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Effects of coffee and tea consumption on urinary incontinence in female twins

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Abstract

Objectives—To assess the effect of coffee and tea consumption on symptoms of urinary incontinence.

Design—Population based study

Setting—The Swedish Twin Register

Population—In 2005, all twins born between 1959–1985 in Sweden (n = 42 852) were invited to participate in a web-based survey to screen for common complex diseases and common exposures. The present study was limited to female twins with information about at least one urinary symptoms and coffee and tea consumption (n = 14 031).

Main outcome measure—The association between coffee and tea consumption and urinary incontinence, as well as, nocturia was estimated as odds ratios (ORs) with 95% confidence intervals (CIs).

Results—Women with a high coffee intake were at lower risk of any urinary incontinence (OR 0.78, 95% confidence intervals (CI) 0.64–0.98) compared to women not drinking coffee. Coffee intake and incontinence subtypes showed no significant associations whereas high tea consumption was specifically associated with a risk for overactive bladder (OR 1.34, 95% CI

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11.07-1.67) and nocturia (OR 1.18, 95% CI 1.01-1.38). Results from co-twin control analysis suggested that the associations observed in logistic regression were mainly due to familial effects.

Conclusions—This study suggests that coffee and tea consumption has a limited effect on urinary incontinence symptoms. Familial and genetic effects may have confounded the associations observed in previous studies.

Keywords

Caffeine; Coffee; Tea; Twin; Urinary incontinence

Introduction

Lower urinary tract dysfunction is highly prevalent in the general population, affecting a majority of women above the age of 40 years.¹ Identification of modifiable risk factors for lower urinary tract disorders such as urinary incontinence is therefore of public health interest.² While some studies have reported coffee drinking to be associated with an increased risk of urinary incontinence,³⁻⁵ others have not found such an association.⁶⁻¹² Population-based studies relating coffee and tea consumption to the risk of urinary incontinence are, however, surprisingly few and inconsistent. Reduction of coffee and tea consumption is nonetheless a widely adopted treatment strategy in patients with urinary incontinence. A relationship between consumption of coffee and tea, and urinary incontinence, could be mediated by caffeine effects such as increased diuresis, central nervous stimulation, and increased lower urinary tract smooth muscle contractility.^{13 14}

Recent data suggest that familial factors such as common genes and a shared family environment influence the occurrence of urinary incontinence.¹⁵⁻¹⁷ Hence, it is important to also investigate whether common genes and shared environmental effects are confounding the previously studied associations.¹⁸ The aim of the present investigation was to study the effects of coffee and tea consumption on urinary incontinence and symptoms of lower urinary tract dysfunction, and to assess the role of familial factors on the associations, in a population based Swedish female twin sample born between 1959 and 1985.

Materials and Methods

Study population and data sources

The Swedish Twin Registry contains data on nearly all twins born in Sweden since 1886. In 2005, all twins born 1959–1985 ($n = 42\,852$) were invited to participate in a web-based survey to screen for common complex diseases and common exposures. The present study was limited to female twins participating in the survey which has been described in detail previously.¹⁹ The overall response rate to the survey was 66% among women ($n = 14\,094$). After 2–5 months, 100 twins were contacted again to assess test-retest reliability. The kappa values for agreement between the web questionnaire and telephone interviews ranged from good to excellent.¹⁹ This study was approved by the Regional Ethics Board at Karolinska Institutet and conforms to the STROBE guidelines for reporting observational studies (www.strobe-statement.org).

Exposure and Outcome measures

Information on symptoms of urinary incontinence and lower urinary tract dysfunction during the 30 day period prior to answering the survey was collected using diagnostic questions concerning female urinary incontinence which have been validated for implementation in epidemiological surveys.²⁰ Definitions of lower urinary tract disorders were based on recommendations from the International Continence Society.²¹ Women who answered yes

to the question “Do you have present involuntary loss of urine?” were classified as women with overall urinary incontinence. Subjects with stress urinary incontinence were identified using the question “Do you have involuntary loss of urine in connection with coughing, sneezing, laughing, lifting heavy items?”, and subjects with urge incontinence were identified using the question “Do you have involuntary loss of urine in connection with a sudden and strong urge to void?”. Participants who answered yes to both of the later questions were classified as having mixed urinary incontinence. Nocturia was defined as having to urinate at least two times per night. Women who reported one or more occurrence of a strong need to urinate with little or no warning during the last month were classified as having overactive bladder.

Data on coffee and tea consumption were categorized into 3 groups: 0 cups, 1-2 cups daily, and 3 or more cups daily. Information on relevant covariates including age, smoking, number of childbirths, body mass index (BMI) and educational level derived from the survey. Age was categorized according to the quartile distribution in the cohort (19-26, 27-33, 34-40, and 41-47 years old at baseline). BMI was grouped in four categories according to WHO guidelines.²² Smoking was categorized as smokers (current or previous) and non-smokers. Parity was defined as ever or never given birth. Educational level was divided into three main categories depending on level of formal education (elementary, high school and college/university degree).

Statistical analysis

To evaluate the effect of coffee and tea consumption on lower urinary tract symptoms we used logistic regression models based on generalized estimating equations, which take into account the correlated twin structure of the data. Odds ratio (OR) with 95% confidence intervals (CIs) was used as measure of association. Using logistic regression we first provided crude and age adjusted estimates of ORs. In the multivariable models we subsequently adjusted for covariates including: BMI, parity, smoking, and educational level.

In the co-twin analysis we analyzed only pairs with information about zygosity and who were discordant for the outcome,¹⁸ i.e. one twin had a lower urinary tract symptom while the healthy co-twin was used as a matched control. The matched nature of the co-twin control design minimizes confounding by factors shared within twin pairs such as intrauterine exposures, maternal factors, 50% (dizygotic) or 100% (monozygotic) of their segregating genes, and childhood and adolescent environment. The co-twin control method is used to control for genetic background and unmeasured early environment shared by twins when studying the relationship between a putative risk factor and a disease. If estimates from co-twin control analysis, compared to logistic regression estimates, are attenuated, then the associations are confounded by familial factors. If the attenuation is present for both mono- and dizygotic twins, the associations are confounded by shared environmental factors. A reduction of the associations only among monozygotic twins suggests that the associations are confounded by genetic factors. Crude and adjusted co-twin control analyses were performed only for the combinations of exposure and incontinence symptoms where a statistically significant association was observed in logistic regression analysis. In co-twin control adjusted analysis the association was controlled for parity, BMI, smoking and educational level. A p-value <0.05 was considered significant for all analyses. All statistical analyses were performed using SAS software (version 9.2, SAS Institute, Cary, NC).

Results

Table 1 describes the cohort characteristics in relation to the prevalence of lower urinary tract symptoms. The prevalence of overall-, stress-, urge- and mixed urinary incontinence showed a near dose-response relationship with increasing age, as well as, increasing BMI.

For nocturia and overactive bladder, the differences across age groups were less pronounced. All types of urinary incontinence were more prevalent among women with the largest consumption of coffee. Chi-square tests, regarding the association between coffee intake and urinary symptoms, were significant for all incontinence subtypes except for nocturia ($P = 0.23$) and overactive bladder ($P = 0.76$). In women with the highest daily tea intake, a significant association was observed for nocturia ($P = 0.05$) and overactive bladder ($P = 0.04$). Smokers had lower rates of urinary tract dysfunction compared to non-smokers, except for nocturia where the prevalence was higher among smokers. Childbirth and a lower educational level were consistently associated with higher prevalence of lower urinary tract dysfunction.

Table 2 shows the crude and adjusted ORs for urinary incontinence and other lower urinary tract symptoms among consumers of coffee and tea compared to non-consumers. Crude associations showed significantly higher odds of having any of the incontinence subtypes for women with a high coffee intake, i.e. more than two cups daily. However, after adjusting for age the associations were no longer significant. Further adjustment for parity, BMI, smoking and educational level did not affect the estimates except for a high coffee intake showing a negative association with overall urinary incontinence (OR 0.79, 95% CI 0.64-0.98). Coffee consumption showed no association with nocturia or overactive bladder symptoms.

There was a significant association between high tea consumption and overactive bladder in crude, age, and multivariable adjusted analysis (Table 2). Women drinking more than two cups of tea per day had 34% higher odds of having overactive bladder compared to non-tea drinkers (95% CI 1.07-1.67). In adjusted analysis, a high tea consumption was negatively associated with stress incontinence (OR 0.72, 95% CI 0.53-0.99) and positively associated with nocturia (OR 1.18, 95% CI 1.01-1.38). We checked for possible interactions between our main exposures (coffee and tea) and parity or age or smoking but none of these interactions were found significant.

Results from co-twin control analysis are shown in Table 3. Since an association between coffee or tea consumption was observed only for overall incontinence, stress urinary incontinence, nocturia, and overactive bladder, the co-twin control analysis was limited to these outcomes. When looking separately at mono- and dizygotic twins the association between a high coffee intake with overall urinary incontinence was significant in dizygotic (OR 0.41, 95% CI 0.18-0.94) but not in monozygotic twins (OR 0.77, 95% CI 0.33-1.78). This indicates that the association was due to genetic confounding. The associations between tea consumption and stress urinary incontinence, nocturia, and overactive bladder in the adjusted co-twin control analysis were non-significant in both mono- and dizygotic twins suggesting that the associations observed in the logistic regression were due to shared environmental factors.

Discussion

In this population-based study on the influence of coffee and tea consumption on urinary incontinence in young female twins, there was some evidence to support an association. Tea drinking was associated with an increased risk for overactive bladder and nocturia and with a significant lower risk for stress urinary incontinence whereas coffee consumption decreased the risk for urinary incontinence overall. However, after controlling for the zygosity of twins and adjusting the analysis for other important confounders we could show that all these associations could be attributed to familial effects, including common genetic and shared environmental factors. In addition to the large scale collection of population-based data in a cohort of well characterized twins our study benefits from several strengths. Information on symptoms of lower urinary tract symptoms was collected using a validated

questionnaire developed for epidemiological surveys. Furthermore, we were able to adjust for established confounders, as well as, control for the effects of genetic background and unmeasured environmental factors.

The hypothesis that caffeine might cause untimely contractions of the bladder, an important cause of urinary incontinence, has spread worldwide and influenced clinical practice. A reduction in caffeine intake for women with incontinence symptoms is recommended by the 4th International Consultation on Incontinence based on the notion that caffeine may exacerbate urinary incontinence.²³ In a study by Creighton and Stanton, women with overactive bladder responded to drinking caffeine citrate by an excitatory effect on the detrusor smooth muscle during the bladder filling phase.³ In another study the relationship between a decrease of caffeine intake and fewer episodes of incontinence approached significance.^{4,5} Thus, the relationship between coffee and tea consumption and lower urinary tract dysfunction is biologically plausible. However, experimental data derived from clinical settings has not convincingly been replicated in population-based studies where the evidence is conflicting.

Judging by the prevalence figures, increasing coffee and tea consumption appears to be clearly related to symptoms of lower urinary tract dysfunction. A more careful analysis of the results does, however, tell a different story. The increased odds of incontinence associated with a high coffee consumption observed in the crude analysis were largely attributed to the increasing prevalence of coffee drinkers in the older age groups. When adjusting for age, a high coffee intake instead showed an inverse association with overall urinary incontinence but there were no significant (positive or negative) relations with any of the specific incontinence subtypes. Adding parity, BMI, smoking and educational level to the model had only minor effects on the risk estimates. Thus, it was primarily increasing age and not the coffee intake itself, which caused urinary symptoms. These findings are largely in agreement with results from Hannestad et al.,⁸ who found no association between coffee drinking and incontinence in an age-adjusted cross-sectional analysis of Norwegian women aged 20-90 years. Furthermore, our adjusted analysis provided no indication that smoking acted as an important confounder and apparently did not mediate a link between coffee/tea drinking and incontinence. We recognize that lifestyle factors such as coffee and tea consumption may change over time causing exposure misclassification. Although this may be a source of misclassification of the exposures we believe this to be of a limited importance on a population based level since during the last ten years the coffee consumption per capita in Sweden did not change notably.²⁴

For tea drinking we found a positive association with overactive bladder and nocturia in women drinking two or more cups per day. We also observed a negative association between tea consumption and stress urinary incontinence. The associations between tea intake, and nocturia and stress urinary incontinence were however only of borderline significance in subsequent adjusted analysis. In the literature there is scant evidence of an effect of tea consumption on nocturia, and only one study has previously reported a positive association between tea drinking and stress incontinence.⁸ The caffeine amount in tea is approximately one-third of that in coffee,²⁵ which suggests that tea might contain components other than caffeine that might be associated with lower urinary tract dysfunction. Dallosso et al¹² in their longitudinal study conducted in women aged 40 years or older found no effect of coffee and tea on overactive bladder. This discrepancy could be explained by the fact that coffee and tea consumption may have different effects among menopausal and premenopausal women but could also be due to differences in methodology and outcome measures.

Recent population-based studies suggest that genetic factors are important for the occurrence of urinary incontinence.¹⁵⁻¹⁷ In order to control for any genetic predisposition towards urinary incontinence we performed a co-twin control analysis. Although the precise underlying mechanisms remains unclear, we found that the protective effect of coffee consumption on overall incontinence could be attributed to genetic confounding since the association was significant only among dizygotic twins and not among monozygotic twins (who share all of their genes). Moreover, the associations between a high daily intake of tea and nocturia, and overactive bladder symptoms, could be due to shared environmental factors since the associations were non-significant in both mono- and dizygotic twin pairs. Such shared environmental factors could include drinking habits and voiding education during childhood.

Even in a large nationwide population sample such as ours, there might have been insufficient numbers of discordant twin pairs. Thus, we cannot entirely rule out the possibility that the non significant association observed in co-twin control analysis could be due to insufficient numbers of discordant twin pairs. Since in a cross-sectional study information regarding disease and exposure are collected at the same time, it is not possible to evaluate whether the exposure preceded or resulted from the disease. For this reason we cannot exclude the possibility that women with urinary symptoms decided to restrict their fluid intake, decreasing also the consumption of caffeine beverages such as coffee and tea. Furthermore, we did not have information on consumption of caffeinated soft drinks which is a further limitation of our study.

Our results add to a growing body of evidence suggesting that in a general population of women of premenopausal age, coffee and tea consumption have limited or no effects on incontinence and other lower urinary tract symptoms. Our findings do not support the common practice of advising women with urinary incontinence and other lower urinary tract dysfunction to stop drinking coffee or tea.

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Prevalence of lower urinary tract symptoms in a Swedish female twin population born 1959-1985 in relation to potentially associated factors.

Table 1

	All women	Overall UI	Stress UI	Urge UI	MUI	Nocturia	OAB
Age							
19-26	3440	63 (2.0)	39 (1.2)	34 (1.1)	17 (0.5)	635 (21.4)	279 (8.1)
27-33	3450	169 (5.3)	134 (4.2)	79 (2.5)	61 (1.8)	846 (28.0)	328 (8.5)
34-40	3851	308 (8.5)	268 (7.4)	123 (3.4)	103 (2.7)	920 (27.1)	315 (9.4)
41-47	3353	389 (12.3)	328 (10.4)	165 (5.2)	131 (3.9)	737 (24.7)	263 (7.6)
Coffee/day							
0 cups	3917	212 (5.8)	168 (4.6)	98 (2.7)	75 (1.9)	854 (24.5)	317 (8.1)
1-2 cups	4392	269 (6.6)	217 (5.3)	113 (2.8)	79 (1.8)	989 (26.0)	370 (8.4)
3+ cups	5722	447 (8.4)	384 (7.2)	190 (3.6)	158 (2.8)	1282 (25.5)	491 (8.6)
Missing	63	-	-	-	-	13 (25.0)	7 (11.1)
Tea/day							
0 cups	7459	527 (7.5)	442 (6.3)	227 (3.3)	184 (2.5)	1660 (25.3)	601 (8.1)
1-2 cups	5425	334 (6.6)	275 (5.4)	145 (2.9)	11 (2.0)	1187 (24.9)	457 (8.4)
3+ cups	1146	67 (6.3)	52 (4.9)	29 (2.7)	17 (1.5)	278 (28.1)	120 (10.5)
Missing	64	-	-	-	-	13 (24.5)	7 (10.9)
BMI							
<18.5	496	16 (3.2)	12 (2.4)	7 (1.4)	3 (0.6)	108 (23.6)	51 (10.3)
18.5-24.9	9407	570 (6.1)	462 (4.9)	233 (2.5)	173 (1.8)	2072 (23.5)	784 (8.3)
25-29.9	2213	188 (8.5)	160 (7.3)	81 (3.7)	68 (3.1)	623 (30.0)	228 (10.3)
≥30	733	127 (17.4)	110 (15.1)	64 (8.8)	54 (7.4)	249 (35.9)	105 (14.3)
Missing	1245	28 (8.2)	25 (7.3)	16 (4.7)	14 (1.1)	86 (28.7)	17 (1.4)
Smoke							
No	7955	533 (7.1)	428 (5.7)	230 (3.1)	174 (2.2)	1749 (24.6)	640 (8.0)
Yes	6013	391 (7.1)	337 (6.1)	167 (3.0)	134 (2.2)	1366 (26.5)	534 (8.9)
Missing	126	5 (4.8)	4 (3.8)	4 (3.8)	4 (3.2)	23 (25.3)	11 (8.7)
Parity							
No	6144	142 (2.5)	88 (1.5)	77 (1.3)	40 (0.6)	1136 (21.2)	498 (8.1)
Yes	7854	785 (10.7)	680 (9.2)	324 (4.4)	272 (3.5)	1986 (28.6)	677 (8.6)

	All women	Overall UI	Stress UI	Urge UI	MUI	Nocturia	OAB
Missing	96	1 (1.3)	1 (1.3)	-	-	16 (22.2)	10 (10.4)
Education							
Low	672	59 (9.5)	53 (8.6)	34 (5.5)	31 (4.6)	173 (30.2)	64 (9.5)
Medium	6972	466 (7.2)	399 (6.1)	203 (3.1)	165 (2.4)	1544 (25.5)	575 (8.2)
High	6354	400 (6.7)	315 (40.9)	162 (2.7)	115 (1.8)	1404 (24.8)	538 (8.5)
Missing	96	3 (3.1)	2 (2.4)	2 (2.4)	1 (1.0)	17 (25.0)	8 (8.3)

Figures are number of women (%).

Table 2

Odds ratios for lower urinary tract symptoms in relation to coffee and tea consumption.

	Crude OR	Age adjusted OR	Adjusted ^a OR
Overall UI			
N	13 096	13 096	12 678
<i>Cups of tea/day</i>			
0	1	1	1
1-2	0.87 (0.76-1.01)	0.9 (0.78-1.04)	0.92 (0.79-1.07)
3+	0.82 (0.63-1.06)	0.81 (0.62-1.06)	0.77 (0.58-1.02)
<i>Cups of coffee/day</i>			
0	1	1	1
1-2	1.14 (0.95-1.37)	0.86 (0.71-1.04)	0.87 (0.7-1.06)
3+	1.43 (1.21-1.7)	0.85 (0.7-1.02)	0.79 (0.64-0.98)
Stress UI			
N	13 087	13 087	12 670
<i>Cups of tea/day</i>			
0	1	1	1
1-2	0.85 (0.73-0.99)	0.88 (0.75-1.03)	0.91 (0.77-1.08)
3+	0.76 (0.57-1.02)	0.75 (0.56-1.01)	0.72 (0.53-0.99)
<i>Cups of coffee/day</i>			
0	1	1	1
1-2	1.17 (0.95-1.43)	0.86 (0.7-1.06)	0.86 (0.69-1.07)
3+	1.55 (1.28-1.88)	0.88 (0.72-1.08)	0.81 (0.64-1.01)
Urge UI			
N	13 073	13 073	12 657
<i>Cups of tea/day</i>			
0	1	1	1
1-2	0.88 (0.71-1.08)	0.9 (0.73-1.12)	1 (0.8-1.26)
3+	0.83 (0.56-1.22)	0.82 (0.55-1.22)	0.85 (0.55-1.3)
<i>Cups of coffee/day</i>			
0 cups	1	1	1
1-2 cups	1.04 (0.79-1.37)	0.82 (0.61-1.08)	0.84 (0.62-1.14)
3+	1.32 (1.03-1.69)	0.83 (0.64-1.08)	0.78 (0.57-1.06)
Mixed UI			
N	14 034	14 034	12 720
<i>Cups of tea/day</i>			
0	1	1	1
1-2	0.82 (0.64-1.04)	0.84 (0.66-1.08)	0.98 (0.75-1.27)
3+	0.6 (0.36-0.98)	0.59 (0.36-0.97)	0.63 (0.37-1.07)
<i>Cups of coffee/day</i>			

	Crude OR	Age adjusted OR	Adjusted ^a OR
0	1	1	1
1-2	0.94 (0.69-1.29)	0.71 (0.51-0.98)	0.72 (0.51-1.01)
3+	1.43 (1.08-1.89)	0.84 (0.62-1.12)	0.74 (0.53-1.04)
Nocturia			
N	12 308	12 308	11 949
<i>Cups of tea/day</i>			
0	1	1	1
1-2	0.99 (0.91-1.08)	0.98 (0.9-1.07)	1.02 (0.93-1.11)
3+	1.14 (0.98-1.32)	1.13 (0.97-1.31)	1.18 (1.01-1.38)
<i>Cups of coffee/day</i>			
0	1	1	1
1-2	1.08 (0.97-1.2)	1.04 (0.93-1.16)	1.06 (0.94-1.19)
3+	1.05 (0.95-1.16)	1.0 (0.89-1.11)	0.96 (0.85-1.08)
OAB			
N	14 030	14 030	12 716
<i>Cups of tea/day</i>			
0	1	1	1
1-2	1.05 (0.92-1.19)	1.05 (0.93-1.2)	1.08 (0.95-1.24)
3+	1.32 (1.07-1.63)	1.32 (1.07-1.63)	1.34 (1.07-1.67)
<i>Cups of coffee/day</i>			
0	1	1	1
1-2	1.04 (0.89-1.22)	1.01 (0.86-1.19)	1.05 (0.89-1.25)
3+	1.06 (0.91-1.23)	0.99 (0.84-1.17)	1.03 (0.86-1.23)

UI denotes urinary incontinence

^a Adjusted for age, parity, BMI, smoking and educational level.

Table 3

Co-twin control analyses of coffee and tea consumption in twins discordant for overall incontinence and overactive bladder.

	Crude OR			Adjusted ^a OR		
	All	MZ	DZ	All	MZ	DZ
Overall urinary incontinence						
N	688	340	348	670	332	338
Cups of coffee/day						
0	1.0	1.0	1.0	1.0	1.0	1.0
3+	0.55 (0.33-0.92)	0.71 (0.33-1.54)	0.42 (0.21-0.85)	0.51 (0.29-0.9)	0.77 (0.33-1.78)	0.41 (0.18-0.94)
Stress incontinence						
N	564	290	274	548	282	266
Cups of tea/day						
0	1.0	1.0	1.0	1.0	1.0	1.0
3+	0.7 (0.33-1.5)	0.48 (0.15-1.49)	1 (0.35-2.82)	0.7 (0.29-1.73)	0.57 (0.14-2.28)	0.69 (0.19-2.42)
Nocturia						
N	1 836	1 034	802	1 782	1 002	782
Cups of tea/day						
0	1.0	1.0	1.0	1.0	1.0	1.0
3+	0.96 (0.65-1.41)	1.17 (0.68-2.01)	0.79 (0.46-1.36)	0.99 (0.65-1.5)	1.24 (0.68-2.27)	0.82 (0.45-1.52)
Overactive bladder						
N	1 056	640	416	990	604	386
Cups of tea/day						
0	1.0	1.0	1.0	1.0	1.0	1.0
3+	0.91 (0.57-1.47)	1.02 (0.54-1.92)	0.78 (0.38-1.63)	0.73 (0.42-1.25)	0.8 (0.38-1.66)	0.65 (0.27-1.57)

^a Adjusted for parity, BMI, smoking and educational level.