



Prevalence of UTI Caused by Gram-Negative Bacteria in Type 2DM Cases at Khoums Diabetes Center in Al-khoums, Libya.

Raghdah A. Ahmed , Ayadah m. alhaseek , Tamalli, M, Hanan B. Abousittash

Department of Biological Sciences, Faculty of Sciences, Al-mergib university, Al-khoums, Libya

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ABSTRACT

Corresponding Author

rghdthadya@gmail.com

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Urinary tract infections (UTIs) are more frequent, more severe, and have worse outcomes in individuals with type 2 diabetes mellitus. These infections are also more commonly caused by resistant pathogens. Several factors, including immune system dysfunction, poor metabolic control, and incomplete bladder emptying due to autonomic neuropathy, may contribute to the increased risk of UTIs in these patients. A prospective study was carried out at Khoums Diabetes Center in Al-Khoums, Libya, from December 2022 to February 2023. The study included 170 participants, 140 of whom were diagnosed with type 2 diabetes, while 30 were non-diabetic (control group). Among the 140 urine samples from diabetic patients, 60 samples (42.9%) showed significant bacterial growth, while 80 samples (57.1%) showed no significant growth. When examining the relationship between liquid intake, socio-economic status, and Gram-negative bacterial species, the data was categorized by sex, age, weight, and employment. A higher percentage of females (84%) were affected compared to males (16%). The age group most affected was 46-55 years, comprising 35.5% of cases. Regarding employment, housewives were the most affected group, making up 67.8%, while laborers had the lowest incidence, with 0%. Improving the management of diabetes mellitus, along with the proper use of antibiotics selected based on sensitivity patterns, could help reduce the prevalence of urinary tract infections (UTIs) and prevent renal complications. The results highlighted the rise of highly resistant bacteria to most of the tested antimicrobials, urging physicians to adjust their treatment approaches based on antimicrobial susceptibility findings

INTRODUCTION:

Type 2 diabetes mellitus is a diverse group of conditions marked by varying levels of insulin resistance, impaired insulin secretion, and increased glucose production. Individuals with type 2 diabetes are at a higher risk of infections, with the urinary tract being the most common site of infection ⁽¹⁾. Several factors, including immune system dysfunction, poor metabolic control of diabetes, and incomplete bladder emptying due to autonomic neuropathy, may all play a role in the development of urinary tract infections (UTIs) in diabetic patients. The risk of developing a UTI is elevated in diabetic patients, especially those with older age⁽²⁾, poor metabolic control, and chronic conditions like diabetic nephropathy and cystopathy⁽³⁾. A urinary tract infection (UTI) is an infection that can affect any part of the urinary system,

including the urethra, kidneys, or bladder. Women are statistically more likely to experience UTIs than men. ⁽⁴⁾, While a bladder infection is typically painful and bothersome, it is crucial to address it promptly to prevent the infection from ascending to the kidneys, which can result in more severe complications ⁽⁵⁾.

The incidence of UTIs significantly increased, rising from 4.3% to 9% in men and from 5% to 7.9% in women. Individuals with type 2 diabetes are at a heightened risk of developing various health conditions ⁽⁶⁾, including cardiovascular conditions like heart disease, eye problems that can lead to blindness, amputation of lower limbs, kidney disease, and various infectious diseases ⁽⁷⁾. Conditions such as immune system disorders, reduced white blood cell count, impaired blood supply, bladder dysfunction caused by kidney disease, and the presence of sugar in the urine can contribute to

the development of urinary tract infections in individuals with type 2 diabetes ⁽⁸⁾. Dysuria, or painful urination, is a common complication of urinary tract infections in diabetic patients. This can be attributed to organ damage caused by the infection. In severe cases, such as pyelonephritis, kidney infection, the condition can become life-threatening⁽⁹⁾. Additionally, these patients often experience urinary retention, a strong urge to urinate, and incontinence, particularly at night. This is due to an increase in urination frequency as the body attempts to eliminate excess glucose through urine ⁽¹⁰⁾. The higher prevalence of urinary tract infections in women compared to men can be attributed to the specific anatomical structure of the female urinary tract. The shorter length of the urethra and its proximity to the anus in women increase the likelihood of bacterial entry and subsequent infection ⁽¹¹⁾. Urinary tract infections can significantly hinder the ability of diabetic patients to effectively manage their blood sugar levels. This increased challenge necessitates more frequent blood sugar monitoring, ultimately diminishing the patient's quality of life and imposing substantial treatment costs ⁽¹²⁾. The aim from this study could provide a better understanding for the development of more detailed programs to reduce the effects of urinary tract infections and improve people's health with type 2 diabetes mellitus.

METHODOLOGY:

Study area:

Diabetes mellitus cases (Type 2) of male and female who attend the Khoums Diabetic center, Al-khoums, Libya.

Study Duration:

The study was carried out during the period from beginning of December 2022 till the end of February of 2023.

Sample size:

Case control study was involved in 170 individuals, 140 of them were diagnosed with type 2 diabetes and 30 non-diabetic (control group).

Sampling Procedure:

Pre-tested structured questionnaire was used for collecting the data pertaining to socio-demographic characteristics and possible risk factors. The specimens were collected from patients by using standard microbiological procedures. Urine in sterile wide mouthed container and blood samples with a sterile syringe. The urine samples giving $\geq 10^5$ CFU/ml were considered significant ⁽¹⁸⁾.

Statistical Analysis:

The data were analyzed by using SPSS version 16.0 and Microsoft excels 2010. The Chi-square test was used to analyze the data. The p-value $p < 0.05$ was considered statistically significant.

RESULTS AND DISCUSSIONS:

During the study period of three months, diabetic patients attending at KDC were randomly selected for the participation in accordance to the inclusion criteria. In total, 140 diabetic patients.

Table 1: Significant Growth Pattern of Uropathogens in T2DM and Control Subjects.

Microbial growth	T2 DM		Control Subject		P-value
	No.	%	No.	%	
Significant growth	60	42.9	2	6.7	0.00
No growth	80	57.1	28	93.3	
Total	140	100	30	100	

Out of 140 urine samples of diabetic cases, 60 (42.9%) samples showed significant growth and 80 (57.1%) samples showed no significant

growth, whereas 2 (6.7%) samples showed significant growth and 28 (93.3%) samples showed no significant growth for non-diabetic cases.

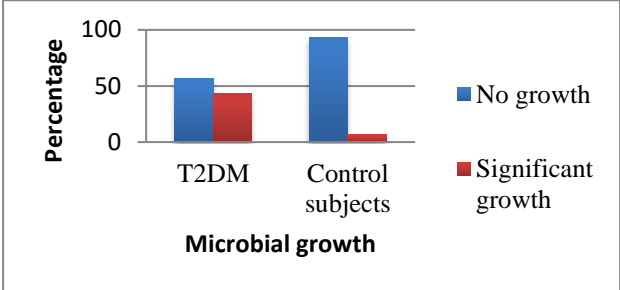


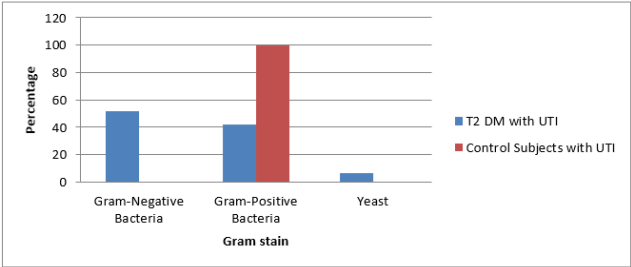
Fig. (1): Pattern of distribution of significant growth of Uropathogens in T2DM and Control Subjects

Table 2: Pattern of Microbial Isolates from the Urine Sample of T2DM and Control Subjects:

Gram stain	T2 DM with UTI		Control Subjects with UTI	
	No.	%	No.	%
Gram-Negative Bacteria	31	51.7	0	0.0

Gram-Positive Bacteria	25	41.7	2	100.0
Yeast	4	6.6	0	0.0
Total	60	100	2	100.0

A total of 60 microbial isolated from T2DM cases, 31 (51.7%) isolates were Gram- negative whereas 25(41.7%) isolates were found to be Gram-positive bacteria and 4(6.6) isolates were found to be yeast.



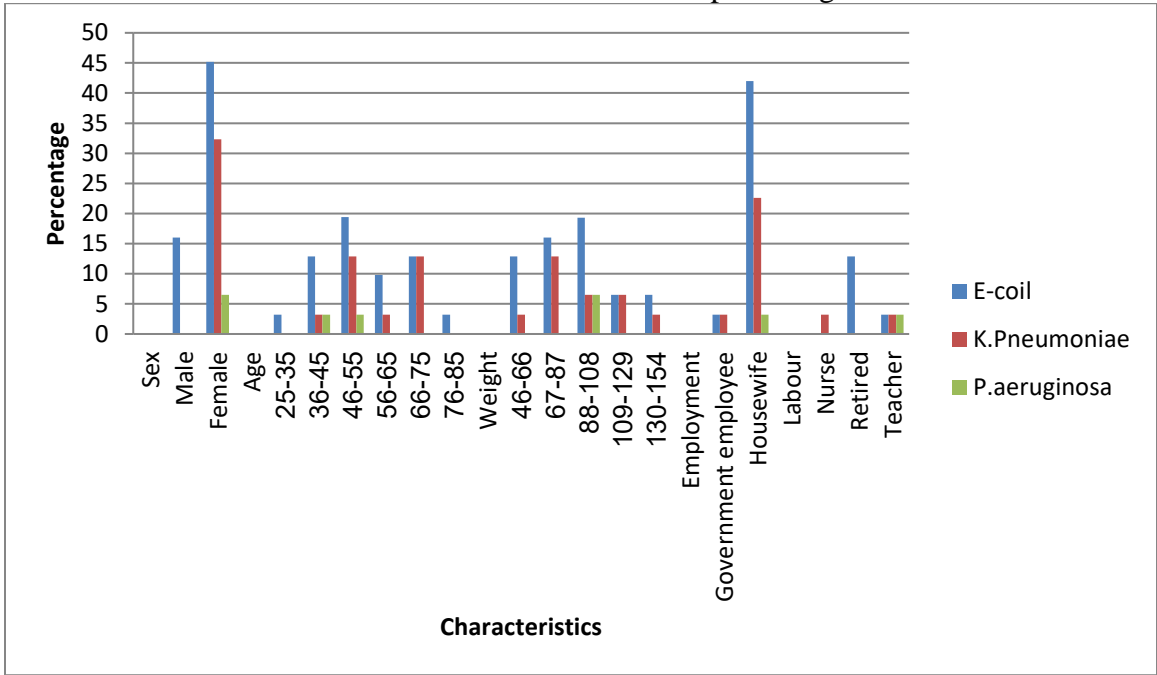
Graph 2: Pattern of Microbial Isolates from the Urine Sample of T2DM

Table 3: Distribution of Liquid Intake and Socio-economic status with Gram-Negative Bacterial Species:

Characteristics	Gram-Negative Bacteria								P-Value
	E-coil		K.Pneumoni ae		P.aeruginosa		Total		
	No.	%	No.	%	No.	%	No.	%	
Sex									
Male	05	16	0	0.0	00	0.0	05	16.0	0.060
Female	14	45.2	10	32.3	02	6.5	26	84.0	
Age									
25-35	01	3.2	0	0.0	00	0.0	01	3.2	0.962
36-45	04	12.9	01	3.2	01	3.2	06	19.3	
46-55	06	19.4	04	12.9	01	3.2	11	35.5	
56-65	03	9.8	01	3.2	00	0.0	04	13.0	
66-75	04	12.9	04	12.9	00	0.0	08	25.8	
76-85	01	3.2	00	0.0	00	0.0	01	3.2	
Total	19	61.4	10	3.2	02	6.4	31	100.0	
Weight									0.661
46-66	04	12.9	01	3.2	00	0.0	05	16.1	
67-87	05	16.0	04	12.9	00	0.0	09	29.0	
88-108	06	19.3	02	6.5	02	6.5	10	32.3	

109-129	02	6.5	02	6.5	00	0.0	04	12.9	
130-154	02	6.5	01	3.2	00	0.0	03	9.7	
Total	19	61.2	10	32.3	02	6.5	31	100.0	
Employment									
Government employee	01	3.2	01	3.2	00	0.0	02	6.4	0.089
Housewife	13	42.0	07	22.6	01	3.2	21	67.8	
Labour	00	0.0	00	0.0	00	0.0	00	0.0	
Nurse	00	0.0	01	3.2	00	0.0	01	3.2	
Retired	04	12.9	00	0.0	00	0.0	04	12.9	
Teacher	01	3.2	01	3.2	01	3.2	03	9.6	
Total	19	61.3	10	32.2	02	6.4	31	100.0	

Table 3 is tabulated with distribution of socio-economic status with Gram-Negative Bacterial Species ⁽¹³⁾, it is divided into sex, age, weight and Employment. Female percentage is more with 84% and male as 16%. In age wise 46-55 comprise the more percentage as 35.5%. By employment house wife’s are most affected with 67.8% and least as labour with zero percentage.



Graph 3: Distribution of Socio-economic status with Gram-Negative Bacterial Species:

CONCLUSION:

Based on the findings of this study, 42.9% of the 140 individuals with diabetes were diagnosed with a urinary tract infection, compared to 6.7% of the 30 control subjects. Additionally, the study indicated a higher

prevalence of UTIs among female patients ⁽¹⁴⁾. UTIs in diabetic patients were linked to gender, occupation, while these factors were not significant in healthy individuals ⁽¹⁵⁾. Because of differences in social, economic, health and environmental conditions between developed

and developing countries ⁽¹⁶⁾, More research is needed in developing countries to improve UTI treatment and management for diabetic patients ⁽¹⁷⁾.

REFERENCES:

- Jagadeesan, S., Tripathi, B. K., Patel, P., & Muthathal, S (2022). Urinary tract infection and Diabetes Mellitus—Etiological profile and antibiogram: A North Indian perspective. *National Library of Medicine*, 11(5), 1902–1906. https://doi.org/10.4103/jfmpc.jfmpc_2017_21.
- Carrondo MC and Moita JJ (2020) Potentially preventable urinary tract infection in patients with type 2 diabetes—a hospital-based study. *Obesity Medicine*, 17:100190.
- Marushchak M and Krynytska I (2021) Insulin Receptor Substrate 1 Gene and Glucose Metabolism Characteristics in Type 2 Diabetes Mellitus with Comorbidities. *Ethiopian Journal of Health Science*, 31(5):1001-1010.
- Maida CD, Daidone M, Pacinella G, Norrito RL, Pinto A and Tuttolomondo A (2022) Diabetes and Ischemic Stroke: An Old and New Relationship an Overview of the Close Interaction between These Diseases. *International Journal of Molecular Science*, 23(4):2397.
- Lawati, H. Al, Blair, B. M., & Larnard, J (2024). Urinary Tract Infections: Core Curriculum 2024. *American Journal of Kidney Diseases*, 83(1), 90–100.
- Eckstein ML, Schwarzinger M, Haupt S, Wachsmuth NB, Zimmer RT, Sourij H, Zimmermann P, Zunner BEM, Aberer F and Moser O (2022) Physiological Responses to Combat Sports in Metabolic Diseases: A Systematic Review. *Journal of Clinical Medicine*, 11(4):1070.
- Rajaobelina K, Dow C, Romana Mancini F, Dartois L, Boutron-Ruault MC, Balkau B, Bonnet F and Fagherazzi G (2019) Population attributable fractions of the main type 2 diabetes mellitus risk factors in women: Findings from the French E3N cohort. *Journal of Diabetes*, 11(3):242-253.
- Farhadnejad H, Teymoori F, Asghari G, Mokhtari E, Mirmiran P and Azizi F (2022) The higher adherence to a healthy lifestyle score is associated with a decreased risk of type 2 diabetes in Iranian adults. *BMC Endocrine Disorders*, 22(1):42.
- Nichols GA, Brodovicz KG, Kimes TM, Déruaz-Luyet A and Bartels DB (2017) Prevalence and incidence of urinary tract and genital infections among patients with and without type 2 diabetes. *Journal on Diabetes Complication*, 31(11):1587–91.
- Wang Z, Hou Y, Huang Y, Ju F, Liang Z and Li S (2022) Clinical efficacy and safety of electroacupuncture combined with beraprost sodium and α -lipoic acid for diabetic peripheral neuropathy. *American Journal of Translational Research*, 14(1):612-622.

- Heidemann C, Du Y, Baumert J, Paprott R, Lampert T and Scheidt-Nave C (2019) Social inequality and diabetes mellitus - developments over time among the adult population in Germany. *Journal of Health Monitor*, 4(2):11-28.
- Ma Y and Chen X (2021) Glibenclamide Ameliorates the Expression of Neurotrophic Factors in Sevoflurane Anaesthesia-induced Oxidative Stress and Cognitive Impairment in Hippocampal Neurons of Old Rats. *Journal of Veterinary Research*, 65(4):527-538.
- Li F and Chen L (2021) The Association between Trajectories of Anthropometric Variables and Risk of Diabetes among Prediabetic Chinese. *Nutrients*, 13(12):4356
- 14. Laway, B. A., Nabi, T., Bhat, M. H., & Fomda, B. A. (2021). Prevalence, clinical profile and follow up of asymptomatic bacteriuria in patients with type 2 diabetes-prospective case control study in Srinagar, India. *Diabetes & Metabolic Syndrome: Clinical Research & Reviews*, 15(1), 455–459. <https://doi.org/10.1016/j.dsx.2020.12.043>
- Shah MA, Kassab YW and Anwar MF (2019) Prevalence and associated factors of urinary tract infections among diabetic patients. *Health Science Journal*, 13(2): 1–5.
- Abu-Ashour W, Twells LK and Valcour JE (2018) Diabetes and the occurrence of infection in primary care: a matched cohort study. *BMC Infect Diseases*, 18(1): 1–8.
- Stephen SJ and Gaharwar R (2019) Effect of glycemic control on the clinical and laboratory profile of UTI in patients with diabetes mellitus. *International Journal of Contemporary Medical Research*, 6(6): 1–5.
- 18. Laway, B. A., Nabi, T., Bhat, M. H., & Fomda, B. A. (2021). Prevalence, clinical profile and follow up of asymptomatic bacteriuria in patients with type 2 diabetes-prospective case control study in Srinagar, India. *Diabetes & Metabolic Syndrome: Clinical Research & Reviews*, 15(1), 455–459. <https://doi.org/10.1016/j.dsx.2020.12.043>.