

# Prevalence and risk factors for urinary incontinence among women with diabetes in Taif city, Saudi Arabia

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## Abstract

**Background:** Urinary incontinence is a detected complication of diabetes mellitus. Studies about UI among diabetic women in Saudi Arabia are limited. The aim of this study was to assess the prevalence of UI in women with diabetes in Taif city, Saudi Arabia and to determine its risk factors.

**Methods:** A cross-sectional study was done on 398 diabetic women who attended the diabetes clinic at Prince Mansour Military Hospital, Taif city, Saudi Arabia. A checklist was used gathering data about socio-demographic characteristics, type and duration of diabetes, chronic diseases, parity, BMI, presence of neuropathy, retinopathy and nephropathy, level of HbA1c and fasting blood glucose (FBG).

**Results:** The prevalence of UI was 34%. In the last four weeks, 48.9%, 25.9%, 6.7%, 12.6% and 34.1% of studied women had frequent urination, urine leakage drops, difficulty in urinating or emptying, pain or discomfort in lower abdomen, leakage related to urgency, and leakage related to physical activity, respectively. Among them, 11.1%, 11.9%, 12.6%, 19.3%, 15.6%, 19.3%, and 20.7% suffered effects of UI on the ability to do household chores, physical recreation, entertaining activities, ability to travel

in car or bus more than 30 minutes, participation in social activities outside, emotional health, and feeling frustrated, respectively. Participants with an age  $\geq 50$  year, and having DM type 2, UTI, Ovarian cyst, and neuropathy higher levels of HbA1 and FBG, had a significantly higher percentage of those having UI. Participants' older age and high HbA1c level were independent predictors for UI.

**Conclusion:** There is a need for educating diabetic women about UI and methods of management.

**Key words:** Prevalence, risk, urinary, incontinence, women Taif

## Introduction

Urine incontinence (UI) is a common health problem in the population and has social and economic impacts (1). It is defined by the International Continence Society as “the complaint of any involuntary leakage of urine” (2). The prevalence of urinary incontinence according to the health and social service agencies was 0.2% in women (3). The prevalence markedly increases with age and the median level of prevalence gives a picture of increasing prevalence during young adult life (20–30%), a broad peak around middle age (30–40%), and then a steady increase in the elderly population (30–50%) (2).

Urinary incontinence has many risk factors proven in many studies such as previous urological disorders, pelvic traumas, parity, recurrent urinary infections, vaginal deliveries and obstetric trauma in women (4). Several other factors have a role in urinary incontinence such as alcohol and coffee consumption (4). Diabetes mellitus is a chronic illness that can lead to various complications; the commonest are retinopathy, neuropathy and nephropathy. One of the under-detected complications is urinary incontinence (5).

A previous study suggests that incontinence may be a microvascular complication, possibly because of disturbance of the nerve supply that causes urethral sphincter damage (6,7,8,9,10,11,12,13). Another study was done in the United Arab Emirates and found that 64.3% of studied women were suffering from incontinence, 48.7% had stress incontinence and 52.4% had symptoms of urge incontinence. The study found that the most significant risk factor was diabetes (4). Another cross-sectional population-based study done in Norway found that out of 21,057 women 638 were found to be diabetics and those who were suffering from diabetes had higher prevalence of urinary incontinence than those who weren't diabetic, with a percentage of 39% and 25.8% respectively (14). A study that was conducted in America found that one-unit increase of hemoglobin A1C was associated with a 13% increase for any type of urinary incontinence and a 34% increase in risk for stress incontinence (15). Another study in the USA stated that obesity was the strongest modifiable risk factor and other risk factors were hysterectomy and urinary tract infections (UTI) (16).

In the Kingdom of Saudi Arabia (KSA), a study was done in 2012 to assess UI risk factors among Saudi women. The study found that the prevalence of UI was 41.4%, urinary leakage was reported daily by 17.2%, and 25.5% experienced leakage more than once a week. Risk factors for UI were increased age, parity greater than 5, menopause and history of vaginal gynecologic surgery (17). Another study was done in 2017 to assess the prevalence of urinary incontinence in Saudi females and its associated risk factors. The study found that the most common risk factors for urinary incontinence were older age, menopause and high parity (18). The aim of the present study was to estimate the prevalence of UI in women with diabetes in Taif city, Saudi Arabia and to determine its risk factors.

## Methods

**Study design, setting and time frame:** a cross-sectional single-center study was conducted on 398 diabetic female patients who attended the diabetes clinic at Prince Mansour Military Hospital, Taif city, Saudi Arabia. The study was done during the period from 1st of November 2019 to the 31th of January 2020.

**Sampling methodology:** according to the rate of patients attending the center the sample size required was 377 and the sample size was calculated by using the following formula  $n = N / (1 + N * e^2)$ , where  $n$  = sample size,  $N$  = population size,  $e$  = margin of error (5%). The inclusion criteria were all women with diabetes who were not pregnant with an age older than 18 years, and the exclusion criteria were those who were non-diabetic, pregnant or with an age outside the mentioned range.

**Study instrument:** a checklist was prepared for every patient and data collected included socio-demographic data such as: (age, marital status, Smoking, Physical exercise), history including: (type and duration of diabetes, any chronic diseases, number of parity, mode of delivery, Surgery), examination involving (Height, Weight, BMI, presence of neuropathy, retinopathy and nephropathy), investigations such as (hemoglobin A1C (HbA1c) and fasting blood glucose (FBG)).

**Ethical considerations:** informed written and verbal consent was signed by patients and the data collected by direct interview.

**Statistical analysis:** Data were coded, tabulated and analyzed using (SPSS) version 25 (Armonk, NY: IBM Corp.). Qualitative data was expressed as numbers and percentages, and Chi-squared test ( $\chi^2$ ) was applied to test the relationship between variables. Quantitative data was expressed as mean and standard deviation (Mean  $\pm$  SD). Mann-Whitney and Kruskal Wallis Tests were applied for non-parametric variables. A  $p$ -value of  $<0.05$  was considered as statistically significant.

## Results

The aim of this study was to estimate the prevalence and risk factors for urinary incontinence in women with diabetes in Taif city, Saudi Arabia. Our study included a total of 398 participants. The participants' mean age was  $57.65 \pm 11.78$  (mean  $\pm$  SD). Only females were recruited. Most of the participants (81.9%) were 50 years old and more, 62.1% were married, 37.9% were practicing physical activity, 1% were smokers, 94.9% had DM type 2, and 48% were hypertensive. Of the participants, 13.1% had hyperlipidemia, 7.8% had asthma, 25.4 had UTI, 0.5% had ovarian cyst, 13.6% had thyroid dysfunction, 13.1% had hypothyroidism, and 0.3% had anemia and anxiety. Only 0.5% of the participants had liver disorders, 0.8% had renal stones, 0.3% had SLE, and 53.3% had previous surgeries. As for their obstetric history, 45.6% had  $> 5$  children, and 68.9% had vaginal mode of delivery. About 40%

(40.2%) had 1st degree obesity, 66.1% had neuropathy, 50.3% had retinopathy and 8.3% had nephropathy. The mean age, vaginal delivery, CS, BMI, FBG and HbA1c of the participants were (57.65 ± 11.76 years, 7.20 ± 6.98 deliveries, 0.55 ± 1.02 deliveries, 33.48 ± 8.06 kg/m<sup>2</sup>, 10.05 ± 5.17, and 9.0 ± 2.16) respectively (Table 1).

Figure 1 shows that the prevalence of UI among the studied participants was 34%. In the last four weeks, 48.9%, 25.9%, 6.7%, 12.6% and 34.1% of females having UI suffered frequent urination, urine leakage drops, difficulty in urinating or emptying, pain or discomfort in lower abdomen, leakage related to urgency, and leakage related to physical activity respectively. Among them, the percentage of those who suffered effects of UI on: the ability to do household chores, physical recreation, entertaining activities, ability to travel in car or bus more than 30 minutes, participation in social activities outside, emotional health, and feeling frustrated was 11.1%, 11.9%, 12.6%, 19.3%, 15.6%, 19.3%, and 20.7% respectively (Table 2).

Table 3 shows that participants with an age ≥ 50 years, having DM type 2, UTI and Ovarian cyst had a significant higher percentage of those who had UI (P < 0.05). On the other hand, a non-significant relationship was found between having UI and participants' marital status,

smoking, physical activity, having HTN, hyperlipidemia, asthma, thyroid dysfunction, hypothyroidism, anemia and anxiety (p > 0.05).

Table 4 shows that participants who had neuropathy as a diabetic complication had a significantly higher percentage of those having UI (p < 0.05). However, a non-significant difference was found between the presence of UI and having liver disorder, SLE, renal stone, retinopathy, nephropathy, or ovarian cyst. The same non-significant difference was found between UI presence and participants' parity, mode of delivery, BMI, and previous surgeries (p > 0.05). Table 5 shows that participants who had higher level of HbA1 and FBG had a significant higher percentage of those having UI (p < 0.05). A non-significant difference was found between the presence of UI and participants' diabetes duration and number of vaginal or CS deliveries.

Table 6 shows that by doing binary logistic regression analysis of the studied variables, participants' age and HbA1c level were independent predictors of UI.

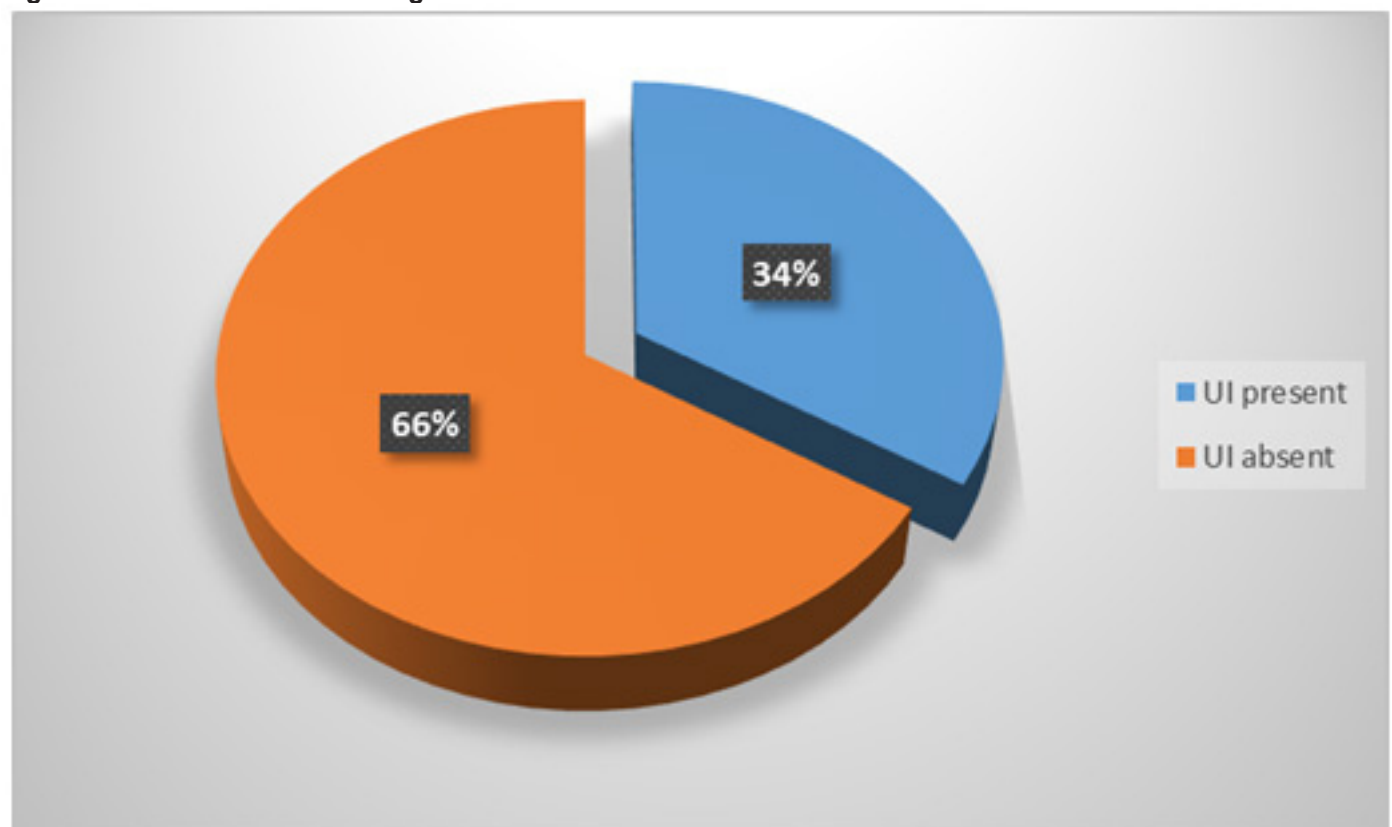
**Table 1. Distribution of the studied participants according to their personal and clinical data**

Variable	No (%)	Variable	No (%)
Age		Asthma	
less than 50 years	71 (18.1)	Yes	31 (7.8)
≥ 50 years	326 (81.9)	No	368 (92.2)
Marital status		UTI	
Married	247 (62.1)	Yes	101 (25.4)
Unmarried	151 (37.9)	No	297 (74.9)
Smoking		Ovarian cyst	
Yes	4 (1)	Yes	4 (0.5)
No	394 (99)	No	396 (99.5)
Physical activity		Thyroid dysfunction	
Yes	151 (37.9)	Yes	54 (13.6)
No	247 (62.1)	No	344 (68.4)
Diabetes		Hypothyroidism	
Type 1	21 (5.3)	Yes	52 (13.1)
type 2	377 (94.7)	No	346 (86.9)
Hypertension		Anaemia	
Yes	191 (48)	Yes	1 (0.3)
No	207 (52)	No	397 (99.7)
Hyperlipidemia		Anxiety	
Yes	52 (13.1)	Yes	1 (0.3)
No	346 (86.9)	No	397 (99.7)

**Table 1. Distribution of the studied participants according to their characteristics, clinical data and obstetric history (continued)**

Variable	No (%)	Variable	No (%)
Liver disorder		SLE	
Yes	2 (0.5)	Yes	1 (0.3)
No	397 (99.5)	No	397 (99.7)
Renal stone		Mode of delivery	
Yes	3 (0.8)	Vaginal	262 (68.9)
No	396 (99.2)	CS	17 (4.5)
Parity		Both	101 (26.6)
< 5 children	85 (21.4)	BMI	
> 5 children	301 (45.6)	Body weight deficit	2 (0.5)
Nulliparity	12 (3)	Normal weight	22 (5.5)
Surgeries		Over weight	85 (21.4)
Yes	212 (53.3)	1 <sup>st</sup> degree obesity	160 (40.2)
No	186 (46.7)	2 <sup>nd</sup> degree obesity	84 (21.1)
Neuropathy		3 <sup>rd</sup> degree obesity	45 (11.3)
Yes	263 (66.1)	Retinopathy	
No	135 (33.9)	Yes	200 (50.3)
Age	57.65 ± 11.76	No	198 (49.9)
No. vaginal deliveries	7.20 ± 6.98	Nephropathy	
No. CS	0.55 ± 1.02	Yes	33 (8.3)
		No	365 (91.7)
		BMI	33.48 ± 8.06
		FBG	10.05 ± 5.17
		HbA1c	9.0 ± 2.16

**Figure 1: Prevalence of UI among studied females**



**Table 2. Distribution of factors associated with UI among females suffering from it in the last four weeks:**

Effects of incontinence	Not at all	A little bit	Moderately	Greatly
	No. (%)	No. (%)	No. (%)	No. (%)
Frequent urination	15 (11.1)	14 (10.4)	40 (29.6)	66 (48.9)
Leakage related to urgency	20 (14.8)	2 (8.9)	57 (42.2)	46 (34.1)
Leakage related to physical activity	55 (40.7)	15 (11.1)	57 (42.2)	46 (34.1)
Urine leakage drops	17 (12.6)	44 (32.6)	39 (28.9)	35 (25.9)
Difficulty in urinating or emptying	99 (73.3)	8 (5.9)	19 (14.1)	9 (6.7)
Pain or discomfort lower abdominal	77 (57)	13 (9.6)	28 (20.7)	17 (12.6)
Affected Ability household chores	96 (71.1)	14 (10.4)	10 (7.4)	15 (11.1)
Affected Physical recreation	90 (66.7)	16 (11.9)	13 (9.6)	16 (11.9)
Affected Entertaining activities	86 (63.7)	14 (10.4)	18 (13.3)	17 (12.6)
Affected Ability to travel in car or bus more than 30 minutes	78 (57.8)	13 (9.6)	18 (13.3)	29 (19.3)
Affected Participation social activities outside	86 (63.7)	13 (9.6)	15 (11.1)	21 (15.6)
Affected emotional health	79 (58.5)	12 (8.9)	18 (13.3)	29 (19.3)
Feeling frustrated	82 (60.7)	9 (6.7)	16 (11.9)	28 (20.7)
All questions regarding previous 4 weeks.				

Table 3. Relationship between urinary incontinence and participants' characteristics and clinical data

Variable	UI present	UI absent	$\chi^2$	p-value
	No (%)	No (%)		
Age				
less than 50 years	14 (19.4)	58 (80.6)	8.21	0.004
≥ 50 years	121 (37.1)	205 (62.9)		
Marital status				
Married	78 (30.8)	171 (69.2)	2.88	0.09
Unmarried	59 (39.1)	92 (60.9)		
Smoking				
Yes	3 (75)	1 (25)	3.04	0.08
No	132 (33.5)	262 (66.5)		
Physical activity				
Yes	47 (31.1)	104 (68.9)	0.84	0.35
No	88 (35.6)	159 (64.4)		
Diabetes				
Type 1	2 (9.5)	19 (90.5)	5.88	0.01
Type 2	133 (35.3)	244 (64.7)		
Hypertension				
Yes	67 (35.1)	124 (64.9)	0.22	0.63
No	68 (32.9)	139 (67.1)		
Hyperlipidemia				
Yes	97 (36.7)	167 (63.3)	2.78	0.09
No	38 (28.4)	96 (71.6)		
Asthma				
Yes	12 (38.7)	19 (61.3)	0.34	0.55
No	123 (33.5)	244 (66.5)		
UTI				
Yes	53 (52.5)	48 (47.5)	20.79	< 0.001
No	82 (27.6)	215 (72.4)		
Ovarian cyst				
Yes	2 (100)	0 (0.0)	3.91	0.04
No	133 (33.6)	263 (66.4)		
Thyroid dysfunction				
Yes	18 (33.3)	36 (66.7)	0.01	0.92
No	117 (34)	227 (66)		
Hypothyroidism				
Yes	18 (34.6)	34 (65.4)	0.01	0.91
No	117 (33.8)	229 (66.2)		
Anaemia				
Yes	1 (100)	0 (0.0)	1.95	0.16
No	134 (33.8)	263 (66.2)		
Anxiety				
Yes	1 (100)	0 (0.0)	1.95	0.16
No	134 (33.8)	263 (66.2)		

Table 4. Relationship between urinary incontinence and participants characteristics and clinical data

Variable	UI present	Absent	$\chi^2$	p-value
	No (%)	No (%)		
Liver disorder				
Yes	0 (0.0)	2 (100)	1.03	0.31
No	135 (34.1)	261 (65.9)		
SLE				
Yes	1 (100)	0 (0.0)	1.95	0.16
No	134 (33.8)	263 (66.2)		
Renal stone				
Yes	1 (33.3)	2 (66.7)	0.001	0.98
No	134 (33.9)	261 (66.1)		
Parity				
< 5 children	25 (29.4)	60 (70.6)	4.98	0.08
> 5 children	109 (36.2)	192 (63.8)		
Nulliparity	1 (8.3)	11 (91.7)		
Mode of delivery				
Vaginal	95 (36.3)	167 (63.7)	1.7	0.42
CS	30 (29.7)	71 (70.3)		
Both	7 (41.2)	10 (58.8)		
BMI				
Body weight deficit	20 (44.5)	25 (55.6)	8.36	0.13
Normal weight	32 (38.1)	52 (61.9)		
Over weight	54 (33.8)	106 (66.3)		
1 <sup>st</sup> degree obesity	26 (30.6)	59 (69.4)		
2 <sup>nd</sup> degree	3 (13.6)	19 (86.4)		
3 <sup>rd</sup> degree	0 (0.0)	2 (100)		
Surgeries				
Yes	72 (34)	140 (66)	0.001	0.98
No	63 (33.9)	123 (63.1)		
Neuropathy				
Yes	101 (38.4)	162 (61.6)	6.95	0.008
No	34 (25.2)	101 (74.8)		
Retinopathy				
Yes	74 (37)	126 (63)	1.7	0.19
No	61 (30.8)	137 (69.2)		
Nephropathy				
Yes	11 (33.3)	22 (66.7)	0.006	0.94
No	124 (34)	241 (66)		

**Table 5. Relationship between urinary incontinence and participants characteristics and clinical data**

Variable	UI present	UI absent	Test*	p-value
	No (%)	No (%)		
HbA1c	9.94 ± 2.1	8.86 ± 2.17	2.93	0.003
Diabetes duration	14.67 ± 8.45	13.1 ± 8.52	1.74	0.08
No. vaginal deliveries	8.39 ± 10.85	6.57 ± 3.32	1.65	0.09
No. CS	0.49 ± 0.98	0.58 ± 1.03	1.01	0.3
FBG	10.53 ± 4.4	9.8 ± 5.51	2.24	0.02

N.B.: Mann-Whitney test\*

**Table 6. Binary logistic regression analysis of UI independent predictors**

Variable	B	Wald	p-value
Age	0.75	4.87	0.02
Diabetes type	1.17	2.23	0.13
Presence of ovarian cyst	9.7	15.56	0.99
Neuropathy	20.7	2.96	0.08
HbA1c	0.15	6.2	0.01
FBG	0.01	0.33	0.56

## Discussion

This study aimed at estimating the prevalence and risk factors for UI among diabetic women who attended the PHCCs in Taif city, Saudi Arabia. The study included a total of 398 participants. The overall prevalence of UI in the present study was 34%, a figure that is lower than that found in a similar study conducted in Palestine (34% versus 43.2%) (19).

At the same time the observed prevalence in the present study is also lower than that revealed from studies done on diabetic women in Jordan (44%) (20) and Turkey (41%) (21), United Arab Emirates (63%) (4) and Kuwait (95.2%) (22). At the same time this prevalence is also lower than that reported in a national study done in Jazan city, Saudi Arabia where the prevalence was (44.2%) (18). The higher prevalence of UI reported in the Jazan study could be explained by including all healthy women in childbearing age. This observed variability in results done across countries could be attributed to many factors such as the difference in study design, study population, sample size, variation in UI definition, different inclusion criteria, different settings and data collection tools.

Age was found to be associated to decreased elasticity and capacity of the bladder, decreased sensation, detrusor muscle mass causing UI (23). In this study participants with an age  $\geq 50$  years had an increased risk of having UI. The same result was found in previous studies (4,20,21). Results from 2 studies that took place in Saudi Arabia agreed with ours where in the first one 66.3% of female whose ages were 50 years and above were UI patients (18) and in the second female UI was found to be more prevalent among older women (17). Women over the age of 45 years were 3.8 times as likely to report UI than those who were younger according to a study in Kuwait (24).

DM type 2 was found to be a risk factor of UI in this work. This was explained by the microvascular damage to bladder innervations and urethral sphincter, in addition to sphincter dysfunction, bladder instability, urinary retention, and elevated postvoid residual urine volume that leads to an overflow of UI (25,26), as shown in Table 3 which links diabetes as a significant risk factor for UI in females. The results of a study that was conducted in Jeddah, Saudi Arabia on the prevalence of urinary incontinence in females, risk factors and barriers to health seeking classified diabetes as a risk factor for UI as 60 out of the 379 females interviewed (15.8%) had diabetes mellitus (17). An opposite finding was present in a previous study, where diabetes was not a risk factor for UI (27).

Another risk factor for UI among the studied participants was UTI. The same result was found in previous studies (17,19). A study on the incidence and risk factors of urinary incontinence in women visiting family health centers in Turkey agreed with ours that urogenital infection had a significant correlation with UI and that to eliminate the negative effects of UI on quality of life it is essential to focus on the prevention of UI's risk factors such as urogenital infection (27). A history of recurrent UTIs was found to be the main risk factor and predictor of UI amongst the diabetic women and tripled the risk of UI in a Palestinian study (19) and other studies (17,18,24).

This study found that a non-significant difference was present between UI and participants' parity. This finding disagrees with a previous study where women who had more than 5 children had a higher risk of having UI (17). It also disagrees with the study done by Kılıç, 2016, where the number of children, the duration of deliveries and POP were the most significant risk factors for UI (27).



In the present work, 12.6% of females having UI suffered leakage related to urgency. A previous study found that 31.8 % of UI was of the urgency type (27). Another study found that most of the participants had a small amount of urinary leakage (28).

In the last four weeks, 48.9%, 25.9%, 6.7%, 12.6% and 34.1% of studied women in this study had frequent urination, urine leakage drops, difficulty in urinating or emptying, pain or discomfort in lower abdomen, leakage related to urgency, and leakage related to physical activity respectively. Among them, 11.1%, 11.9%, 12.6%, 19.3%, 15.6%, 19.3%, and 20.7% suffered effects of UI on the ability to do household chores, physical recreation, entertaining activities, ability to travel in car or bus more than 30 minutes, participation in social activities outside, emotional health, and feeling frustrated respectively. This result agrees with that found in another study, where only a small number of the patients were greatly bothered by the incontinence (19). This effect on daily life activities reported by the participants in the present study is somewhat lower than that observed in a study done by Ghafouri et al. (2014) (28) and Al-Badr et al (17) who found that the percentages of women who UI had a great effect on their daily life were 34 % and 49.8% respectively.

A non-significant relationship was found between smoking and UI ( $p > 0.05$ ). In agreement with this result is that revealed from another Saudi study where smoking was not a risk factors for UI (17). In contrast to our results is that reported by Donforth et al. where there was an association between smoking and UI (29).

In this study it was observed that patients suffering from diabetic neuropathy and those who had an ovarian cyst had a significantly higher percentage of UI. A study done in Palestinian women found that diabetic nephropathy and ovarian cysts were not risk factors for UI (19). The higher the HbA1C and FBG in diabetic patients in this study was associated with a higher risk of getting UI, a result that was observed in a study done in Jeddah (30).

A non-significant relationship was found between vaginal or CS deliveries and UI in the present study, while in Jazan's study, UI prevalence was significantly higher in females who delivered vaginally than who delivered via CS (18).

### Limitations

Using a cross sectional study had the limitation of observing the relationship between studied variables without the detection of the cause-effect relationship.

## Conclusions

The prevalence of UI among studied participants was 34%. Participants with an age  $\geq 50$  year, having DM type 2, UTI, Ovarian cyst, neuropathy, higher levels of HbA1 and FBG had a significantly higher percentage of those having UI. Binary logistic regression analysis found that participants' older age and high HbA1c level were independent predictors for UI. The study calls for health education of all diabetic women about UI. As this problem is often neglected, all diabetic women suffering UI should be targeted by the caring physician to be treated.

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## References

1. T. Burge A, Lee AL, Kein C, Button BM, Sherburn MS, Miller B, et al. Prevalence and impact of urinary incontinence in men with chronic obstructive pulmonary disease: a questionnaire survey. *Physiotherapy* 2017;103(1): 53-58.
2. Altaweel W, Alharbi M, Urinary incontinence: prevalence, risk factors, and impact health related quality of life in Saudi women. *Neurourol Urodyn* 2012;31(5): 642-645.
3. Nitti VW. The prevalence of urinary incontinence. *Rev Urol* 2001;3 Suppl 1(Suppl 1):S2-6.
4. Bani-issa WA, Halabi JO, Abdullah AR, Hasan HA, Raigangar VL. Prevalence and risk factors for incontinence among Emirati women with diabetes. *J Transcult Nurs* 2014;25(1):42-50.
5. Brown JS, Vittinghoff E, Lin F, Nyberg LM, Kusek JW, Kanaya AM. Prevalence and risk factors for urinary incontinence in women with type 2 diabetes and impaired fasting glucose: findings from the National Health and Nutrition Examination Survey (NHANES) 2001-2002. *Diabetes Care* 2006;29(6):1307-1312.
6. Jackson SL, Scholes D, J. Boyko E, Abtraham L, D. Fihn S, et al., Urinary incontinence and diabetes in postmenopausal women. *Diabetes Care* 2005. 28(7):1730-1738.
7. Report of the Expert Committee on the Diagnosis and Classification of Diabetes Mellitus. *Diabetes Care* 1997;20(7): 1183-1197.
8. Genuth S, Alberti KG, Bennett P, Buse J, Defronzo R, Kahn R, et al. Follow-up report on the diagnosis of diabetes mellitus. *Diabetes Care* 2003;26(11):3160-3167.
9. Chavers BM, Simonson J, Michael AF. A solid phase fluorescent immunoassay for the measurement of human urinary albumin. *Kidney Int* 1984; 25(3):576-578.
10. Grady D, Brown JS, Vittinghoff E, Applegate W, Varner E, Snyderet T. et al. Postmenopausal hormones and incontinence: the Heart and Estrogen/Progestin Replacement Study. *Obstet Gynecol* 2001;97(1):116-120.
11. Nakayama H, Jørgensen HS, Pedersen PM, Raaschou HO, Olsen TS. Prevalence and risk factors of incontinence after stroke. The Copenhagen Stroke Study. *Stroke* 1997;28(1):58-62.

12. M. Haffner S, P. Stern M, P. Hazuda H, D. Mitchell B, K. Patterson J. Cardiovascular risk factors in confirmed prediabetic individuals. Does the clock for coronary heart disease start ticking before the onset of clinical diabetes? *JAMA* 1990;263(21):2893-2898.
13. Kaplan SA, Te AE, Blaivas JG. Urodynamic findings in patients with diabetic cystopathy. *J Urol*. 1995;153(2):342-4.
14. Ebbesen MH, Hannestad YS, Midthjell K, Hunskaar S. Diabetes and urinary incontinence – prevalence data from Norway. *Acta Obstet Gynecol Scand* 2007;86(10):1256-1262.
15. Wang R, Lefevre R, Hacker MR, Golen TH. Diabetes, Glycemic Control, and Urinary Incontinence in Women. *Female Pelvic Med Reconstr Surg* 2015;21(5):293-297.
16. Phelan S, Kanaya AM, Subak LL, Hogan PE, Espeland MA, Wing RR, et al. Prevalence and risk factors for urinary incontinence in overweight and obese diabetic women: action for health in diabetes (look ahead) study. *Diabetes Care* 2009;32(8):1391-1397.
17. Al-Badr A, Brasha H, Al-Raddadi R, Noorwali F, Ross S. Prevalence of urinary incontinence among Saudi women. *Int J Gynaecol Obstet* 2012;117(2):160-163.
18. Ahmed YDA, Mohammed SMA, Mohammed RI, Ahmed HAS, Abdulmajeed ARN, Shammakhi INM, et al. Urinary Incontinence in Healthy Saudi Women. *The Egyptian Journal of Hospital Medicine* 2017;69 (7): 2890-2896
19. Nazzal Z, Khatib B, Al-Quqa B, Abu-Taha L, Jaradat A. The prevalence and risk factors of urinary incontinence amongst Palestinian women with type 2 diabetes mellitus: A cross-sectional study. *Arab J Urol* 2019;9;18(1):34-40.
20. Bani-Issa W, Almomani F, Eldeirawi K. Urinary incontinence among adult women with diabetes in Jordan: epidemiology, correlates and perceived impact on emotional and social well-being. *J Clin Nurs* 2014;23:2451–2460.
21. Izci Y, Topsever P, Filiz T, Cinar ND, Uludağ C, Lagro-Janssenet T, et al. The association between diabetes mellitus and urinary incontinence in adult women. *Int Urogynecol J* 2009;20:947–952.
22. Taghaddom SM, Omu EF, AlHarbi FS, Velloikalam C, Dwaib SIA, Joseph S, et al. Types of urinary incontinence prevalent among Kuwaiti women with type two diabetes mellitus. *Open J Nurs* 2017;7:1131–1143.
23. Golbidi S, Laher I. Bladder dysfunction in diabetes mellitus. *Front Pharmacol* 2010; 16;1:136.
24. Al-Sayegh NA, Leri A, Al-Qallaf A, Al-Fadhli H, Al-Sharrah S. Urinary Incontinence in Kuwait: Prevalence and Risk Factors of Men and Women. *International Journal of Health Sciences* December 2014;2(4):47-57
25. Brown JS. Diabetic cystopathy-what does it mean? *J Urol* 2009;181:13–14.
26. Brown JS, Nyberg LM, Kusek JW, Burgio KL, Diokno AC, Foldspang A, et al. Proceedings of the national institute of diabetes and digestive and kidney diseases international symposium on epidemiologic issues in urinary incontinence in women. *Am J Obstet Gynecol* 2003;188: S77–S88.
27. Kılıç M. Incidence and risk factors of urinary incontinence in women visiting Family Health Centers. *Springerplus*. 2016 11;5(1):1331-40.
28. Ghafouri A, Alnaimi AR, Alhothi HM, Alroubi I, Alrayashi M, Molhim NA, et al. Urinary incontinence in Qatar: A study of the prevalence, risk factors and impact on quality of life. *Arab J Urol* 2014;12(4):269-274.
29. Danforth KN, Townsend MK, Lifford K, Curhan GC, Resnick NM, Grodstein F. Risk factors for urinary incontinence among middle-aged women. *Am J Obstet Gynecol* 2006;194(2):339-345.
30. Bakarman MA, Al-Ghamdi SS. The Effect of Urinary Incontinence on Quality of Life of Women at Childbearing Age in Jeddah, Saudi Arabia. *Glob J Health Sci* 2015; 19;8(2):281-287.