements had significantly lower median daily fluid intake (2839 mL) than women with quite a bit of bother (3312 mL,  $p=0.01$ ). The association between volume of fluid intake and straining with bowel movements persisted after controlling for age, body mass index, history of prolapse or incontinence surgery, and stage of prolapse ( $p < 0.05$ ). There was no association between caffeinated fluid intake and any bowel symptom or between the behavior of restricting fluid intake and any bowel symptom.

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**Conclusion**—In women with urinary incontinence, higher volume of total fluid intake is reported by women with greater straining with bowel movements. The behavior of fluid restriction is not associated with bothersome bowel symptoms.

### Keywords

fluid intake; bowel symptoms; urinary incontinence

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### Introduction

Bowel symptoms, especially constipation and fecal incontinence, are common in women with urinary incontinence. Prevalence rates of chronic constipation and fecal incontinence in women with overactive bladder reach 36% and 32%, respectively; compared to 7% and 7%, respectively in women without urinary incontinence. (1) In women with urinary incontinence and advanced pelvic organ prolapse, Jelovsek et al reported a 36% overall rate of constipation. (2)

Women with urinary incontinence often self-restrict their fluid intake. (3) Initial treatment options for urinary incontinence include fluid management as a part of lifestyle interventions and behavioral therapy.(4) Prior studies have shown that reducing the total volume of fluid intake and caffeine can reduce the number of voids and episodes of urinary incontinence in women with urgency and stress urinary incontinence.(5, 6) However, restriction of fluid intake has been implicated as a cause of constipation and women with constipation are often instructed to increase their fluid intake.(7, 8) A management dilemma may arise for women with concomitant urinary and bowel symptoms such that treatment of bowel symptoms with increased fluid intake may worsen urinary incontinence and vice versa. However, there is a lack of studies that have examined the relationship between fluid intake and bowel symptoms in this population of women. The aim of this study was to determine the association between the type and volume of fluid intake and bowel symptoms in women with urinary incontinence. We hypothesize that a lower volume of fluid intake would be associated with greater straining with bowel movements in women with urinary incontinence.

### Methods

Institutional Review Board approval was obtained from the University of Pennsylvania. We performed a cross sectional study of women 18 years of age and older who presented with urinary incontinence at their initial visit to a urogynecology practice between January 2009 through January 2010. Women with symptoms of urinary incontinence as recorded on the Incontinence Severity Index (9) at their initial visit were included. Individuals with known kidney disease, interstitial cystitis, diabetes, recurrent urinary tract infections, neurologic disorders, known bladder or gastrointestinal malignancies, and recent (within 6 months) pregnancy or pelvic surgery were excluded. Women taking diuretics or anti-cholinergic medications were also excluded. Demographic data was extracted from the medical record.

Data on the type and volume of fluid intake and fluid intake behavior was collected using a validated questionnaire, the Questionnaire-based Voiding Diary (QVD). (10, 11) The instrument has been shown to provide valid results for measuring fluid intake and behavior in women with urinary incontinence. (12)

The design of the fluid intake portion of the QVD is based on food frequency questionnaires (13) and the questionnaire has been validated against a 48-hour bladder diary. This instrument is a 25-item, self-administered questionnaire that consists of 4 subscales: fluid

intake, urinary output, fluid intake behavior, and urinary symptoms. Patients are asked to recall the average type and volume of fluid intake in the previous four weeks. The beverages included in the instrument include: water, caffeinated coffee, decaffeinated coffee, caffeinated tea, decaffeinated tea, caffeinated soda, decaffeinated soda, milk, fruit juice/drinks, and alcoholic drinks. Daily fluid intake volume is calculated by multiplying the reported number of drinks (0 to greater than 10) by the size of each drink (less than 8 ounces, 8–16 ounces, 17–24 ounces, or more than 24 ounces). The fluid intake behavior scale consists of five questions that address behaviors of drinking large amounts of caffeinated or carbonated beverages, drinking excess fluid to lose or maintain weight, drinking excess fluid even when not thirsty, and restricting fluid intake to control urinary symptoms. Urinary symptoms measured by the urinary symptom subscale include urgency urinary incontinence, stress incontinence, urinary frequency and nocturia. Responses to fluid intake behavior, urinary output, and urinary symptoms are scored on a five-level Likert scale as “never”, “occasionally”, “sometimes”, “most of the time”, and “all of the time.” We defined the presence of a symptom or fluid intake behavior as the response of “sometimes”, “most of the time”, or “all of the time”.

The presence and severity of urinary incontinence was calculated using the validated, 2-item instrument, the Incontinence Severity Index. (9)

The Pelvic Floor Distress Inventory short form subscale, Colorectal-Anal Distress Inventory (CRADI), was used to quantify bowel symptoms. (14) Women report “yes” or “no” to each symptom, and the level of bother is reported on 4 levels (“not at all” “somewhat” “moderately” “quite a bit”). Responses to bother from colorectal-anal symptoms of “somewhat” “moderately”, or “quite a bit” were considered as the presence of the symptom.

All women had undergone a complete urogynecologic examination including Pelvic Organ Prolapse Quantification System (POP-Q) staging, and the findings were extracted from the medical record.

All data was analyzed using STATA 10.1 (Stata Corp., College Station, TX). Descriptive data was displayed using mean and standard deviation or medians where appropriate. Fluid intake data was reported in ounces and converted to milliliters for analysis. The volume of total and caffeinated fluid intake was described using median and interquartile range. Daily fluid intake was analyzed by type (caffeinated, carbonated, and total) and volume of fluid intake by determining quartiles of total and caffeinated daily fluid intake. The relationship between the volume of fluid intake and bowel symptoms and fluid intake behavior and bowel symptoms were analyzed using chi-square analysis and chi square for trend, if appropriate. The median volume of fluid intake for women with severe bowel symptoms (‘quite a bit’ of bother) and no bowel symptoms was compared using the Wilcoxon rank sum test. The median volume of fluid intake for the four levels of bother of bowel symptoms (“not at all” “somewhat” “moderately”, and “quite a bit”) was compared using the Kruskal-Wallis rank test. Univariate and multivariate linear regression was used to analyze bowel symptoms and covariates.  $P < 0.05$  was considered significant.

The mean fluid intake in women with urinary incontinence has been previously reported as  $93.2 \pm 48.9$  oz ( $2756 \pm 1446$  ml). (10) We fixed alpha at 0.05 and power at 0.8. Based on these parameters, we estimated that we needed 49 incontinent women with and without symptoms of straining with bowel movements to detect a 30% difference in fluid intake between groups.

## Results

Mean age and BMI of the 256 women was  $52.5 \pm 12.6$  years and  $27 \pm 6.2$  kg/m<sup>2</sup> respectively. The majority of the women were Caucasian (83%). Based on the QVD urinary symptom subscale responses, 115 (44.9%) women reported urgency urinary incontinence and 144 (56.3%) reported stress urinary incontinence. Mixed urinary incontinence symptoms were experienced by 74 (28.9%) of women. Approximately 10% of women had undergone prior anti-incontinence or pelvic reconstructive surgery. The distribution of pelvic organ prolapse in this population was 25% stage 0, 28% stage 1, 23% stage 2, and 24% stage 3 or greater. Table 1 displays the distribution of the demographic characteristics among the quartiles of fluid intake.

### Patterns of bowel symptoms in women with urinary incontinence

The percentage of women with symptoms of straining with bowel movements or a sense of incomplete emptying was 44% and 47%, respectively. Fecal urgency was reported by 35% of women. Bother from painful bowel movements and rectal prolapse symptoms were infrequently reported in this cohort. Anal incontinence was common with 9% women reporting incontinence of solid stool, 21% reporting incontinence of liquid stool, and 49% reporting incontinence of flatus (Table 2).

### Distribution of fluid intake in women with urinary incontinence

Based on QVD responses, the volume of total fluid intake was divided into the following quartiles: 237–2100ml (quartile 1), 2101–2950ml (quartile 2), 2951–3550 (quartile 3), 3551–15380ml (quartile 4). Volume of caffeinated beverage intake was calculated by totaling daily caffeinated coffee, caffeinated tea, and caffeinated soda intake. Caffeinated fluid intake was divided into the following quartiles: 0–265ml (quartile 1), 266–709ml (quartile 2), 710–1034ml (quartile 3), >1034ml (quartile 4). Total daily carbonated beverages included caffeinated and decaffeinated soda. After tabulating responses to carbonated beverage intake, a skewed distribution was noted with 61% of women drinking no soda daily. Therefore, for analysis, carbonated beverage intake was dichotomized into groups of less than 237ml (8 ounces) and greater than 237ml of daily intake.

### Bowel symptoms and total daily fluid intake

A significant association was noted between quartiles of total daily fluid intake and bother from straining with bowel movements ( $\chi^2 = 17.3$ ,  $p = 0.04$ ) (Table 3). The median total daily fluid intake increased significantly for women with increasing bother from straining with bowel movements such that the median total fluid intake for women with “not at all” “somewhat” “moderately”, and “quite a bit” of bother from straining with bowel movements was 2839mL, 2484mL, 2720mL, and 3312mL, respectively ( $\chi^2 = 10.8$ ,  $p = 0.01$ ). The median total fluid intake for women with “no” bother with straining with bowel movements was significantly lower than that of women who reported “quite a bit” of bother from straining with bowel movements ( $Z = -2.55$ ,  $p = 0.01$ ). The significant association between quartiles of total daily fluid intake and bother from straining with bowel movements remained significant after controlling for age, body mass index, history of prolapse or incontinence surgery, and stage of prolapse ( $p < 0.05$ ).

Flatal incontinence was also significantly associated with total daily fluid intake ( $\chi^2 = 22.25$ ,  $p = 0.01$ ). The median total daily fluid intake for women with no bother from flatal incontinence (2957ml) was significantly lower than the median total daily fluid intake for women with “quite a bit” of bother from flatal incontinence (3017mL). ( $z = -2.07$ ,  $p = 0.03$ ).

No significant association was noted between volume of daily fluid intake and bother from incomplete emptying, fecal incontinence of solid or liquid stool, painful bowel movements, fecal urgency, or tissue protruding through the rectum. (Table 3) There was no significant association between the behavior of restricting fluid intake and any bowel symptom (Table 4).

### **Bowel symptoms and daily caffeinated and carbonated fluid intake**

No significant association was noted between the amount of daily caffeinated fluid intake and bother from any bowel symptom (Table 5). Similarly, no association was seen between carbonated beverage intake and any bowel symptom ( $p>0.05$ ).

## **Discussion**

Our study suggests that in women with urinary incontinence, the presence of bothersome bowel symptoms is associated with the volume of fluid consumed. We noted a statistically significant association between increasing quartiles of total fluid intake and increasing bother from straining to have a bowel movement. This overall trend of an increasing percentage of women with bothersome straining was noted across quartiles 1, 2, and 4. The median total fluid intake for women reporting no bother from straining with bowel movements was significantly lower than that of women who reported “quite a bit” of bother. This association persisted even after controlling for age, BMI and stage of pelvic organ prolapse. However, no relationship was noted between the behavior of restricting fluid intake and any bowel symptom. A possible explanation of our findings is that the presence of bothersome bowel symptoms may influence the volume of fluid consumed by women. It is possible that in our cohort women with bothersome straining with bowel movements were consuming large amounts of fluid in an effort to relieve their bowel symptoms. In women with urinary incontinence and functional bowel disorders, the influence of fluid intake modification on bowel symptoms may be studied prospectively to guide behavioral management of these disorders.

Another important finding of our study is that lower volumes of fluid intake were not associated with worse bowel symptoms in women with urinary incontinence.

Fluid restriction is an adaptive behavior that is widely practiced by women with urinary incontinence. In our study, 32% women with urinary incontinence reported restricting their fluid intake at least “some of the time”. It is unclear if such fluid restriction can result in worsening of bowel symptoms.(8) Our findings suggest that women with urinary incontinence who restrict their fluid intake do not report worse bother from straining with bowel movements. If prospective trials confirm our findings, clinically useful information for physicians interested in recommending behavioral management to women with urinary incontinence will emerge. Therefore, women with urinary incontinence may be allowed to restrict their fluid intake to control symptoms; however it would be prudent to warn them about the risks of severe fluid restriction and dehydration.

Women reporting bother from bowel symptoms such as straining with bowel movement, flatal incontinence, and sense of incomplete emptying in our study are similar to those previously reported in women with pelvic floor disorders.(15, 16) Chronic constipation is common in women with urinary incontinence.(1, 2) Increased fluid and fiber intake are widely recommended for the treatment of constipation (8) even in the absence of dehydration.(17) Since high consumption of fiber has been associated with increased flatus (18), women with urinary incontinence and obstructive bowel symptoms may differentially report flatal incontinence. The bother from flatal incontinence did not show an increasing trend with total daily fluid intake, and a significant association may arise from pairwise

comparisons alone. We found that the difference in median daily fluid intake volume among those with and without flatal incontinence is small and may not be clinically meaningful.

Excess caffeine intake has been previously reported to be associated with overactive bladder (19) either through its diuretic effect or direct stimulation of the smooth muscle. (20, 21) Caffeine has been also been reported to directly stimulate the gastro-intestinal tract. (22, 23) However, we did not find any association between daily caffeinated beverage intake and bother from anal incontinence. This may be due to the fact that we did not measure the precise caffeine content of various beverages. Croswell et al observed that community-dwelling adults with fecal incontinence self-restricted dietary caffeine to manage their severe symptoms. (24) Therefore, it is also possible that a direct statistical relationship between caffeine intake and anal incontinence may not be noted unless fecal incontinence symptoms are severe. Studies with measurement of caffeine content of beverages will be required to confirm our findings.

Strengths of our study include the use of validated questionnaires for the measurement fluid intake, urinary incontinence, and bowel symptoms. Limitations include our cross sectional study design that does not allow us to determine a cause-effect relationship between fluid intake and bowel symptoms. We also did not use food diaries to measure daily fluid and fiber intake or the caffeine content of beverages and food. However, the fluid intake subscale of the Questionnaire Based Voiding diary has been validated against daily fluid intake-output diaries. Use of an easily administrable instrument to measure fluid intake allowed us to obtain data from a relatively large sample of women. Finally, our findings may have limited generalizability because majority of women in our population were well-educated Caucasian women with high water and low carbonated beverage intake that may lead to high overall fluid intake outside the normal physiologic range. Although diabetes insipidus is an uncommon disease, some women may not have been diagnosed at the time of inclusion into the study. Nevertheless, our study provides practical data for behavioral management of women with urinary incontinence.

## Conclusion

In women with urinary incontinence, higher volume of total fluid intake is reported by women with greater straining with bowel movements. The behavior of fluid restriction is not associated with bothersome bowel symptoms.

## Acknowledgments

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**Table 1**

Demographic variables distributed by total daily fluid intake

Variable	Quartile 1 (237-2100mL) (n = 57)	Quartile 2 (2101-2950mL) (n=73)	Quartile 3 (2951-3550mL) (n=66)	Quartile 4 (3551-15,380mL) (n=60)	P value
Age (mean ± SD)	53.0 ± 12.0	53.2 ± 14.3	52.2 ± 12.3	51.6 ± 11.5	0.87*
Parity (median, IQR <sup>**</sup> )	2 (1,3)	2 (1,3)	2 (1,3)	2 (2,2)	0.60 <sup>†</sup>
Race (% Caucasian)	89.5%	76.6%	88.0%	78.0%	0.46 <sup>‡</sup>
Body mass index, (median, IQR <sup>**</sup> )	26 (23, 31)	26 (23, 31)	26 (23, 28)	25 (22, 31)	0.88 <sup>‡</sup>
History of prolapse surgery, n (%)	8 (3.1)	5 (2.0)	0 (0)	4 (1.6)	0.02 <sup>‡</sup>
History of incontinence surgery, n (%)	5 (2.0)	2 (0.8)	0 (0)	2 (0.8)	0.07 <sup>‡</sup>
Urgency urinary incontinence, n (%) <sup>***</sup>	27 (10.6)	32 (12.6)	29 (11.4)	27 (10.6)	0.93 <sup>‡</sup>
Stress urinary incontinence, n (%) <sup>***</sup>	32 (12.6)	38 (15)	35 (13.8)	39 (15.4)	0.97 <sup>‡</sup>
Pelvic organ prolapse quantification stage 3 or 4, n (%)	15 (26)	16 (22)	8 (12)	11 (18)	0.21 <sup>‡</sup>

\* ANOVA

\*\* Interquartile range

\*\*\* n(%) yes = "sometimes", "most of the time", "all of the time"

<sup>†</sup> Kruskal-Wallis

<sup>‡</sup>  $\chi^2$



**Table 2**

Patterns of bowel symptoms in this study population with urinary incontinence

Obstructive symptoms	Bowel Symptoms	
	Yes*	No <sup>†</sup>
Strain too hard to have a bowel movement, <i>n</i> (%)	105 (44)	137 (56)
Incomplete emptying at the end of a bowel movement, <i>n</i> (%)	107 (47)	120 (53)
<b><u>Anal incontinence symptoms</u></b>		
Fecal incontinence (well formed stool), <i>n</i> (%)	22 (9)	217 (91)
Fecal incontinence (liquid stool), <i>n</i> (%)	49 (21)	185 (79)
Flatal incontinence, <i>n</i> (%)	115 (49)	122 (51)
<b><u>Pain/Irritation and rectal prolapse symptoms</u></b>		
Fecal urgency, <i>n</i> (%)	84 (35)	155 (65)
Pain when passing stool, <i>n</i> (%)	35 (15)	201 (85)
Passage of bowel through rectum with bowel movements, <i>n</i> (%)	34 (15)	196 (85)

\*  
n(%) yes = “somewhat”, “moderately”, “quite a bit”

<sup>†</sup>  
n(%) No = “not at all”

**Table 3**

Quartiles of **total** fluid intake and bowel symptoms

	Quartile 1 (2,37–2100mL)	Quartile 2 (2101–2950mL)	Quartile 3 (2951–3550mL)	Quartile 4 (3551–15,380mL)	P value <sup>†</sup>
Strain too hard to have a bowel movement, <i>n</i> (%) *	24 (43)	31 (45)	22 (37)	28 (49)	0.04
Incomplete emptying at the end of a bowel movement, <i>n</i> (%)	19 (37)	31 (49)	28 (49)	29 (52)	0.63
Pain when passing stool, <i>n</i> (%)	6 (12)	10 (15)	10 (16)	9 (17)	0.78
Fecal incontinence (well formed stool), <i>n</i> (%)	2 (4)	7 (10)	4 (6)	9 (16)	0.11
Fecal incontinence (liquid stool), <i>n</i> (%)	9 (18)	14 (20)	12 (20)	14 (26)	0.66
Flatal incontinence, <i>n</i> (%)	27 (50)	39 (58)	19 (31)	30 (55)	0.01
Fecal urgency, <i>n</i> (%)	19 (37)	28 (26)	21 (34)	26 (46)	0.06
Passage of bowel through rectum with bowel movements, <i>n</i> (%)	6 (12)	8 (12)	10 (17)	10 (19)	0.07

\* *n*(%) yes = “somewhat”, “moderately”, “quite a bit”

<sup>†</sup>  $\chi^2$

**Table 4**  
The relationship between **fluid intake restriction** (to manage urinary symptoms) and bowel symptoms

	Behavior of Restricting Fluid Intake					P value <sup>†</sup>
	Never	Occasionally	Sometimes	Most of the time	All of the time	
Strain too hard to have a bowel movement, <i>n</i> (%) <sup>*</sup>	70 (60)	12 (10)	24 (21)	5 (4)	6 (5)	0.18
Incomplete emptying at the end of a bowel movement, <i>n</i> (%)	75 (56)	17 (13)	29 (22)	6 (5)	6 (5)	0.77
Pain when passing stool, <i>n</i> (%)	30 (57)	7 (13)	9 (17)	2 (4)	5 (9)	0.25
Fecal incontinence (well formed stool), <i>n</i> (%)	21 (58)	3 (8)	9 (25)	1 (3)	2 (6)	0.72
Fecal incontinence (liquid stool), <i>n</i> (%)	33 (49)	7 (10)	20 (29)	4 (6)	4 (6)	0.36
Flatal incontinence, <i>n</i> (%)	71 (54)	16 (12)	30 (23)	6 (5)	8 (6)	0.48
Fecal urgency, <i>n</i> (%)	52 (54)	14 (14)	22 (23)	5 (5)	4 (4)	0.99
Passage of bowel through rectum with bowel movements, <i>n</i> (%)	20 (59)	4 (12)	8 (24)	0 (0)	2 (6)	0.57

\* *n*(%) yes = “somewhat”, “moderately”, “quite a bit”

<sup>†</sup>  $\chi^2$

Table 5

Quartiles of **caffeinated** fluid intake\* and bowel symptoms

	Quartile 1 (0–265mL)	Quartile 2 (266–709mL)	Quartile 3 (710–1034mL)	Quartile 4 (>1034 mL)	P value †
Strain too hard to have a bowel movement, <i>n</i> (%) **	25 (39)	24 (44)	25 (49)	31 (44)	0.39
Incomplete emptying at the end of a bowel movement, <i>n</i> (%)	28 (47)	28 (56)	17 (35)	34 (50)	0.08
Pain when passing stool, <i>n</i> (%)	13 (21)	5 (10)	3 (6)	14 (20)	0.18
Fecal incontinence (well formed stool), <i>n</i> (%)	7 (11)	3 (6)	3 (6)	9 (13)	0.79
Fecal incontinence (liquid stool), <i>n</i> (%)	17 (27)	7 (13)	8 (16)	17 (25)	0.54
Flatal incontinence, <i>n</i> (%)	35 (56)	26 (49)	21 (41)	33 (47)	0.89
Fecal urgency, <i>n</i> (%)	29 (45)	16 (31)	11 (22)	28 (39)	0.12
Passage of bowel through rectum with bowel movements, <i>n</i> (%)	6 (10)	7 (13)	7 (15)	14 (20)	0.44

\* Caffeinated fluid includes caffeinated coffee, soda and tea

\*\* *n*(%) yes = “somewhat”, “moderately”, “quite a bit”

†  $\chi^2$