

Prevalence of Urinary Tract Infections among Diabetic and Non-Diabetic Patients at Msalata and Tarhuna Cities

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مدى انتشار عدوى المسالك البولية بين مرضى السكري والمرضى غير المصابين بداء السكري
في مدينتي ترهونه ومسلاته

المستخلص:

الخلفية: تجدر الإشارة إلى أن مرضى السكري هم أكثر الأشخاص عرضة لمضاعفات عدوى المسالك البولية غير العرضية، حيث تعتبر الإصابة البكتيرية هي الأكثر شيوعاً بين المرضى المصابين بداء السكري.

المواد والطرق المستخدمة: شملت الدراسة (120) مريضاً، حيث كان (60) منهم مصاباً بداء السكري، وغير المصابين بمرض السكري (60) مريضاً، والذين تم دخولهم إلى مستشفى ترهونه ومسلاته في الفترة من شهر يناير إلى شهر مارس لسنة 2019 م. حيث تم جمع عينات البول من المرضى المشاركين بالدراسة من منتصف جريان البول وأجريت لهم كافة الفحوصات المخبرية المجهرية والميكروبيولوجية (مزرعة بكتيرية)، باعتبار أن عدد البكتيريا الأكثر من 10^5 CFU/1ml (وحدة مستعمرة بكتيرية) مؤشراً للإصابة بالتهاب المسالك البولية.

النتائج: بعد اتمام إجراءات الفحوصات المعملية، أظهرت النتائج أن عدد المصابين بعدوى المسالك البولية للمرضى المصابين بالداء السكري (49) وبنسبة (81.6%) وعدد المصابين بعدوى المسالك البولية للمرضى غير المصابين بالسكري (36) وبنسبة (58.3%). وعلى الجانب الآخر كانت نسبة الإصابة بالبكتيريا العنقودية القولونية (*Escherichia coli*) لمرضى السكري هي (61.5%) في الإناث وبنسبة (38.33%) في الذكور، بينما كانت نسبة حدوث الإصابة بالبكتيريا العنقودية القولونية (*Escherichia coli*) للمرضى غير المصابين بداء السكري هي (52.4%) في الإناث وبنسبة (47.6%) في الذكور.

الاستنتاج: استنتجت الدراسة أن البكتيريا العنقودية القولونية (*Escherichia coli*) هي المسبب الرئيسي للإلتهابات المسالك البولية عند الأشخاص المصابين بمرض السكري، وغير المصابين بداء السكري.

الكلمات المفتاحية: البكتيريا العنقودية القولونية (Escherichia coli)، عدوى المسالك البولية، البكتيريا في البول.

Abstract:

Background: There are indications that patients with diabetes have many of complications to asymptomatic bacteriuria and urinary tract infections (UTIs). UTI is the majority of common bacterial infections in diabetic subjects. The purpose of this study was to evaluate the occurrence of UTI in companies with diabetic and non-diabetic individuals in Tarhuna and Emsallatah cities and to recognize the most repeated bacteria responsible for it.

Materials and Methods: The study had integrated 120 patients (60) diabetics and (60) non-diabetic patients, who they admitted to Tarhuna and Emsallatah Hospitals from January to May 2019. All patients had investigated for UTI during mid-stream urine samples. Their macroscopic, microscopic and urine culture characteristics were investigated, and a colony count of $\geq 10^5$ CFU/ml; it considered for the diagnosing as urinary tract infections.

Results: After the investigations have done; the results demonstrated that (49) diabetic subjects and (36) non-diabetic patients are infected. The ratio of infection is (81.6%) and (58.3%) respectively. On another side, the percentage of *Escherichia coli* in diabetic patients are (61.5%) females and (38.33%) males, while the incidence in non-diabetic patients were (52.4%) females and (47.6%) males.

Conclusion: We have concluded that *Escherichia coli* is the major cause of urinary tract infections in both diabetic and non-diabetic individuals.

Keywords: *E. coli*, *UTIs*, *bacteriuria*.

Introduction:

The predominance of diabetes mellitus has amplified over the previous decades, and it is now approaching epidemic magnitude (Zimmet *et al.*, 2001). In general, 371 million individuals have diabetes (International Diabetes Federation, 2012). It is predictable that by 2030; this sum will reach 552 million (International Diabetes Federation, 2011). Changes in way of life, the elderly of the populations and, the growing prevalence of fatness are responsible for these dramatic conditions (Zimmet *et al.*, 2001). The number of cured diabetic patients in Romania is nearly 80,000. In Times Region, more than 22,000 people with type I and type II diabetes are registered. Diabetes is one of the highest ten causes of death around the world (WHO, 2011) and this statement is due particularly to its complications. In the United States of America; Diabetic kidney ailment occurs in 45% of patients with diabetes patients (USRDS, 2004) and it is the most important cause of end- phase renal disease (American Diabetes Association, 2012). With the rising number of diabetic patients, the incidence of diabetic kidney disease will also enhance (de Boer *et al.*, 2011). Hyperglycemia and hypertension are the major risk factors for instigation of chronic kidney disease (National Kidney Foundation, 2002) but other factors, such as repeated episodes of acute kidney injury (infections, drugs, or nephrotoxins) can also contribute to its deterioration. (Chin-Hong, 2006) stated that in diabetic patients, it is commonly established that infections are recurrent causes of morbidity and mortality. Immunologic defects contribute to the amplified risk for infection: impaired neutrophil function, low levels of prostaglandin E, thromboxane B2, decreased T cell-mediated immune reactions. (Chin-Hong, 2006; Boyko *et al.*, 2005).

Other circumstances such as imperfect bladder emptying due to autonomic neuropathy and high glucose attentiveness in the urine allow urinary colonization by microbes (Boyko *et al*, 2005; Boyko and Lipsky, 1995). Asymptomatic bacteriuria and urinary tract infections are an increased risk factors among diabetic patients (UTIs) (Muller *et al*., 2005; Boyko *et al*., 2005). also (Ribera *et al*., 2006) mentioned that UTIs being the most ordinary bacterial infections in diabetic patients. Furthermore, it is important to distinguish and to treat UTIs in diabetic patients because of their probably forbidding complications, including Bacteremia, renal eruption, renal papillary necrosis (Boyko *et al*., 2005; Boyko and Lipsky, 1995; Geerlings *et al*., 2000). This study aimed to evaluate the prevalence of UTI among diabetic and non-diabetic patients in Tarhona and Emsallatah cities and to determine the most common microorganisms that cause it according to age and gender.

Materials and Methods:

Study Area: A total of 120 urine samples were collected from men and women of different ages attending Tarhona and Emsallatah hospitals, From 01 January to 25 May 2019.

Study Population: The studied populations were men and women aged between 10 to 80 years. Urine samples were collected from 120 patients; 60 of these samples were from individuals with diabetes millets and 60 from non-diabetic patients.

Sample Collection: Urine samples were collected at morning from men and women patients and the sample should be collected by obtaining the mid-stream urine flow in a sterile container and transported to the laboratory within one hour of collection.

Materials Required for The Study: Sterile specimen container, Calibrated wire loop, urine test strip, Incubator, Light microscope, culture media: Blood agar, MacConkey and CLED agar.

Physical examination: The physical characteristics of the urine samples: color and appearance are recorded immediately after collecting the sample.

Chemical examination: Urine chemistry is a group of one or more tests done to check the chemical content such as nitrite, glucose, proteins, ketones, and leukocytes. All of them were done by dipping a test strip into each urine sample and comparing the observed color changes in the strip to a reference color chart provided on the package of the test strip.

Microscopic Examination: After the urine samples were collected into test tubes; they were centrifuged at 3000 rpm for 5 min. The clear portion of the urine has been discarded and the deposits remixed by tapping the bottom of the tube. A drop of deposit has been transferred to cleaned and dry slide and covered by a coverslip. The deposits were examined under a microscope using both low and high power objective lenses (10x and, 40x) with the condenser iris closed sufficiently to give well contrast for identifications of pus cells, bacteria, casts, yeast-like cells, crystals and other unusual components.

Urine culture: A loop full of each urine sample streaked on MacConkey, blood and CLED agars for isolation of the bacteria present in the urine, then set the plate incubated at 37°C for 24hrs. Finally, the types of bacterial colonies have been identified and their accounts.

Statistical Analysis: The data entered into the computer after coding; to perform the statistical analysis is required for data analysis using statistical packages for social sciences (SPSS) used to answer the questions of the study at a significant level (P-value less than 0.05)

Results:

Distribution of Studied Samples among Diabetic and Non-Diabetic Patients at Emsallatah and Tarhona Hospitals:

The results showed that P-value was equal to 0.008, which was less than 0.05, that there was a statistically significant relationship between diabetes and the presence of UTIs (Table 01).

Table 01: Distribution of Studied Samples among Diabetic and Non-Diabetic Subjects:

			existence of UTIs		Total	P-Value
			UTIs	no UTIs		
Cases	Diabetic	Number	49	11	60	0.008
		Percentage	81.7%	18.3%	100.0%	
	Non diabetic	Number	36	24	60	
		Percentage	60.0%	40.0%	100.0%	
Total		Number	85	35	120	
		Percentage	70.8%	29.2%	100.0%	

Distribution of Studied Samples According to Ages:

Concerning bacterial growth: the results have shown that P-value for urinary tract infections was equal to 0.04, which indicates there was a statistically significant relation between the UTIs and the ages (Table 02).

Table 02: Distribution of Studied Samples According to Ages:

				cases		Total	P-Value
				Non Diabetic	Diabetic		
UTIs	Ages	less than or equal 20	Number	1	0	1	0.04
			Percentage	100.0%	0.0%	100.0%	
		30 to 39	Number	16	11	27	
			Percentage	59.3%	40.7%	100.0%	
		40 and more than	Number	19	38	57	
			Percentage	33.3%	66.7%	100.0%	
		Total	Number	36	49	85	
			Percentage	42.4%	57.6%	100.0%	
No, UTIs	Ages	less than or equal 20	Number	4	0	4	0.02
			Percentage	100.0%	0.0%	100.0%	
		30 to 39	Number	17	5	22	
			Percentage	77.3%	22.7%	100.0%	
		40 and more than	Number	3	6	9	
			Percentage	33.3%	66.7%	100.0%	
		Total	Number	24	11	35	
			Percentage	68.6%	31.4%	100.0%	
Total	Ages	less than or equal 20	Number	5	0	5	
			Percentage	100.0%	0.0%	100.0%	
		30 to 39	Number	33	16	49	
			Percentage	67.3%	32.7%	100.0%	
		40 and more than	Number	22	44	66	
			Percentage	33.3%	66.7%	100.0%	
		Total	Number	60	60	120	
			Percentage	50.0%	50.0%	100.0%	

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Distribution of Studied Samples According to Gender:

According to bacterial growth, the results showed that P-value for UTIs was equal to 0.311, which was more than 0.05, that there wasn't a statistically significant relationship between the diabetic and the gender (Table 03).

Table 03: Distribution of Studied Samples According to Gender:

				Cases		Total	P-Value
				Non Diabetic	Diabetic		
UTIs	Gender	males	Number	16	18	34	0.311
			Percentage	47.1%	52.9%	100.0%	
		females	Number	20	31	51	
			Percentage	39.2%	60.8%	100.0%	
	Total		Number	36	49	85	
			Percentage	42.4%	57.6%	100.0%	
No, UTIs	Gender	males	Number	6	5	11	0.205
			Percentage	54.5%	45.5%	100.0%	
		females	Number	18	6	24	
			Percentage	75.0%	25.0%	100.0%	
	Total		Number	24	11	35	
			Percentage	68.6%	31.4%	100.0%	
Total	Gender	Males	Number	22	23	45	
			Percentage	48.9%	51.1%	100.0%	
		females	Number	38	37	75	
			Percentage	50.7%	49.3%	100.0%	
	Total		Number	60	60	120	
			Percentage	50.0%	50.0%	100.0%	

Bacteria Caused UTI in Diabetic Patients According to Gender and Age:

For type of bacteria in Diabetic patients, the results showed that P-value for age was equal to 0.294, which was more than 0.05, that there wasn't a statistically significant relation between the type of bacteria and the age, also the results revealed that P-value for gender was equal to 0.423, which was more than 0.05, that there wasn't a statistically significant relation between the type of bacteria and the gender (table 04).

Table 04: Bacteria Caused UTI in Diabetic Individuals According to Gender and Age:

Type of Bacteria	Age			P-Value	Gender		P-Value
		20 - 39	40 and more		Male	female	
<i>E.coli</i>	Number	7	19	0.294	10	16	0.423
	Percentage	26.9%	73.1%		38.5%	61.5%	
<i>S.aureus</i>	Number	0	6		1	5	
	Percentage	0.0%	100.0%		16.7%	83.3%	
<i>Streptococcus spp</i>	Number	2	2		1	3	
	Percentage	50.0%	50.0%		25.0%	75.0%	
<i>Klebsiella pneumonia</i>	Number	2	7		3	6	
	Percentage	22.2%	77.8%		33.3%	66.7%	
<i>Proteus mirabilis</i>	Number	0	4		3	1	
	Percentage	0.0%	100%		75.0%	25.0%	
Total	Number	11	38		18	31	
	Percentage	22.4%	77.6%		36.7%	63.3%	

Bacteria Caused UTI in Non-Diabetic Subjects According to Gender and Age:

The type of bacteria in diabetic patients, the results illustrated that P-value for age was equal to 0.919, which was more than 0.05, that there wasn't a statistically significant relationship between the type of bacteria and the ages; also the results showed that P-value for gender was equal to 0.561, which was more than 0.05, that there wasn't a statistically significant relationship between the type of bacteria and the gender (table 5).

Table 5: Bacteria Caused UTI in Non-Diabetic According to Gender and Age:

Type of bacteria		Age				Gender		
		Less than 20	20 to 39	40 and more than	P-Value	male	female	P-Value
<i>E.coli</i>	Number	1	9	11	0.919	10	11	0.561
	Percentage	4.8%	42.9%	52.4%		47.6%	52.4%	
<i>S.aureus</i>	Number	0	4	3		3	4	
	Percentage	0.0%	57.1%	42.9%		42.9%	57.1%	
<i>Klebsiella pneumonia</i>	Number	0	3	4		2	5	
	Percentage	0.0%	42.9%	57.1%		28.6%	71.4%	
<i>Proteus mirabilis</i>	Number	0	0	1		1	0	
	Percentage	0.0%	0.0%	100.0%		100.0%	0.0%	
Total	Number	1	16	19		16	20	
	Percentage	2.8%	44.4%	52.8%		44.4%	55.6%	

Discussion:

This study showed that an increase in UTI with aging, it has observed that UTI is predominant among individuals at age ≥ 40 years in both diabetic and non-diabetic. This observation is agreed with (Al-Ammar, 1999; Rostler, 2003) where they evidenced in their studies that about (95%) of increased percentage of UTI among individuals above 40 years is due to hormonal change in the case of females, which affects the immune response after menopause.

(Patrick *et al.*, 2000) have proved that most of males suffer from prostate inflammations in elderly males (more than 50 years' old) which enhances UTI; this consistent with our findings in this study. Possibly this is due to the natural killer cells NK & the phagocytic activities remarkably decrease with aging resulting in recurrent infections frequently in older people. (Goldspy *et al.*, 2000). Similar results have been reported by (Herman *et al.*, 1995; Dived, 2002).

This study also showed the frequency of UTI in diabetic & non-diabetic patients according to gender. The high incidence of UTI among diabetic females (60.8%) rather than in diabetic males (52.9%) is quite compatible with another study (El-Ali *et al.*, 2002). The explanations of these results may have related to the nature of diabetes mellitus for mainly a metabolic disorder under non-controlled to some extent, the autoimmune disease recently has been reported by (Evan, 2003). Whose majority of patients are females due to factors of hormones increasing the chance for autoimmune disease appears as a result of the activation (Roitt *et al.*, 1998; Goldspy *et al.*, 2000). In this study, we have found prominent UTI among females rather than males diabetic or non-diabetic patients. These results are in agreement with (El-Ali, *et al.*, 2002) who was reported that the percentage of this disease in Tunisian was higher in women (8.6 %) than that of men (7.1%).

(Evan, 2003) showed in his study that women with diabetes are about 2-3 times more likely to have UTI than non-diabetic women because of the combination of host and local risk factors, and to another extent, the autoimmune disease has been reported (Goldspy *et al.*, 2000). The prevalence of UTI in diabetes mellitus was higher when compared to controls (Goswami *et al.*, 2001). Since the increased sugar in urine enhances bacterial growth which in turn increases the chance for UTI development (Al-fatlawy, 2001). This study shows the description and frequency of each bacterial isolation. Among (60) samples were obtained from diabetic patients. five bacterial types have been diagnosed distributed among 49 isolates that have been recovered. It is observed that *Escherichia coli* (26 isolates) most of them (19 isolates) in the age of them more than 40 years, females (16 isolates), it was accepted by (Ali, 2000) that the immune response is reduced at the extremes of the life span (at infancy and elderly age), which explains the high incidence of diseases at these periods. These facts are compatible with this study's findings which reveal arising in UTIs by ages noncases (0.0%) at <20 years to 11 cases (22.4%) at 20-39 years increased to 38 (77.6%) above 40 years of age. Moreover, the incidence among females in 31 cases (63.3%) more than males 18 cases (36.7%) due to anatomical & physiological differences between gender, which encourage bacterial transmission from the rectal and genital area to the urinary tract (Lewis, 1989). The fact that most of the bacterial isolates are of the Enterobacteriaceae family which inhabit the GIT agreed with the current results revealed. While the other types of bacteria were (9 isolates) of Klebsiella, (4 isolates) of proteus, in addition to *Escherichia coli* as had been mentioned previously and (4 isolates) of streptococcus and (6 isolates) while *staphylococcus aureus* has been isolated, though it is considered as the skin normal flora which it may be easily transmitted to the urinary tract. These results concurred with another study (Al-Khazrachi, 2001) and abroad (Tan, 1990; Andersen, 1992; Guyer *et al.*, 1989). In this study, we found that the description and frequency of each bacterial isolates among (60) samples were obtained from non-diabetic patients to four bacterial types we diagnosed in distributed among (36 isolates) that have been recovered. It was observed that *Escherichia coli* is the most frequent (21 isolate); this agrees with (Farooqi *et al.*, 2000). Followed by *klebsiella* (7 isolates) and *Staphylococcus aureus* (7 isolates), finally *Proteus* (1 isolate); these results are in agreement with (Swiezko *et al.*, 2000).

Also, the result reveals that bacterial infection in non-diabetic women (55.6%) was more than in non-diabetic men (44.4%). UTI was observed higher in elderly in both genders, so it is (2.8%) for those < 20 increased to (44.4%) in 20-39 years and reached (52.8%) for patients \geq 40 years. There was no marked difference in types of microorganism causing the UTIs in diabetic and non-diabetic women. *Escherichia coli* was the predominant pathogen in both groups, which agrees with (Asahara *et al.*, 2001; Pinero *et al.*, 2003; Sotto *et al.*, 2003) because *Escherichia coli* seems to have many antigens that play a role in adherence and pathogenicity (AL-Moaid, 2003).

adherence of *Escherichia coli* to an epithelial cell is dependent on the interaction between the Pilli and some sugar sequences in the form of glycolipids found in the urinary system. (Robertis *et al.*, 2000). The presence of *Staphylococcus aureus* in the urine is a result contamination from the skin (Al-Fatlawy, 2001). The rate of *Klebsiella* infection increases in patients with urinary tract infections because the

capsules of these bacteria are the main virulent factors. (Robertis *et al.*, 2000).

All of *Proteus* has a potent urease which is producing ammonia from urea.

Ammonia production has been observed of depressing the phagocytic activity of infiltrating leucocytes for this cause, thereby the destructions of complements actions (Al-Moaid, 2003).

Conclusion: The UTIs are most common in patients with diabetes than in non-diabetic patients, women have more frequent UTI than in men, Women with diabetes have more frequent and more severe UTI than those without diabetes, there was association between age in diabetic and non-diabetic patients and UTI, and finally.

There was no marked difference in the type of micro-organisms causing the UTI in diabetic and non-diabetic persons whereas *Escherichia coli* were the most common pathogen isolated in both group.

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