



Prevalence of Asymptomatic Bacteriuria in Type Two Diabetes Patients in A Tertiary Care Centre in Tamilnadu

Dr. Linda P Johnson^{1*}, Dr. Rajamani Shanmugasundaram², Dr. S. Pravin Selvam³

¹Highest Degree- MBBS, Designation- Post Graduate Resident, Department of General Medicine, Vinayaka Mission's Kirupananda Variyar Medical College and Hospital, Vinayaka Mission's Research Foundation (DU), Salem- 636308.

²Highest Degree- MD (General Medicine) Designation-Professor, Department of General Medicine, Vinayaka Mission's Kirupananda Variyar Medical College and Hospital, Vinayaka Mission's Research Foundation (DU), Salem- 636308.

³Highest Degree- MD (General Medicine) Designation-Assistant Professor, Department of General Medicine, Vinayaka Mission's Kirupananda Variyar Medical College and Hospital, Vinayaka Mission's Research Foundation (DU), Salem- 636308.

***Corresponding Author:** Dr. Linda P Johnson,

Highest Degree- MBBS, Designation- Post Graduate Resident, Department of General Medicine, Vinayaka Mission's Kirupananda Variyar Medical College and Hospital, Vinayaka Mission's Research Foundation (DU), Salem- 636308.

Email ID- lindajohnson@rediffmail.com

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KEYWORDS

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ABSTRACT

BACKGROUND: Diabetes has a number of long term effects on the genitourinary system. These effects predisposes to bacterial urinary tract infection. It may also be an influencing factor for asymptomatic bacteriuria. Presence of excessive number of bacteria in urine without causing any symptoms is known as Asymptomatic Bacteriuria (ASB). Untreated ASB predisposes the individual to recurrent UTI, leads to renal disease and septicemia. ASB is common in females than compared to males. The high sugar level is the main cause of prevalence of UTI among the diabetic patients

AIM: To determine the prevalence of asymptomatic bacteriuria in type two diabetes mellitus patients

METHODOLOGY: A Cross-sectional study was conducted for a period of one year in the medicine department of Vinayaka Mission's Kirupananda Variyar Medical College and Hospital, Salem. A total of 180 diabetes patients were selected for this study. This study was conducted after getting the ethical clearance from the institutional ethical committee. Informed consent was obtained from all the participants involved in this study. All the study participants were administered a semi structured questionnaire. Fasting and post prandial blood sugars, urine complete and urine culture & sensitivity were done in patients. Incidence of ASB and growth of organism in urine were seen in the study

RESULT: In this study the prevalence of asymptomatic bacteriuria was found to be 22.2 %. E.coli (45%) is the most commonest organism found among the patients in this study and other organisms present were candida, klebsiella, pseudomonas and citrobacter. Females were affected more than males (p value = 0.003) and patients who had poorly controlled diabetes status were more affected than the controlled diabetes patients (p value = 0.007).

CONCLUSION : This present study suggested E.coli is the most common organism causing ASB. The association of gender with asymptomatic bacteriuria shows female patients had more risk of getting ASB. This shows female gender is a risk factor of asymptomatic bacteriuria. The association of diabetes control status with asymptomatic bacteriuria shows that diabetes control status was significantly associated with bacteriuria. Uncontrolled diabetes status shows a risk factor for asymptomatic bacteriuria.

INTRODUCTION

Diabetes mellitus, which was popularly known as "Madhumeha" in ancient India (literally means presence of sugar in the urine). It was most common among people with high socio-economic status in the past decades. But now it is one among the most common life style disorders in all parts of the world and it affects

almost all age group either as Type 1 diabetes or Type 2 diabetes mellitus⁽¹⁾

According to World Health Organisation (WHO) the term diabetes, defines a metabolic disorder of multiple aetiologies which is characterised by chronic hyper glycaemia with disturbance of carbohydrate, protein and fat metabolism resulting from flaw in insulin secretion,



action or both.⁽²⁾ Of types of diabetes, Type 1, Type 2 and gestational diabetes, type 2 constitutes almost 90% of all diabetic cases.⁽³⁾

WHO has predicted that the countries with highest proportion of diabetes will be India, China and United states by 2025.⁽⁵⁾ India is facing a grave health care burden due to the increase in diabetes prevalence.⁽⁶⁾

Diabetes mellitus has a number of long term effects on the genitourinary system of which Urinary Tract Infection (UTI) is common. It is also an influencing factor for asymptomatic bacteriuria (ASB). Presence of excessive number of bacteria in urine without causing any symptoms is known as ASB. ASB in patients with T2DM is a predictor of subsequent development of a symptomatic UTI. E.Coli is the main causative organism for ASB.⁽⁷⁾ Untreated ASB predisposes the individual to recurrent UTI; leads to renal disease (pyelonephritis and gram negative septicemia).⁽⁸⁾

UTI is one of the most major cause of morbidity in diabetic patients. It is common in females compared to males.

ASB is defined as the presence of at least 10*5 colony forming units per ml of 1 or 2 bacterial species in clean-voided midstream urine sample from an individual without symptoms of a urinary tract infection (UTI). The main causative organism for ASB was *Escherichia coli*, followed by *Enterobacteriaceae*, nonfermentive Gram-negative bacilli, Gram-positive bacteria and coagulase-negative staphylococci.

There are some hospital-based studies mainly conducted in prevalence of asymptomatic bacteriuria, but majorly from western countries or from northern India. Magnitude of association of socio-demographic and other associated factors like diabetes control status, family history of diabetes, duration of diseases etc. will help in understanding the favouring or hindering factors of it and it was not adequately addressed in earlier studies. There is a paucity of data from southern part of India. Hence there is a need for studying the impact of ASB in patients with diabetes mellitus. Therefore, the present study was conducted to determine the prevalence of ASB in patients with T2DM, the causative organisms involved in ASB and also aimed to find the socio-demographic characteristics, behavioural factors, and clinical features associated with asymptomatic bacteria in type 2 DM patients.

AIMS AND OBJECTIVES

- 1) To determine the prevalence of asymptomatic bacteriuria Among the patients with type 2 Diabetes mellitus (aged 30 years and above) attending Vinayaka Mission's Kirupananda Variyar Medical College and Hospital, Salem
- 2) To find the main causative organisms involved in ASB
- 3) To find the sociodemographic and clinical features associated with ASB

METHODOLOGY

A hospital based cross-sectional analytical study was conducted among patients with type 2 Diabetes mellitus patients attending Vinayaka Mission's Kirupananda Variyar Medical College and Hospital, Salem from December 2022 to January 2024.

Inclusion criteria

- Type 2 diabetic patient aged 30 – 75 years who do not have any complaints relating to urinary tract infection were included in the study.

Exclusion criteria

Patients with any of the following conditions

- Recent hospitalization (Or) surgery (<4months)
- Urinary tract abnormality (cystopathy (or) recent urinary tract instrumentation)
- Symptoms of urinary tract infection (dysuria, frequency of urine, urgency, abdominal discomfort)
- Antimicrobials therapy in past 14 days
- Immunocompromised patients

Before proceeding with the study ,ethical clearance was obtained from the Institutional Ethics Committee on Human Subjects(Approval No. VMKVMC&H/IEC/19/63). Patients were informed regarding the study at the time of enrolment and written informed consent was taken . A pretested semi-structured questionnaire was used to assess the sociodemographic and behavioural characteristics. Patients' case records were reviewed to get the details of recent blood sugar values and previous history of UTI. Complete urine analysis and culture analysis was done to identify the asymptomatic bacteriuria and the types of bacteria.

Uncontrolled diabetes was considered as FBS>125 or PPBS>180⁽¹²⁾ and uncontrolled hypertension was considered as SBP>140 mmHg or DBP>90 mm Hg

Data analysis

The data were transferred into excel sheet and analyzed by using STATA -version

16 and the data were analyzed by using descriptive statistics and inferential statistics.

Continuous variables such as age, and duration of DM were summarized as mean (standard deviation).

Categorical variables like gender, education, occupation, religion, area of residence, socio-economic status, marital status, number of family members, alcohol use, tobacco use, type of medications, presence of comorbidities, and diabetes control status were summarized as percentages.



The prevalence of asymptomatic bacteriuria and the types of organisms were expressed as percentage with 95% confidence intervals (CIs).

The association of socioeconomic and behavioural characteristics with asymptomatic bacteriuria was analyzed using a Chi-squared test. A p-value less than 0.05 was considered as statistically significant.

RESULTS

Description of the demographic variables among the patients

Almost half (45.6) of the patients were in 45 to 60 years of **age** and one third (36%) was aged above 60 years. **Gender** wise majority (54%) of the patients were females and 46% were males.

About one fourth (27%) of the patients had no formal **education** and 60% were educated, 1 to 10th standard. Most of the patients belonged to Hindu **religion** (94%).

Majority of the patients were currently unemployed (55%) and 6% were monthly waged and almost half (45%) belonged to class 5 (poor) **socioeconomic** class according to BG Prasad's classification. Almost all (84%) of the patients were **residing** in rural areas and 16% were residing urban areas. Regarding **marital status** more than three fourth (77%) were married and rest were widowed or single. Around one fourth had more than five **family members** in their house.

Eleven (6%) of the patents reported **tobacco use** in last one month.

About **diabetes control status**, more than half (53%) had poor FBS control status and (76%) had poor PPBS control status and half (58%) of the patients were on oral hypoglycaemic agents and 6% were on insulin.

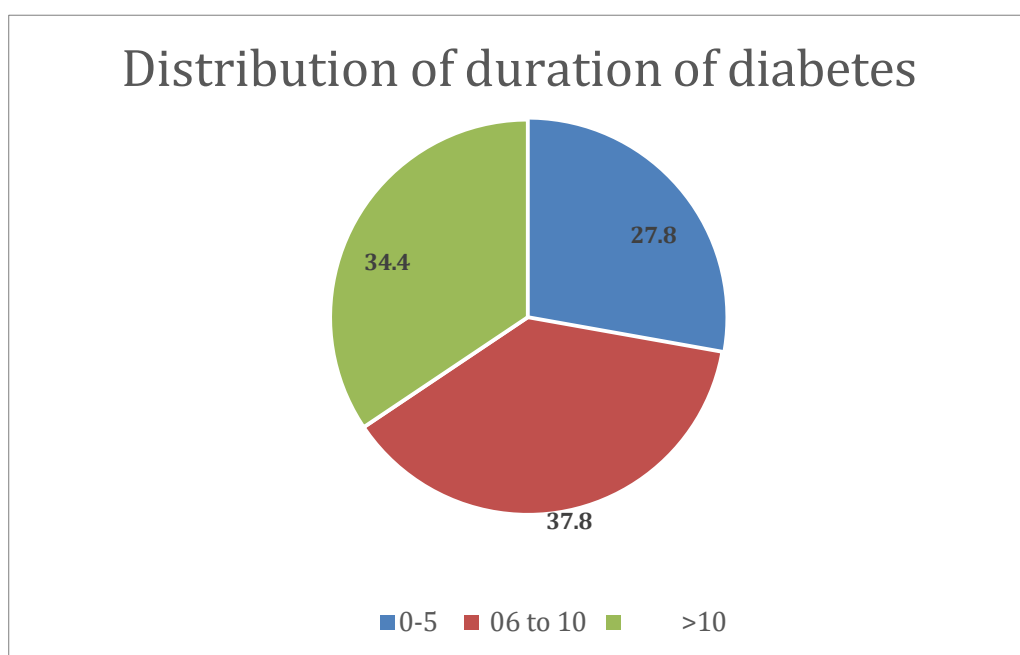


Fig. 1 Piechart showing distribution of duration of diabetes mellitus

Mean (SD) **duration** of diabetes was 10 (7.5) years and one third (34%) had duration more than 10 years (Fig. 1) and 28% were **on medication** for the last five years or less.

More than half (57%) had associated comorbidities such as hypertension, cardiovascular diseases, joint pain, disabilities etc. Most of them (87%) had no history of UTI but 13% reported a **UTI history**.

Prevalence of asymptomatic bacteriuria

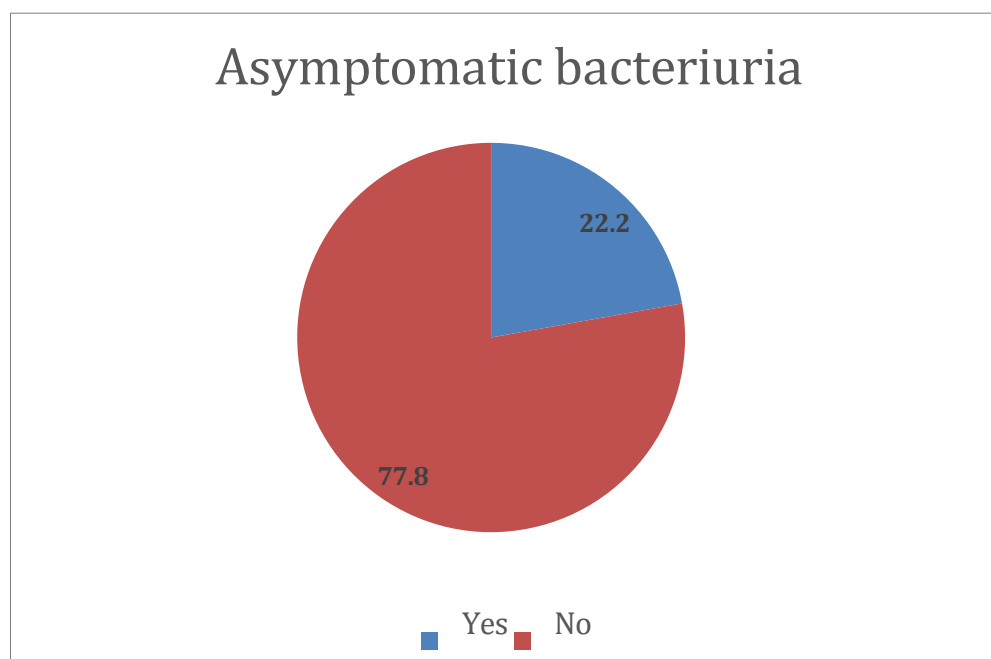
The **prevalence** of asymptomatic bacteriuria was 22.2 % (95% CI 16.4-29.0).

Escherichia coli (45%) was the most common organism causing ASB followed by Candida (20%), Klebsiella (18%), Pseudomonas (13%), and Citrobacter.

The association of age with asymptomatic bacteriuria shows that **45 to 60 years old patients had more risk of getting asymptomatic bacteriuria**. But this finding was not statistically significant(p value 0.396).

**Table 1. Distribution of Asymptomatic Bacteriuria**

Asymptomatic bacteriuria	n	%	95 % CI
Yes	40	22.2	16.4% to 29.0%
No	140	77.8	
Total	180	100	

**Fig.2 Piechart showing prevalence of asymptomatic bacteriuria****Table 2. Distribution of type of organism**

Asymptomatic bacteriuria	n	%	95% CI
E. coli	18	45.0	29% to 61.5%
Candida	8	20.0	9.0% to 35.6%
Klebsiella	7	17.5	7.3% to 32.8%
Pseudomonas	5	12.5	4.2% to 26.8%
Citrobacter	2	5.0	0.6% to 16.9%

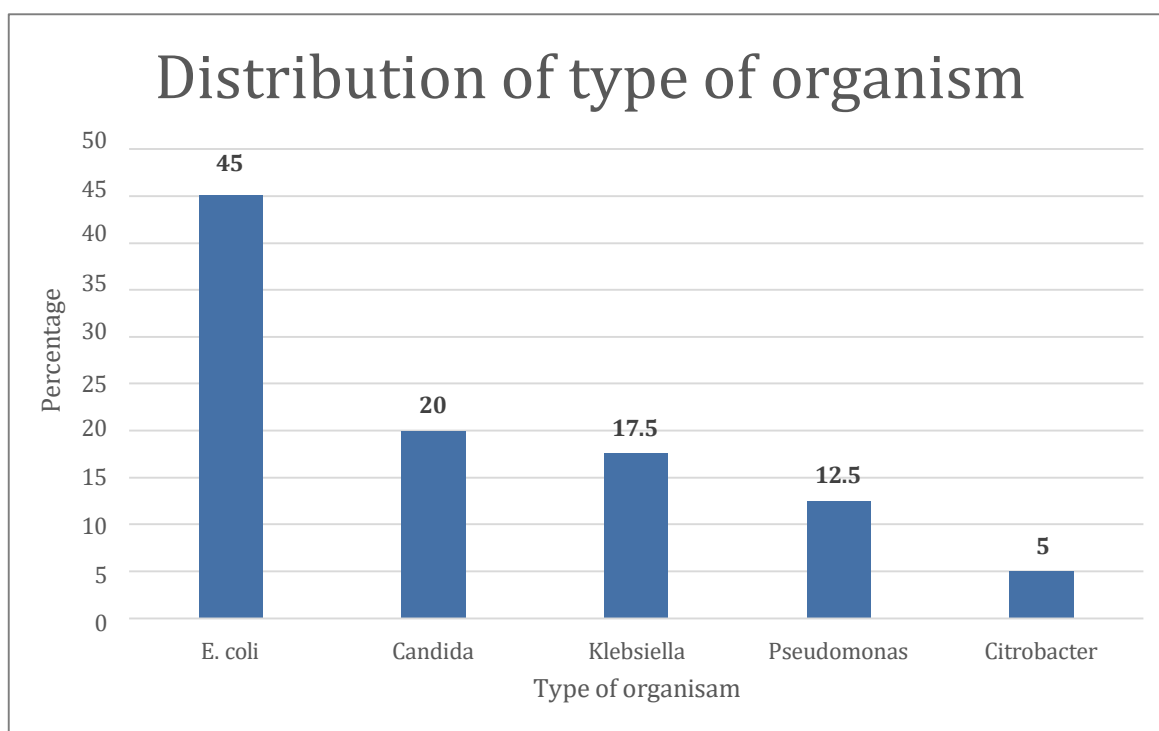
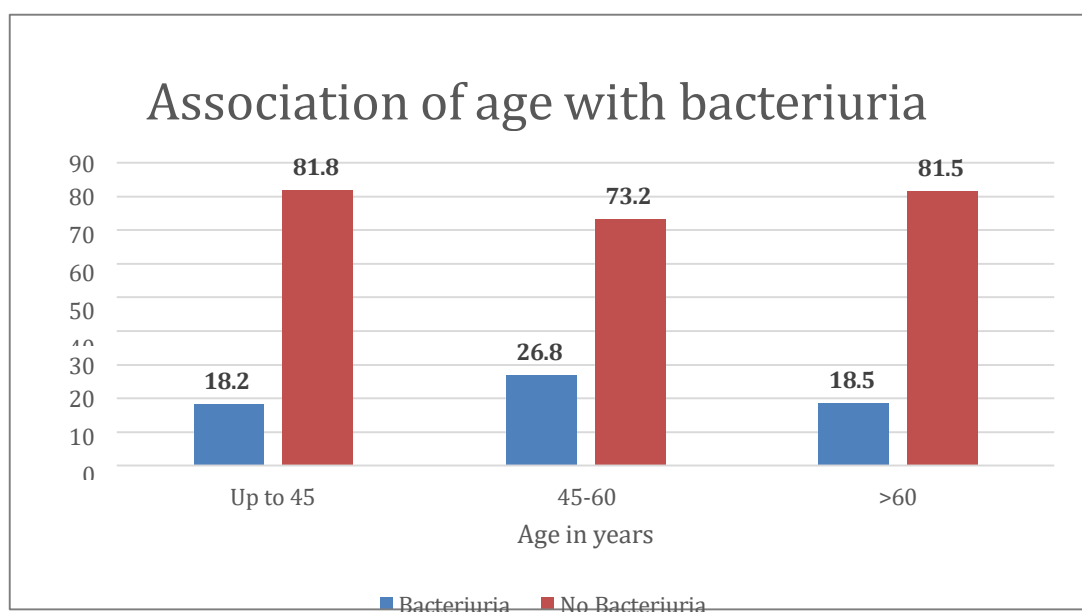


Fig. 3 Distribution of type of organism

Table 3. Association of age with bacteriuria (N=180)

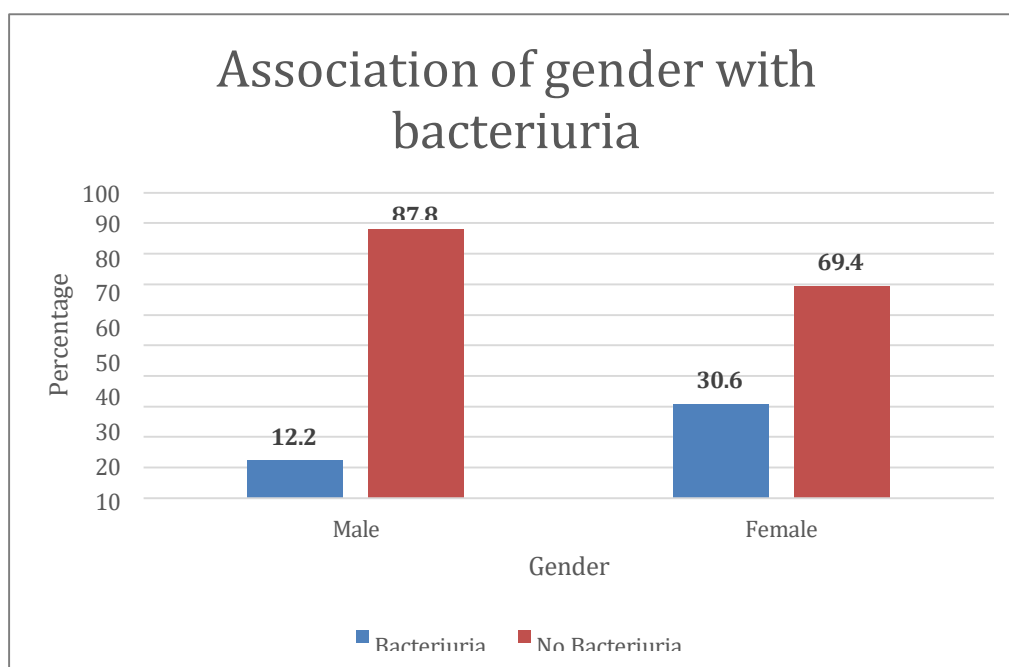
Age	Bacteriuria n (%)		P value
	Yes	No	
Up to 45	6 (18.2)	27 (81.8)	0.396
45-60	22 (26.8)	60 (73.2)	
>60	12 (18.5)	53 (81.5)	

Fig. 4 chart showing association of age with bacteriuria



**Table 4. Association of gender with bacteriuria(N=180)**

Age	Bacteriuria n (%)		P value
	Yes	No	
Male	10 (12.2)	72 (87.8)	0.003
Female	30 (30.6)	68 (69.4)	

**Fig. 5 Chart showing association of gender with bacteriuria**

The association of gender with asymptomatic bacteriuria shows female patients had more risk of getting asymptomatic bacteriuria. And this finding was found to be significant ($p=0.003$). Female gender is found to be a risk factor for asymptomatic bacteriuria.

Table 5. Association of Education with bacteriuria (N=180)

Education	Bacteriuria n (%)		P value
	Yes	No	
No formal education	14 (28.6)	35 (71.4)	0.638
1 to 5	8 (18.2)	36 (81.8)	
6 to 10	15 (22.7)	51 (77.3)	
11 to 12	2 (18.2)	9 (81.8)	
Graduate and above	1 (10.0)	9 (90.0)	

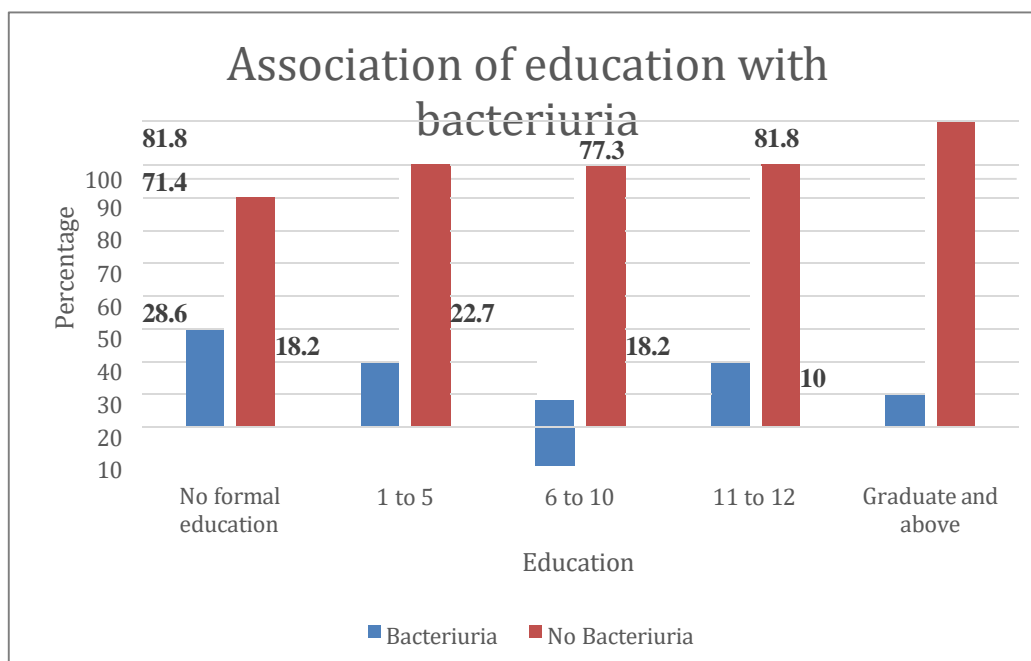


Fig.6 Chart showing association between education with ASB

The association of education with asymptomatic bacteriuria shows that patient's education was not found to be associated with bacteriuria ($p=0.638$)

Table 6. Association of occupation with bacteriuria (N=180)

Occupation	Bacteriuria n (%)		P value
	Yes	No	
Monthly salaried	3 (30.0)	7 (70.0)	0.485
Daily waged	6 (14.3)	36 (85.7)	
Agriculture	6 (20.7)	23 (79.3)	
Unemployed	25 (22.2)	140 (77.8)	

Table 7. Association of Socioeconomic status with bacteriuria (N=180)

SES	Bacteriuria n (%)		P value
	Yes	No	
Class 1	1 (16.7)	5 (83.3)	0.867
Class 2	2 (15.4)	11 (84.6)	
Class 3	4 (21.1)	15 (78.9)	
Class 4	16 (26.7)	44 (73.3)	
Class 5	17 (20.7)	65 (79.3)	

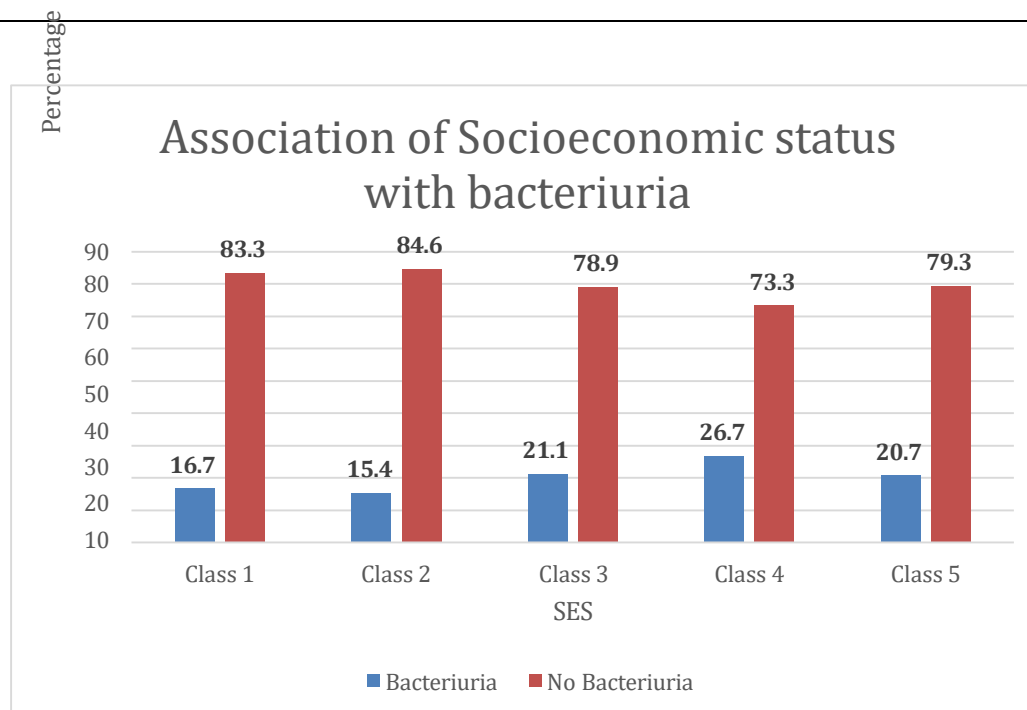


Fig 7 Chart showing association between socioeconomic status with ASB

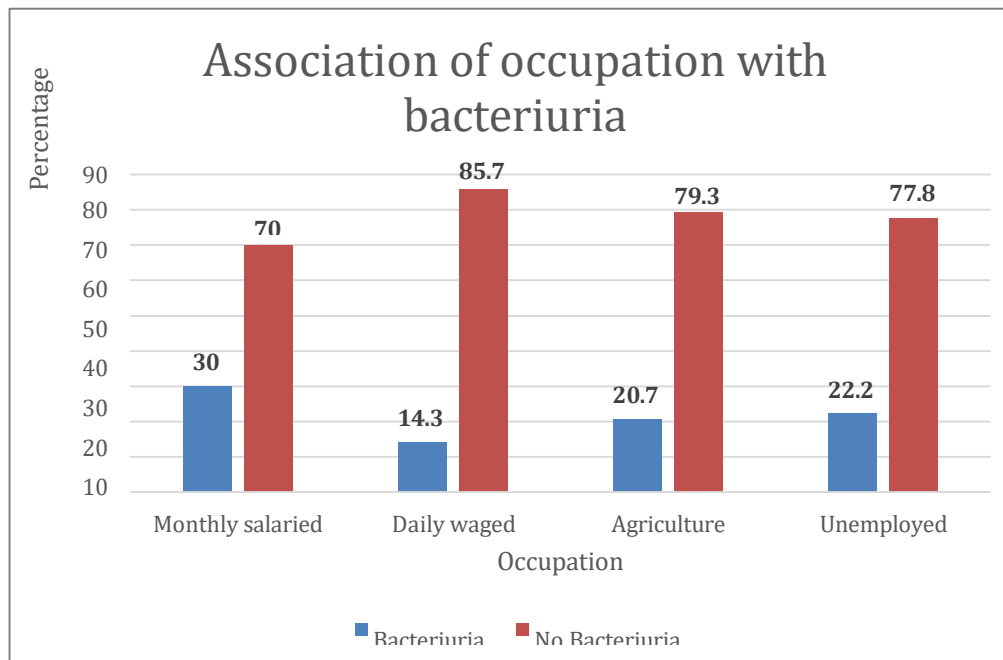


Fig. 8 Chart showing association between occupation and ASB

Education (p value 0.638), occupation (p value 0.485), social class (p value 0.867), area of residence (p value 0.093) and marital status (p value 0.409), medication use (p value 0.627), were not found to be associated with bacteriuria.

The association of alcohol use (p value 0.739) and tobacco use (p value 0.678) with asymptomatic

bacteriuria shows that, both were not found to be associated with bacteriuria.

The association of patient's DM duration with asymptomatic bacteriuria shows that patient's DM duration was not found to be associated with bacteriuria (p=0.662)

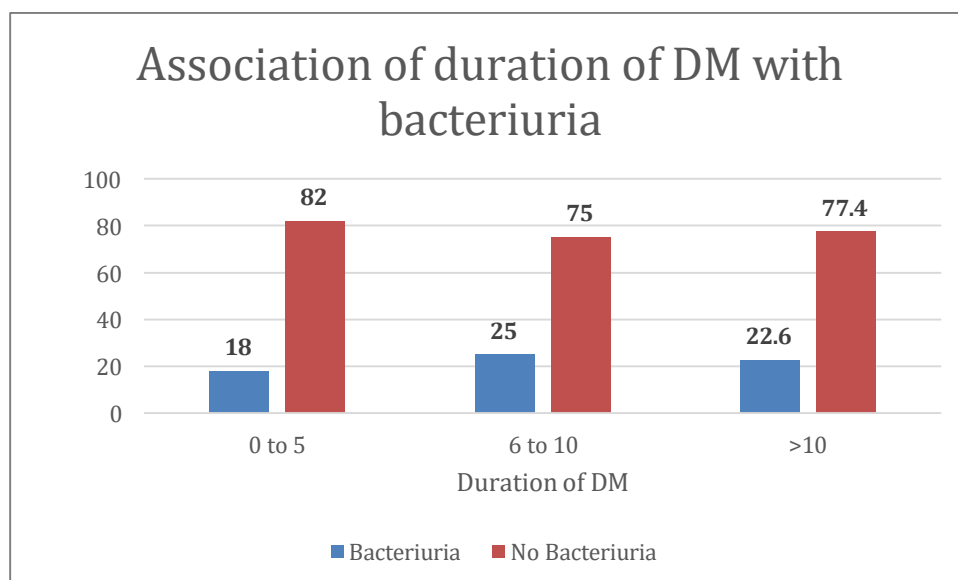


Fig. 9 Chart showing association between duration of Diabetes Mellitus and Bacteriuria

The association of diabetes control status with asymptomatic bacteriuria shows that **diabetes control status was significantly associated with bacteriuria (p value 0.007)**, but other

comorbidities(p value 0.295) were not associated with bacteriuria.

Table 8. Association of diabetes control status with bacteriuria (N=180)

Diabetes control	Bacteriuria n (%)		P value
	Yes	No	
Poor	39 (28)	100 (72)	0.007
Good	1 (2.5)	40 (97.5)	

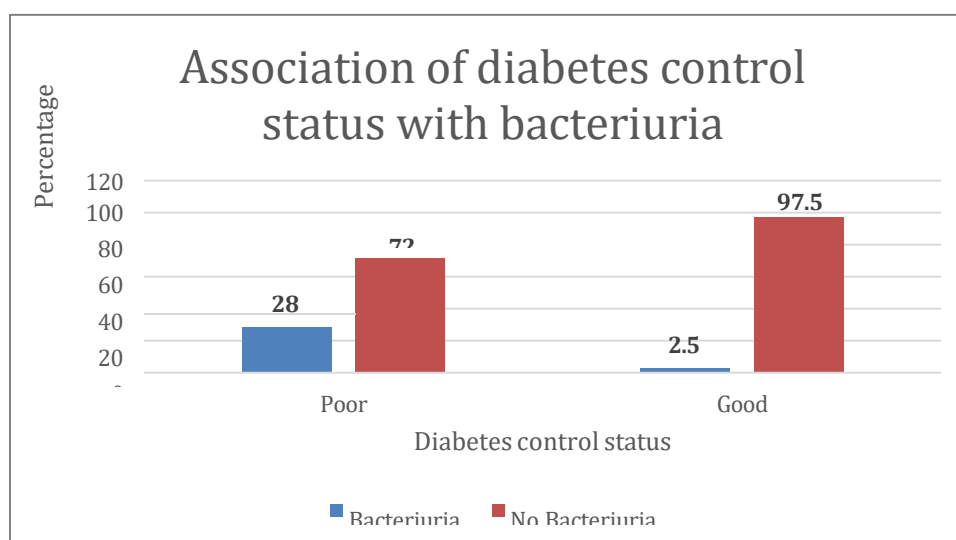


Fig.10 Chart showing association of Diabetes control status with Asymptomatic Bacteriuria



The association of history of UTI with asymptomatic bacteriuria shows that history of UTI with was not found to be associated with bacteriuria ($p=0.121$).

DISCUSSION

This study attempted to find the prevalence of asymptomatic bacteriuria among type 2 diabetes patients and the factors associated with it. Diabetes is a disease with disordered metabolism and increase in sugar level in blood stream due to either lack of production of insulin or due to resistance to insulin or a combination of both. Urinary tract infection is very common among diabetes patients. The mechanism of pathogenesis is not evolved totally, but its suggestive that the increased amount of sugar in urine due to diabetes is creating an environment, that may favour the growth of microorganisms; which leads to symptomatic UTI or ASB. Even though lots of literature is available on ASB, very limited evidence is available for ASB in T2DM patients from southern India. Also, ASB leads to serious complications if not properly managed.¹³

The differences between asymptomatic bacteriuria and symptomatic urinary tract infection is that the asymptomatic bacteriuria has no major clinical implications. Both UTI and ASB denote the presence of bacteria in the urinary tract, however, asymptomatic bacteriuria develops without symptoms attributable to bacteria in the urinary tract. As there is no symptoms associated, the identification of asymptomatic bacteriuria is quite difficult. The diagnosis of asymptomatic bacteriuria requires presence of $\geq 10^5$ bacterial CFUs/mL, except in catheter-associated disease, in which $\geq 10^2$ CFUs/mL is the cut off.¹⁰

The current study among 180 type 2 diabetes patients found that almost one fifth (22%) of the study population had asymptomatic bacteriuria. These findings are similar to a study conducted by Bharathi et al. in which they found that the prevalence of asymptomatic bacteriuria to be 21%.¹⁰ Another study conducted by Venkatesan et al. found the prevalence as 32% in 100 diabetes patients.¹⁴ Also, another study by Vishwanath et al. from Manipal reported that the prevalence of asymptomatic bacteriuria was 4%¹⁵, here this study conducted as a pilot study with a small sample size, leads to a small prevalence.

In the current study, the prevalence of ASB was found to be more in patients with uncontrolled glycemic status having FBS >125 or PPBS >180 mg/dl. Out of 40 asymptomatic bacteriuria -positive patients, 32 (80%) were found to have FBS >125 or PPBS >180 mg/dl and 8 (120%) patients had FBS <125 or PPBS <180 mg/dl. There was a positive association between diabetic control and asymptomatic bacteriuria. In a similar study, from Punjab reported a same result.¹⁰ Another study reported significantly higher prevalence in poor

glycemic control in ASB positive as compared with ASB- negative patients.¹⁶ Another study by Bonadio et al. reported a prevalence of ASB was 17.5% and the higher HbA1c levels was a significant risk factor for asymptomatic bacteriuria.¹⁷ But this study was conducted among 228 diabetic women patients. A study by Ajay Adhikaree et al. observed that overall prevalence of ASB was 10.3% and patients with poor glycemic control had higher prevalence of ASB in comparison to those with good glycemic control.¹⁸

In the present study, *E. coli* was the most common organism identified in urine analysis, and it was reported as 18 (45%) cases., followed by *Candida* in eight (20%), *Klebsiella* in seven (17.5%), *Pseudomonas* in five (12.5%), and *Citrobacter* in two case (5.0%). *E. coli* being the most common etiological agent in urinary tract infections due to its toxins and adhesions, pili or fimbriae. This toxins and adhesions, pili or fimbriae allow adherence to uroepithelial cells and prevent bacteria from urinary lavage. This allows multiplication and tissue invasion, which plays an essential and critical role in the infectious process because they mediate the initial mucosal colonization of the host. These adhesins enable the bacterium to recognize specific cell surface receptors in the uroepithelium of the host.^{19,20} A study by Simkhada et al. also reported a similar finding where *E. coli* was the most common organism isolated, found in 11 (52.38%) cases, followed by *Klebsiella* in three (14.28%), *Pseudomonas*, two (9.52%) each, and *Acinetobacter*.²¹ In another study by Rijal et al. was found the most commonly isolated organism was *E. coli* (47.7%), followed by *K. pneumoniae* (18.6%) and *Streptococcus pyogenes* (2.3%).²²

A study conducted by Bissong et al. found that out of 265 participants, asymptomatic bacteriuria was found in 33.2% of participants. Coagulase-negative staphylococci were the predominant organisms (36.3%) isolated. Others included *Klebsiella* (15.9%), *Candida* (13.7%), *E. coli* (10.8%) and *Serratia* (10.8%).¹³

Another study was conducted by Boyko et al., who concluded that among the antibiotics, aminoglycosides (34%), NFT (21%), and gatifloxacin (14%) had good activity against the isolates and could be used for treatment.²³

Duration of DM had a negative association in the present study. This result was similar to various other studies.²⁴⁻²⁶ A different finding was reported by a study among Type-2 diabetic women along the sea coast might be due to the presence of other risk factor like nephropathy in their study making asymptomatic bacteriuria common even in early period of diabetes.²⁷

Even though age is a well-known risk factor for bacteriuria in patients without diabetes and there are studies that reported age as an important risk factor for ASB in T2DM patient,²⁸ the present study found that age had no significant relation with asymptomatic bacteriuria ($p = 0.396$). This might be due to the uneven distribution



of study participants in our study where only a smaller number of participants belonged to an age less than 45 years.

LIMITATION

One of the limitations is, as with all other cross-sectional studies, temporal association could not be established with this study, since there is always a chance of reverse causal association and hence a cohort study with a long follow up would have been more ideal.

CONCLUSION

A total of 180 diabetes patients participated in the study. Response rate was 100%. The mean (SD) age of the participants was 56 (12) years. The prevalence of asymptomatic bacteriuria was 22.2 % (95% CI 16.4-29.0). *Escherichia coli* (45%) was the most common organism causing ASB followed by *Candida* (20%), *Klebsiella* (18%), *Pseudomonas* (13%), and *Citrobacter*. The association of gender with asymptomatic bacteriuria shows female patients had more risk of getting asymptomatic bacteriuria. And this finding was found to be significant ($p=0.003$).

The association of diabetes control status with asymptomatic bacteriuria shows that diabetes control status was significantly associated with bacteriuria ($p=0.007$). The association of history of UTI with asymptomatic bacteriuria shows that history of UTI was not found to be associated with bacteriuria ($p=0.121$). This finding opens our eyes broader since there is an alarmingly high prevalence of ASB among type 2 diabetes patients. Screening programmes to identify the ASB at early stage is a need of the hour. Interventions to educate the patients regarding the importance of checking the presence of pathogens in urine is important.

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