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Prevalence and Antibiotic Susceptibility of Urinary Tract Infections in Diabetic and Non-Diabetic Individuals: A Prospective Study

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ABSTRACT

Background & Objectives: The increasing prevalence of Diabetes mellitus is one of today's major emerging health problems in most developing countries like India. In many studies it is discovered that diabetic individuals are more prone to catching UTIs. And with emergence of drug resistant uropathogens the treatment of UTI with empirical drugs is not as effective. So, the goal of this study is to determine the prevalence and etiology of uropathogens causing UTIs in diabetics. Comparative study of etiological distribution and overall susceptibility pattern among diabetic and non-diabetic individuals.

Materials and Methods: A cross-sectional prospective study on 220 individuals was carried out from March to April 2023 to determine the spectrum of pathogens causing urinary tract infections and to determine their antibiotic susceptibility profile. Primary cultures were done on standard Mcconkey and sheep blood agar to determine growth and selecting bacterial isolates. Identification & AST was done with the Vitek2 system and Kirby Bauer's disc diffusion method on Muller Hinton Agar.

Results: Among the 220 samples tested 150 samples showed significant bacteriuria. Of 48 diabetic individuals 36 (75%) were found positive for UTI's, prevalence of UTI was more common in females in comparison to males in both diabetic and normal population.In this study, 135 (61.4%) gram negative bacilli and 12 (5.5%) gram positive cocci were isolated, among which E.coli (52.7%) was the most common uropathogen followed by Klebsiella (25.3%), Pseudomonas (6.7 %), Citrobacter (3.3%), Acinetobacter (2%) and Proteus (2%). Among the gram positive organisms, Enterococcus (5.3%) was the highest followed by Staphylococcus spp. (2.7%). Candida isolates were detected in 3 cases (2%).

Meropenem (87.6%) was the most susceptible antibiotic for gram negative bacilli followed by Netilmycin (87.6%), Imipenem (82.5%), Amikacin (82%) and Fosfomycin (81%). For the gram positive organisms Imipenem, Nitrofurantoin, Gentamicin, Vancomycin and Linezolid were all found to be highly susceptible antibiotics followed by Ciprofloxacin, Rifampin. For gram positive organisms Ampicillin, Ampicillin sulbactam, Ticarcillin clavulanic, Minocycline and for the gram negative organisms Ciprofloxacin, Ampicillin sulbactam, Doxycycline were found to be highly resistant.

Conclusion: E.coli is still the most common uropathogen in both diabetic and normal populations. Sensitivity to meropenem, imipenem, amikacin and fosfomycin are still highly retained and may be prescribed for complicated UTI. Routine monitoring of drug resistance patterns will help to identify the resistance trends regionally. This will help in the empirical treatment of UTIs to the clinicians.

Keywords: UTI, Uropathogens, Diabetes, Antibiotic susceptibility, Resistance, Sensitivity, Vitek2.

INTRODUCTION

Diabetes mellitus (DM) is a metabolic syndrome usually characterized by abnormally elevated levels of blood glucose. It is defined by deficiency of insulin secretion by pancreas or inability of the body to utilize insulin. Increasing prevalence of diabetes is an alarming situation throughout the world and is a serious health problem, in most developing countries. In many studies it is concluded that individuals with DM show higher prevalence to many infectious diseases[6,7,26].

Poor control over diabetes, impaired renal function and nonspecific or specific immunity have not been shown to be substantial contributors to the increased occurrence of morbidity of UTI among patients with diabetes. Hyperglycemia by itself alone does not provide enough evidence to be causing predictable increase in uropathogens in individuals with DM.[11]

Urinary tract infections (UTI) are the one of the most common infections after the infections of the respiratory tract. The symptoms of UTI may vary from mild asymptomatic cystitis to pyelonephritis and septicemia[17,21]. Most of the research done in recent years conclude that there is clinical evidence pointing to the higher prevalence of UTIs among individuals with DM[19,25]. And has a higher risk factor to evolve into complicated or serious conditions.

UTI is the second most common clinical indication that employs use of empirical antibiotics for treatment. And since hyperglycemia and hypertension are major risk factors for complicated UTI. So, diabetic individuals are found to be at a higher risk to develop serious bacteriuria[9,14].

Pathogenesis and etiology of UTI

Urinary tract infection (UTI) is a disease in which microbial growth in the urinary tract causes bacteriuria and inflammation in the urinary tract. The urinary tract consists of kidneys, uterus, bladder, and urethra. UTI can cause inflammation of the urethra known as urethritis, inflammation of kidney nephrons called pyelonephritis, and inflammation of the bladder called cystitis[1,5].

Symptomatic infection of the bladder due to bacteriuria is called cystitis and its symptoms includes; dysuria, hematuria, pyuria, and continuous urge to urinate. Infection of the upper urinary tract and kidneys is called pyelonephritis. Symptoms usually include fever, nausea, vomiting, pyuria, and is confirmed by the finding presence of significant bacteriuria in urinalysis and urine culture in case along with these symptoms[3,13].

Asymptomatic UTI is defined with the presence of significant bacteriuria without the symptoms of an acute urinary tract infection. Asymptomatic bacteriuria is quite common in poorly controlled diabetic individuals commonly of a complication called diabetic nephropathy in which due to continuous level of elevated blood glucose kidney stats filtering small amount of glucose along with other waste resulting in presence of glucose in urine known as glycosuria.

UTI are most common bacterial infections in both males and females, but it is seen more frequently in females[10,12]. There are many routes by which uropathogens can invade and spread within the urinary tract, but the ascending route is the most common site for bacteria to enter the body. In the ascending route pathogenic bacteria ascend from the perineum and rectum to enter the urinary tract causing bacterial infections.. In an uncomplicated UTI usually only the bladder is involved. And when the bacteria invades the mucosal wall of the bladder, it causes an inflammatory reaction called cystitis[11,18,21].

Asymptomatic UTIs are commonly treated with different broad-spectrum empirical antibiotics. But the emergence of antibiotic resistant bacteria is a major global public health problem in both nosocomial and

community-acquired infections[1,3,6]. The problem is even more challenging in most developing countries with low socio-economic conditions, because of high prevalence of cases, irresponsible uses of antibiotics, with poor hygiene and infection prevention practices[7,15].

RATIONALE OF THE STUDY

So, in view of the increasing antibiotic resistance, regular monitoring of resistance patterns of uropathogen is necessary to improve use of empirical antibiotics to ensure appropriate treatment. And to do that current local knowledge of the organisms that cause UTI and their antibiotic susceptibility testing is necessary.

Objectives of study

- To determine the prevalence of UTI cases in diabetic and non-diabetic individuals.
- To study the antimicrobial susceptibility patterns of underlying uropathogens.
- Comparative study of etiological distribution and overall susceptibility pattern among diabetic and non-diabetic individuals.

LITERATURE REVIEW

Most of the research done in recent years conclude that there is clinical evidence pointing to the higher prevalence of infectious diseases like UTI's among individuals with DM. Asymptomatic bacteriuria can be defined as presence of bacteria in the urine with absence of urinary infection symptoms, a common clinical finding that often warrants a decision about whether to initiate antimicrobial therapy. There are few indications for treatment of asymptomatic bacteriuria with commonly used empirical drugs, but using inappropriate drugs for treatment contributes to the development of antimicrobial resistance[10,15].

From recent studies around the world, the resistance rate of various drugs is different for different regions of the world which is suspected to be due to availability of some drugs in certain regions. Since the use of empirical drugs is concerned with resistance rates of uropathogens knowledge of resistance patterns is important to reduce the risk of further development of drug resistance bacteria. Resistance rate of 20 % can be considered an acceptable limit for use of empirical drugs for treatment of UTIs[3,13].

UTI is caused by both GNB & GPC. However,according to most studies, commonly encountered bacteria are Gram negative in which E. coli is found to be the most common bacterial uropathogen worldwide. E.coli being the predominant aetiological agent in community practice[1,11]. Other bacterial agents include species of Klebsiella, Enterobacter, Proteus, Pseudomonas, Staphylococcus, Streptococcus and Enterococcus faecalis. As is evident from the results, this study demonstrated E coli to be the predominant aetiological agent (44.96%) amongst the gram negative bacilli and Staphylococcus aureus amongst the gram positive bacteria (92.3%) as the causative agents of UTI The isolates of most of the species exhibited a high rate of resistance to Ampicillin, Co-trimoxazole, Cefozolin, Norfloxacin and Nitrofurantoin. Resistance to antibiotics develops due to its frequent misuse[4].

Though some studies indicate that there's not much significance, the difference in resistance of the uropathogens to the antibiotics was found similar in patients with and without DM. The Pseudomonas resistance to ciprofloxacin was stated to be very high but at a similar rate in patients with and without DM[7].

METHODOLOGY

Study Type and Population

A cross-sectional prospective study was carried out for 2 months in the year 2023, from March to April

2023. Urine samples of a total 220 individuals were taken at random from the Microbiology department and were analyzed for this study.

Screening of diabetic individuals was done by taking measures of their glycosylated hemoglobin (HbA1c) levels. All samples were cultured to obtain isolates for identification and sensitivity testing.

Inclusion criteria:

Samples from all patients with a presumptive case of UTI were included in the study. Individuals having HbA1c level of ≥ 7 were considered as diabetic. Of all 220 individuals in study 48 (21.8%) were found diabetic of which there were 22 males and 26 females.(As shown in table1).

Inoculation of primary isolation culture media

The urine samples were processed using standard microbiological procedures. The specimens were directly inoculated on dried media plates of McConkey and Sheep Blood agar, by standard sterile nichrome loop streaking method and incubated at 37°C for 24 hr and 48 hr for negative cases. A growth of ≥ 10^5 colony forming units/mL was considered as significant bacteriuria causing UTIs.

Table1: Distribution of Population with gender.

Distribution of Population with gender	Male	Female
Diabetic	22	26
Non-diabetic	79	93

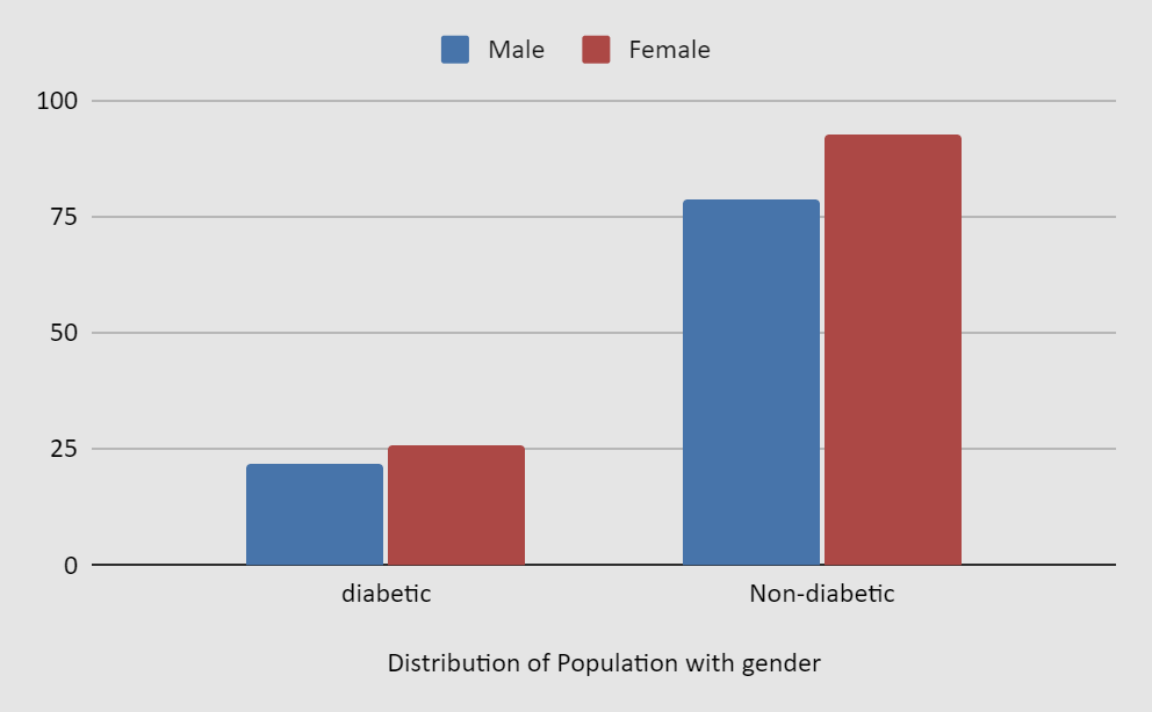

Fig 1: Distribution of diabetic population with gender

Identification of isolates and determination of antimicrobial susceptibility

Primary identification was by reading the shape, size and characteristics of bacterial colonies cultured on the Macconkey and sheep blood agar plates. And biochemical tests like catalase, coagulase and oxidase.

Identification of bacterial species and the antibiotic susceptibility testing of both Gram-positive and Gram-negative isolates were determined with the automated VITEK 2 system (bioMérieux, France) using GN, GP and AST cards. The VITEK 2 system is a fully automated system for bacterial identification and antibiotic susceptibility testing. The system detects bacterial growth and metabolic changes in the microwells of plastic cards using advanced colorimetry based technology.

GN ID cards were used for the identification and AST-GN 405 cards for susceptibility testing of Gram-negative bacteria. While the GP ID cards were used for the identification and AST-GP 628 cards for susceptibility testing of Gram-positive bacteria. Every card contains one positive control well with no antibiotic (growth-promoting broth only) and multiple wells with increasing concentrations of various antibiotics in the broth. Growth in the control well shows that the test isolate is viable and appropriate for drug susceptibility testing. MIC is determined by comparing the growth of the patient isolate to the growth of isolates with known MIC.

A test tube containing the bacterial suspension in saline solution was placed into a rack (cassette) and the identification card was placed in the neighboring slot while placing another transfer tube corresponding to the suspension tube. All card types were automatically incubated at 35.5 ± 1.0 °C. Final identification results were obtained in approximately 12-18 hrs.

Antibiotics used for sensitivity testing of GNB in AST-GN405 cards:

Amikacin, Augmentin, Azteronam ,Ampicillin Sulbactam, Cefepime, Cefoperazone sulbactam, Cefepime Tazobactam, Ceftriaxome, Cefuroxime, Ciprofloxacin, Doripenem, Doxycycline, Ticareillin Clavuanic, Gentamicin, Imipenam, Ertapenem, Co-Trimoxazole, Levofloxacin, Minocycline, Meropenam, Netilmicin, Nitrofurantoin, Piperacillin Tazobactam, Fosfomycin, Colistin.

Antibiotics used for sensitivity testing of GPC in AST-GP 628 cards:

Ampicillin, Augmentin, Amoxicillin, Ampicillin Sulbactam, Ciprofloxacin, Rifampin Doxycycline, Teicoplanin, Ticarcillin clavulanic, Gentamicin, Imipenam, Levofloxacin, Minocycline, Nitrofurantoin, Daptomycine, Penicillin-g, Vancomycin, Linezolid, Piperacillin-tazobactam, Tetracycline.

Manual sensitivity testing using Kirby Bauer's disc diffusion method on Muller Hinton Agar was also employed for some antibiotics to serve as comparison for AST data from the Vitek2 system. ATCC strains were used as quality control of both identification and sensitivity testing.

Statistical Analysis: All of the data was entered and analyzed using IBM SPSS statistics version 26.

RESULT

A total of 220 urine samples were processed in microbiology laboratory tests. Of which a total of 150 samples showed significant bacteriuria. A total 0f 48 individuals were found to be diabetic after surveying their HbA1c levels(having HbA1c level greater than 7). Of all 48 diabetic individuals 36 (75%) were found positive for UTI's, prevalence of UTI was more common in females in comparison to males in both diabetic and normal population(Table 4).

In this study of all 150 positive cultures, 135 (61.4%) gram negative and 12 (5.5%) gram positive bacteria were isolated, among which E.coli (52.7%) was the most common uropathogen followed by Klebsiella (25.3%), Pseudomonas (6.7 %), Citrobacter (3.3%), Acinetobacter (2%) and Proteus (2%). Among the gram positive organisms, Enterococcus (5.3%) was the highest followed by Staphylococcus spp. (2.7%). Candida isolates were detected in 3 cases (2%). Table 5 & Table 6 are showing distribution and frequency of all the isolates identified during study.

Isolates of gram negative bacteria were more prevalent than gram positive bacteria in causing urinary tract infections. Among all GNB isolates E.coli from enterobacteriaceae family were the most common uropathogen in both diabetic and non-diabetic individuals(Table 4). The pattern of antibiotic sensitivity and resistance of the organisms were variable. E.coli being the most prevalent isolate showed most resistance to Azteronam, Ampicillin Sulbactam, Ceftriaxone and Cefuroxime (Table 7).

Table 2: Distribution of results from primary culture

	Diabetic	Non-diabetic
No growth	12	58
Growth	36	114
Total	48	172

Table 3: Gender based distribution of population

	Frequency	Percent
Male	101	45.9
Female	119	54.1
Total	220	100.0

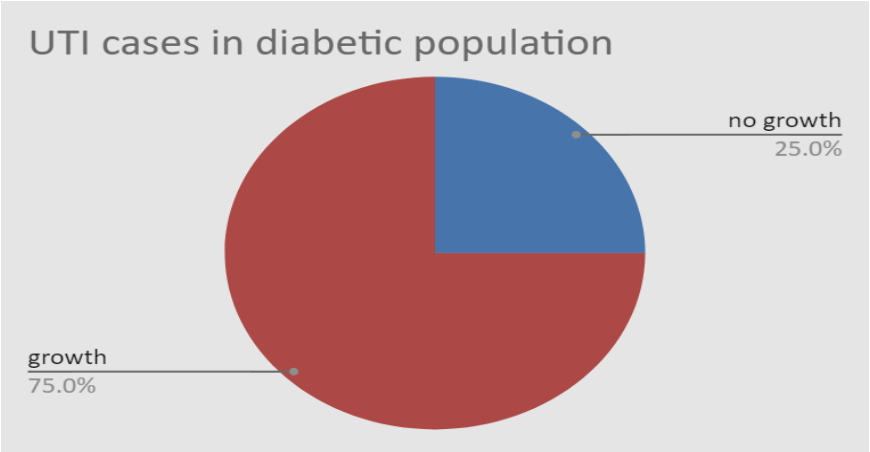

Fig 2: Prevalence of UTI cases in diabetic population

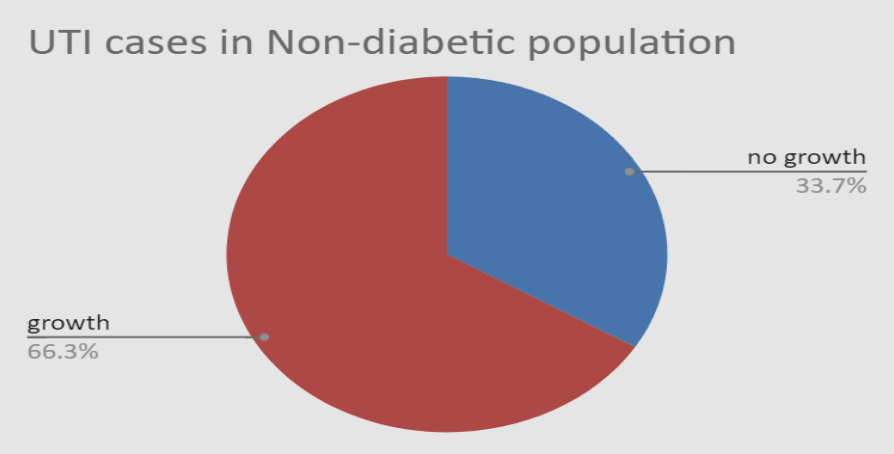

Fig 3: Prevalence of UTI cases in non-diabetic population

Table 4: Primary distribution of isolates obtained from reading culture plates.

	diabetic		Non-diabetic	
	Male	Female	Male	Female
No growth	8	4	24	34
Gram-positive	1	1	6	4
Gram-negative	13	21	48	53
Byc	0	0	1	2

Table 5: Distribution of Isolates identified from all cultures

	Male		Female	
	diabetic	Non-diabetic	diabetic	Non-diabetic
No growth	8	24	4	34
E.coli	8	29	13	29
Klebsiella	3	12	4	16
Enterococcus faecalis	1	3	1	3
Pseudomonas aeruginosa	0	4	2	4
Citrobacter ferndii	0	3	1	1
Proteus mirabilis	0	0	1	2
Candida albicans	0	1	0	2
Acinetobacter	2	0	0	1
Staphylococcus saprophyticus	0	3	0	1

Table 6: Distribution of organisms causing UTI

Distribution of Organism		
	Frequency	Percent
E.coli	79	52.7
Klebsiella	35	23.3
Enterococcus faecalis	8	5.3
Pseudomonas aeruginosa	10	6.7
Citrobacter ferndii	5	3.3
Proteus mirabilis	3	2.0
Candida albicans	3	2.0
Acinetobacter	3	2.0
Staphylococcus saprophyticus	4	2.7
Total	150	100.0

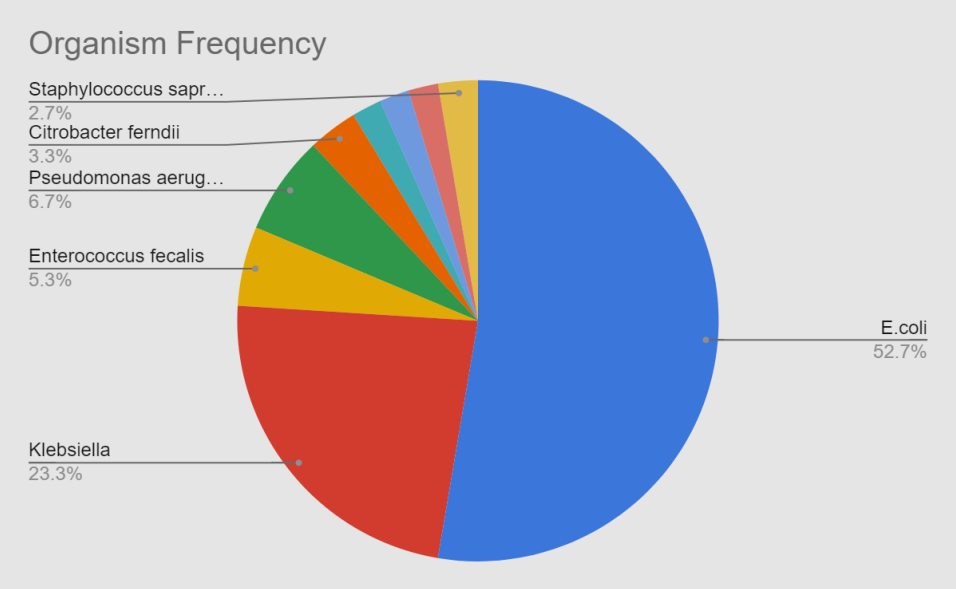

Fig 4: Distribution of isolates in UTI

Antibiotic resistance pattern

The susceptibility testing of Gram-negative bacteria was done for a total of 25 antibiotics included in AST-GN 405 card and overall results are summarized in Table 7. Overall resistance pattern of GNB isolates was graphically represented in Fig 5. Meropenem (87.6%) was the most susceptible antibiotic for gram negative bacilli followed by Netilmycin (87.6%), Imipenem (82.5%), Amikacin (82%) and Fosfomycin (81%).

The susceptibility testing of Gram-positive bacteria done for the 20 antibiotics included in AST-GP 628 card and overall results are summarized in Table 8. Overall resistance pattern of GPC isolates was graphically represented in Fig 6. .For the gram positive organisms Imipenem, Nitrofurantoin, Gentamicin, Vancomycin and Linezolid were all found to be highly susceptible antibiotics followed by Ciprofloxacin, Rifampin.

Overall for gram positive organisms Ampicillin, Ampicillin sulbactam, Ticarcillin clavulanic, Minocycline showed high resistance rates and are not suitable to prescribe for treatment of UTIs without proper sensitivity testing (Fig 6). And for the gram negative organisms Ciprofloxacin, Ampicillin sulbactam, Doxycycline were found to be highly resistant (Fig 5).

Table 7: Sensitivity testing of all Gram negative isolates

		Organism					
Antibiotics		E.coli	Klebsiella	Pseudomonas aeruginosa	Acinetobacter	Citrobacter ferndii	Proteus mirabilis
Amikacin	RESISTANT	12	5	3	1	2	0
	SENSITIVE	63	28	7	3	3	3
	MODERATELY SENSITIVE	5	2	0	0	0	0
Augmentin	RESISTANT	28	13	5	3	4	2

	SENSITIVE	38	14	5	1	1	1
	MODERATELY SENSITIVE	14	8	0	0	0	0
Aztreonam	RESISTANT	42	21	5	3	4	2
	SENSITIVE	38	14	5	1	1	1
	MODERATELY SENSITIVE	0	0	0	0	0	0
Ampicillin-Sulbactam	RESISTANT	42	21	5	3	4	2
	SENSITIVE	38	14	5	1	1	1
	MODERATELY SENSITIVE	0	0	0	0	0	0
Cefepime	RESISTANT	28	13	5	3	4	2
	SENSITIVE	52	22	5	1	1	1
	MODERATELY SENSITIVE	0	0	0	0	0	0
Cefoperazone Sulbactam	RESISTANT	31	16	3	1	2	0
	SENSITIVE	49	19	7	3	3	3
	MODERATELY SENSITIVE	0	0	0	0	0	0
Cefepime-Tazobactam	RESISTANT	27	13	3	1	2	0
	SENSITIVE	47	19	5	1	1	1
	MODERATELY SENSITIVE	6	3	2	2	2	2
Ceftriaxone	RESISTANT	38	19	6	3	4	2
	SENSITIVE	42	16	4	1	1	1
	MODERATELY SENSITIVE	0	0	0	0	0	0
Cefuroxime	RESISTANT	38	20	6	3	4	2
	SENSITIVE	42	15	4	1	1	1
	MODERATELY SENSITIVE	0	0	0	0	0	0
Ciprofloxacin	RESISTANT	45	23	7	3	4	2
	SENSITIVE	21	9	3	1	1	1
	MODERATELY SENSITIVE	14	3	0	0	0	0
Doripenem	RESISTANT	19	11	1	0	0	0
	SENSITIVE	56	22	9	4	5	3
	MODERATEL	5	2	0	0	0	0

	Y SENSITIVE						
Doxycycline	RESISTANT	37	19	5	1	1	1
	SENSITIVE	38	14	5	3	4	2
	MODERATELY SENSITIVE	5	2	0	0	0	0
Ticareillin-Clavuanic	RESISTANT	31	18	4	2	2	2
	SENSITIVE	37	13	4	1	1	1
	MODERATELY SENSITIVE	12	4	2	1	2	0
Gentamicin	RESISTANT	22	10	3	1	2	0
	SENSITIVE	58	25	7	3	3	3
	MODERATELY SENSITIVE	0	0	0	0	0	0
Imipenem	RESISTANT	15	8	1	0	0	0
	SENSITIVE	65	27	9	4	5	3
	MODERATELY SENSITIVE	0	0	0	0	0	0
Ertapenem	RESISTANT	10	6	1	0	0	0
	SENSITIVE	58	24	7	3	3	3
	MODERATELY SENSITIVE	12	5	2	1	2	0
Co-Trimoxazole	RESISTANT	21	12	2	0	0	0
	SENSITIVE	59	23	8	4	5	3
	MODERATELY SENSITIVE	0	0	0	0	0	0
Levofloxacin	RESISTANT	30	18	2	0	0	0
	SENSITIVE	31	12	8	4	5	3
	MODERATELY SENSITIVE	19	5	0	0	0	0
MInocycline	RESISTANT	20	10	3	1	1	1
	SENSITIVE	55	23	7	3	4	2
	MODERATELY SENSITIVE	5	2	0	0	0	0
Meropenem	RESISTANT	10	6	1	0	0	0
	SENSITIVE	70	29	9	4	5	3
	MODERATELY SENSITIVE	0	0	0	0	0	0
Netilmicin	RESISTANT	10	6	1	0	0	0
	SENSITIVE	70	29	9	4	5	3

	MODERATELY SENSITIVE	0	0	0	0	0	0
Nitrofurantoin	RESISTANT	5	3	1	0	0	0
	SENSITIVE	52	22	6	3	3	3
	MODERATELY SENSITIVE	23	10	3	1	2	0
Piperacillin-Tazobactam	RESISTANT	37	19	4	1	2	0
	SENSITIVE	38	13	6	3	3	3
	MODERATELY SENSITIVE	5	3	0	0	0	0
Fosfomycin	RESISTANT	19	6	1	0	0	0
	SENSITIVE	61	29	9	4	5	3
Colistin	RESISTANT	35	15	4	1	1	1
	SENSITIVE	11	3	0	0	0	0
	MODERATELY SENSITIVE	34	17	6	3	4	2

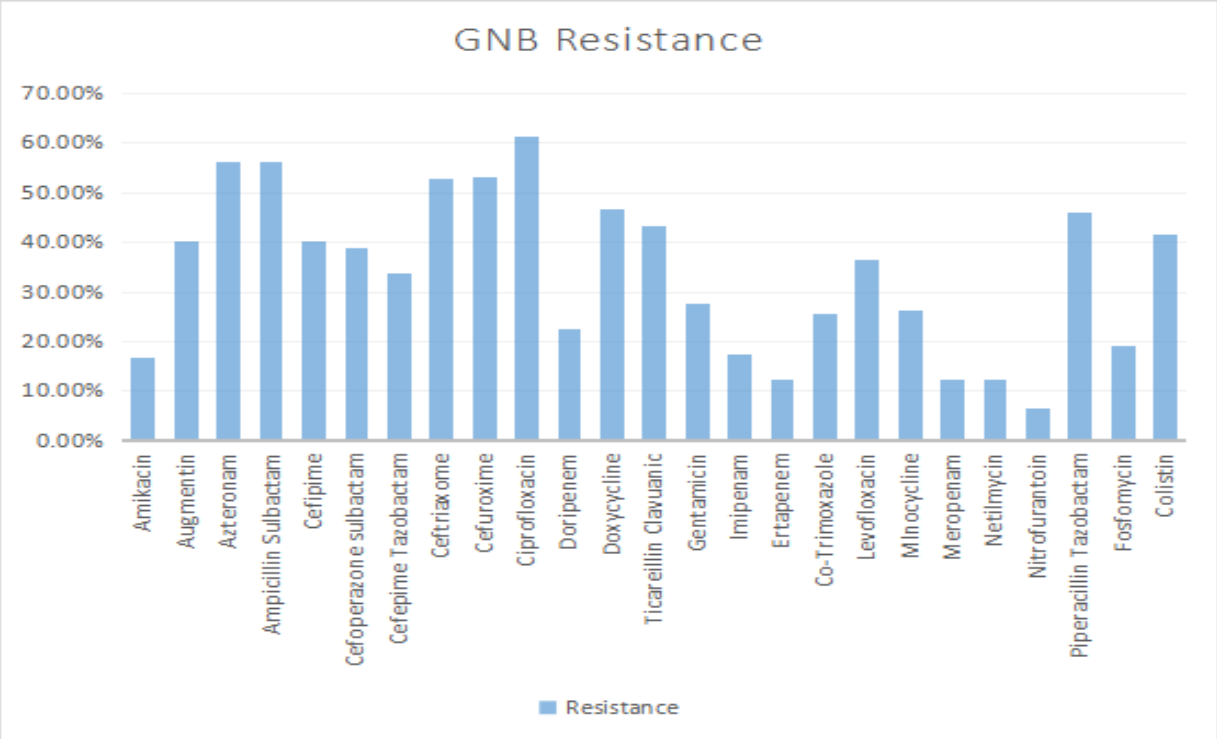

Fig 5: Overall Resistance patterns of Gram negative organisms

Table 8: Sensitivity testing of all Gram positive isolates

		GPC	
Antibiotics		Enterococcus faecalis	Staphylococcus saprophyticus
Ampicillin	RESISTANT	3	1
	SENSITIVE	3	2
	MODERATELY SENSITIVE	2	1
Augmentin	RESISTANT	0	1
	SENSITIVE	6	2
	MODERATELY SENSITIVE	2	1
Amoxicillin	RESISTANT	1	0
	SENSITIVE	6	4
	MODERATELY SENSITIVE	1	0
Ciprofloxacin	RESISTANT	0	0
	SENSITIVE	7	2
	MODERATELY SENSITIVE	1	2
Rifampicin	RESISTANT	0	0
	SENSITIVE	7	4
	MODERATELY SENSITIVE	1	0
Doxycycline	RESISTANT	2	0
	SENSITIVE	5	3
	MODERATELY SENSITIVE	1	1
Teicoplanin	RESISTANT	1	1
	SENSITIVE	4	1
	MODERATELY SENSITIVE	3	2
Ticarcillin Clavulanic	RESISTANT	2	1
	SENSITIVE	6	2
	MODERATELY SENSITIVE	0	1
Gentamicin	RESISTANT	0	0
	SENSITIVE	7	4
	MODERATELY SENSITIVE	1	0
Imipenem	RESISTANT	0	0

	SENSITIVE	8	4
	MODERATELY SENSITIVE	0	0
Levofloxacin	RESISTANT	0	0
	SENSITIVE	7	3
	MODERATELY SENSITIVE	1	1
Minocycline	RESISTANT	2	1
	SENSITIVE	4	3
	MODERATELY SENSITIVE	2	0
Nitrofurantoin	RESISTANT	0	0
	SENSITIVE	6	3
	MODERATELY SENSITIVE	2	1
Daptomycine	RESISTANT	2	0
	SENSITIVE	3	4
	MODERATELY SENSITIVE	3	0
Penicillin	RESISTANT	2	1
	SENSITIVE	5	3
	MODERATELY SENSITIVE	1	0
Vancomycin	RESISTANT	0	0
	SENSITIVE	7	3
	MODERATELY SENSITIVE	1	1
Linezolid	RESISTANT	1	0
	SENSITIVE	5	4
	MODERATELY SENSITIVE	2	0
Piperacillintazobactam	RESISTANT	0	2
	SENSITIVE	7	2
	MODERATELY SENSITIVE	1	0
Tetracycline	RESISTANT	1	2
	SENSITIVE	4	1
	MODERATELY SENSITIVE	3	1

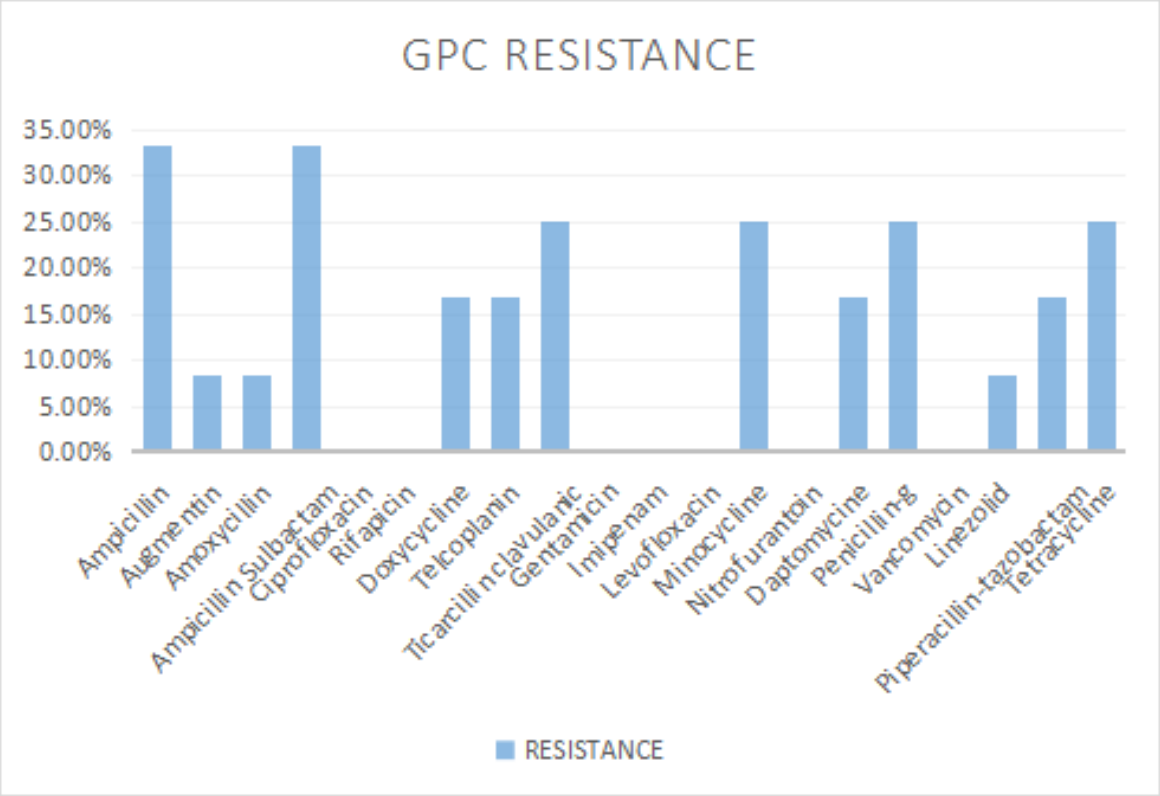

Fig 6: Overall Resistance patterns of Gram positive organisms

DISCUSSION

UTIs are one of the most common infections diagnosed worldwide. However, with the emergence of antibiotic resistant bacteria the management of UTIs has become more difficult with common empirical antibiotics[2,5,26]. And employing resistant antibiotics for management of UTIs also adds to the increase in the prevalence of multidrug resistant bacterial isolates[16,24].

In this study we tried to determine whether there are differences in the etiology of UTI causing bacteria and in the antibiotic sensitivity patterns of the uropathogens causing UTI in diabetic and non-diabetic patients[7].

In this study out of the 48 diabetic individuals 36 individuals about 75% showed significant bacteriuria (Table 2)(Fig 2). Diabetic individuals showed greater than prevalence of UTI in non-diabetic individuals, 66.3% of all non-diabetic individuals showed significant bacteriuria (Fig 3). In this study it is observed that both gram negative and gram positive bacterias can cause UTI with different percentages (Table 4). Samples with a colony count of 10^5 CFU/ml were considered confirmed cases of UTI and were considered for identification and susceptibility testing.

Like most of recent studies, it is evident that prevalence of gram-negative bacteria causing UTI is much greater than gram-positive (Table 4). Among all GNB isolates obtained in current study E.coli is the most common pathogen responsible for causing urinary infections which is the same for all related recent studies[1,3,7,16,26] (Fig4).

There are few indications to treat UTIs, but employing inappropriate antibiotics without knowing etiology of pathogens for treatment is a major contributor to the development of multidrug resistance among uropathogens[7,15,25]. So, it is necessary to keep on monitoring the resistance pattern of different isolates in the population to avoid development of resistance of bacteria.

Limitation of the study

Since this study used a hospital- based non-probability random sampling method, there's a possible bias that hinders the generalization of the results to all DM patients in the community. Study has no data regarding the degree of glycemic control and type of diabetes.

The lack of clinical information to confirm the source of infection, as to whether the UTI cases in this study were hospital or community-acquired. And whether the individual has contracted symptomatic or asymptomatic bacteriuria were the major limitations of the present study**.**

CONCLUSION

In this study out of the 48 diabetic individuals 36 individuals about 75% showed significant bacteriuria (Table 2)(Fig 2), which is greater than prevalence of UTI in the normal population. E.coli isolates were the most common pathogen responsible for causing UTIs in both diabetic and non-diabetic populations. Antibiotics like meropenem, imipenem, amikacin and fosfomycin are found to be the most sensitive and can be prescribed by physicians for treatment of complicated UTI. The isolates of bacterial uropathogens showed higher resistance rates for commonly used empirical antimicrobials.

In this study many bacterial isolates showed multidrug resistance (Fig 5)(Fig 6). So, the knowledge of resistance patterns of routinely isolated uropathogens in a particular region or hospital may provide better options to physicians regarding the use of empirical antibiotics for treatment of UTI. Hence, routine monitoring of antibiotic resistance patterns will help to avoid the indiscriminate use of antibiotics and prevent the further development of antimicrobial resistance and administer the proper treatment to manage UTIs.

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APPENDIX-I

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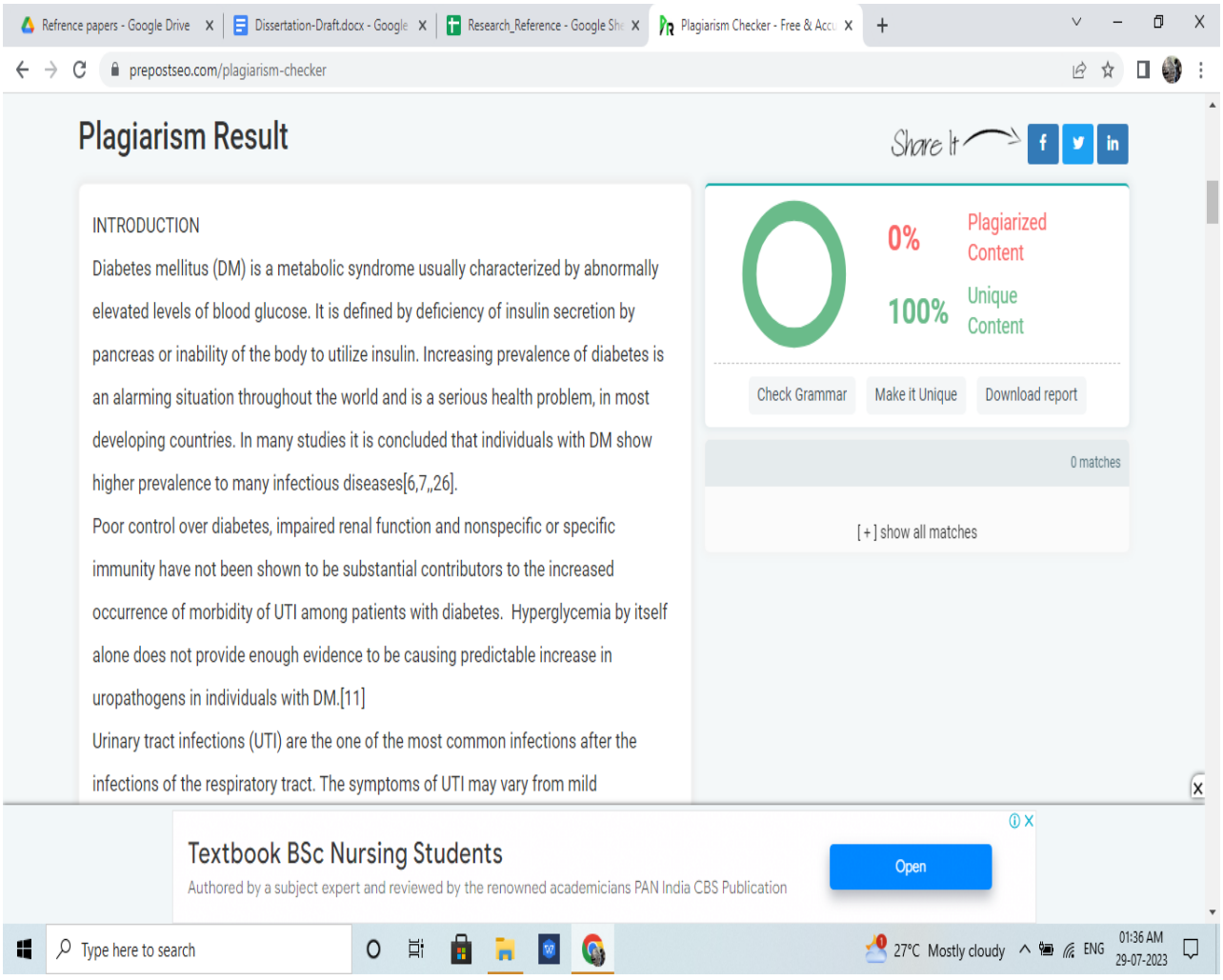

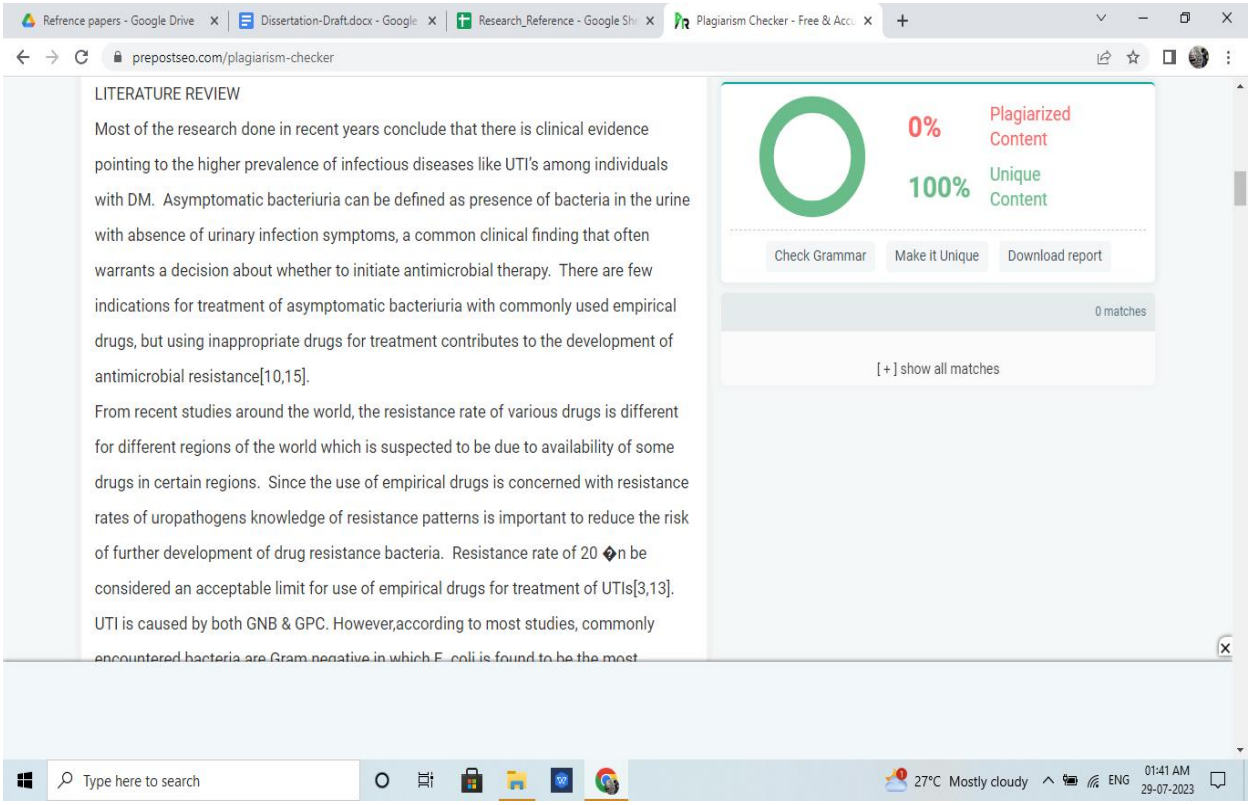
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LITERATURE REVIEW
Most of the research done in recent years conclude that there is clinical evidence pointing to the higher prevalence of infectious diseases like UTI's among individuals with DM. Asymptomatic bacteriuria can be defined as presence of bacteria in the urine with absence of urinary infection symptoms, a common clinical finding that often warrants a decision about whether to initiate antimicrobial therapy. There are few indications for treatment of asymptomatic bacteriuria with commonly used empirical drugs, but using inappropriate drugs for treatment contributes to the development of antimicrobial resistance[10,15].
From recent studies around the world, the resistance rate of various drugs is different for different regions of the world which is suspected to be due to availability of some drugs in certain regions. Since the use of empirical drugs is concerned with resistance rates of uropathogens knowledge of resistance patterns is important to reduce the risk of further development of drug resistance bacteria. Resistance rate of 20 n be considered an acceptable limit for use of empirical drugs for treatment of UTIs[3,13].
UTI is caused by both GNB & GPC. However,according to most studies, commonly
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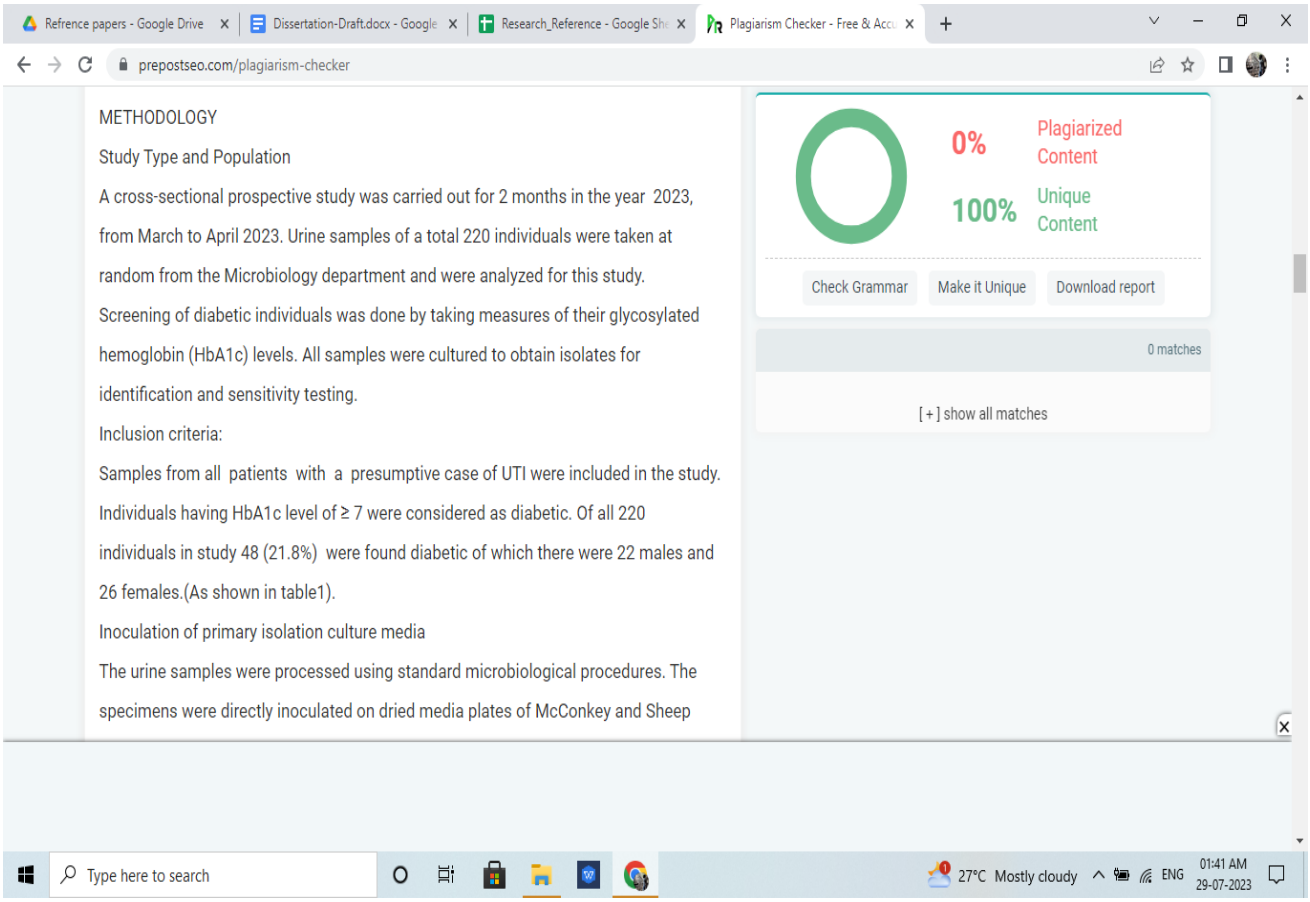
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METHODOLOGY
Study Type and Population
A cross-sectional prospective study was carried out for 2 months in the year 2023, from March to April 2023. Urine samples of a total 220 individuals were taken at random from the Microbiology department and were analyzed for this study.
Screening of diabetic individuals was done by taking measures of their glycosylated hemoglobin (HbA1c) levels. All samples were cultured to obtain isolates for identification and sensitivity testing.
Inclusion criteria:
Samples from all patients with a presumptive case of UTI were included in the study. Individuals having HbA1c level of ≥ 7 were considered as diabetic. Of all 220 individuals in study 48 (21.8%) were found diabetic of which there were 22 males and 26 females.(As shown in table1).
Inoculation of primary isolation culture media
The urine samples were processed using standard microbiological procedures. The specimens were directly inoculated on dried media plates of McConkey and Sheep
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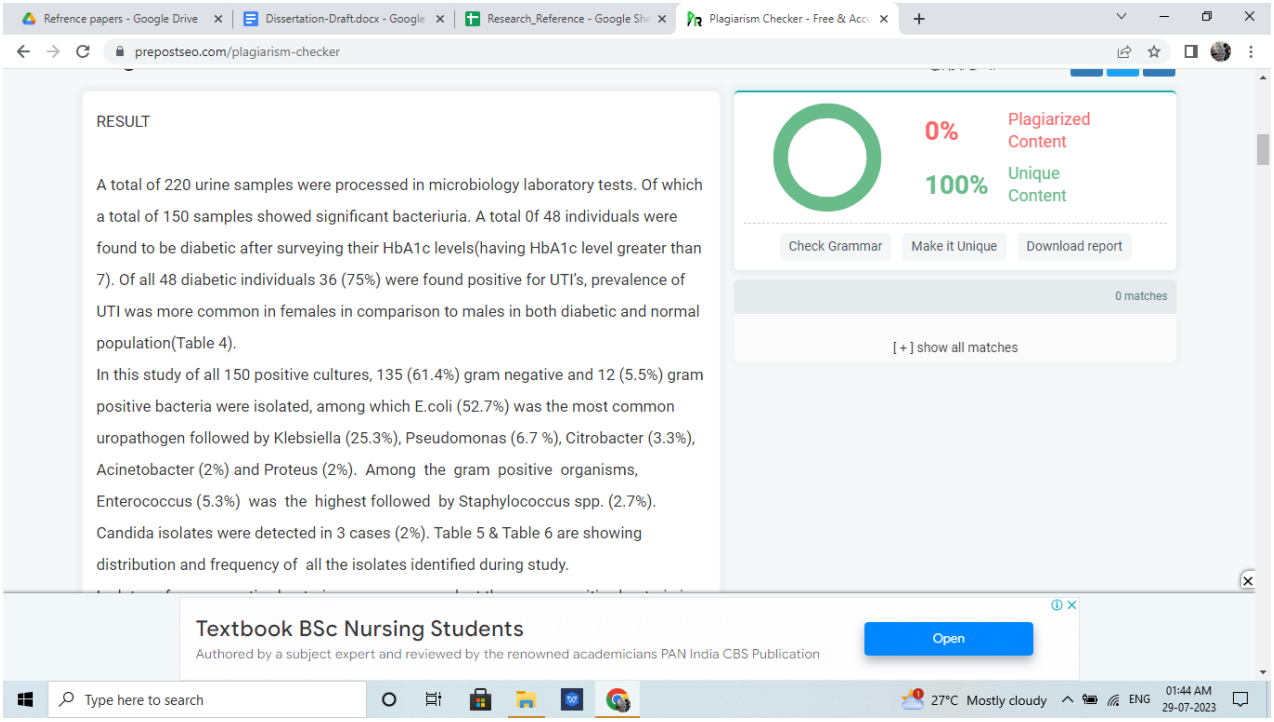

APPENDIX-II

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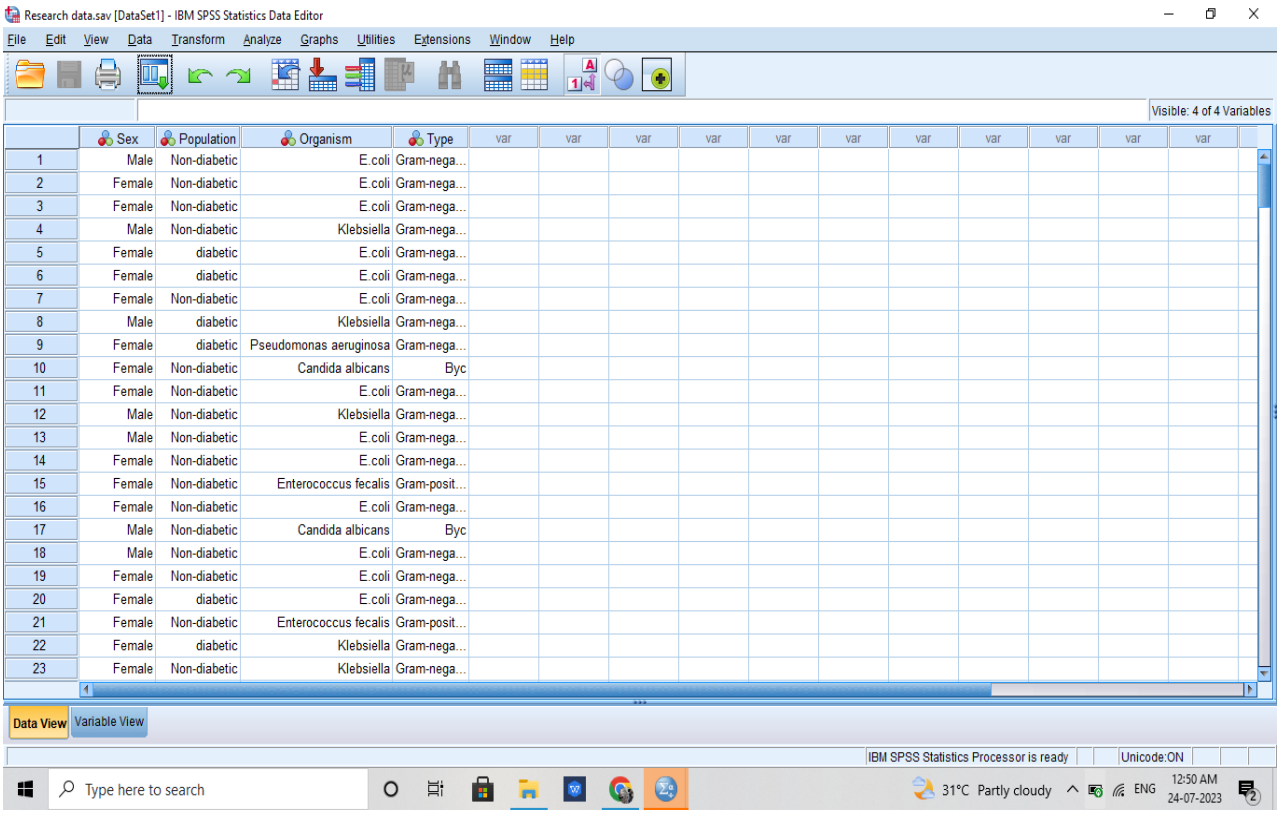

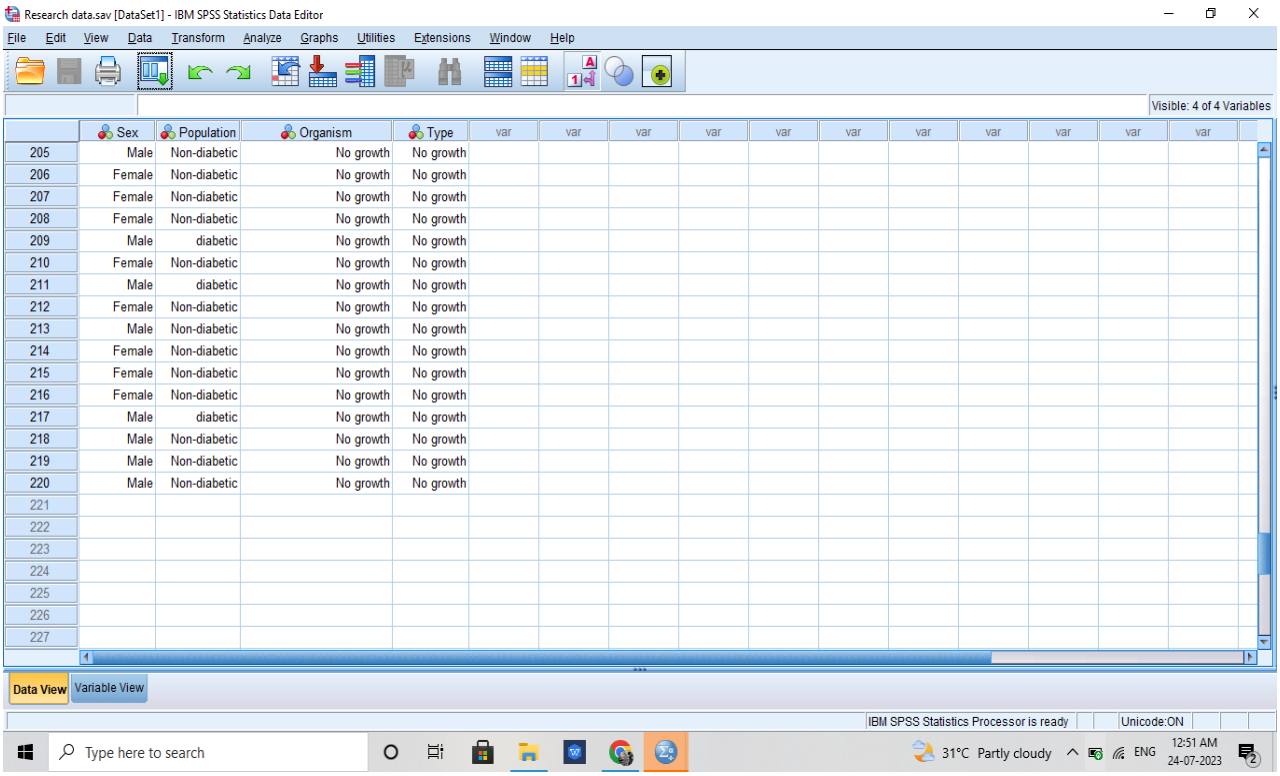
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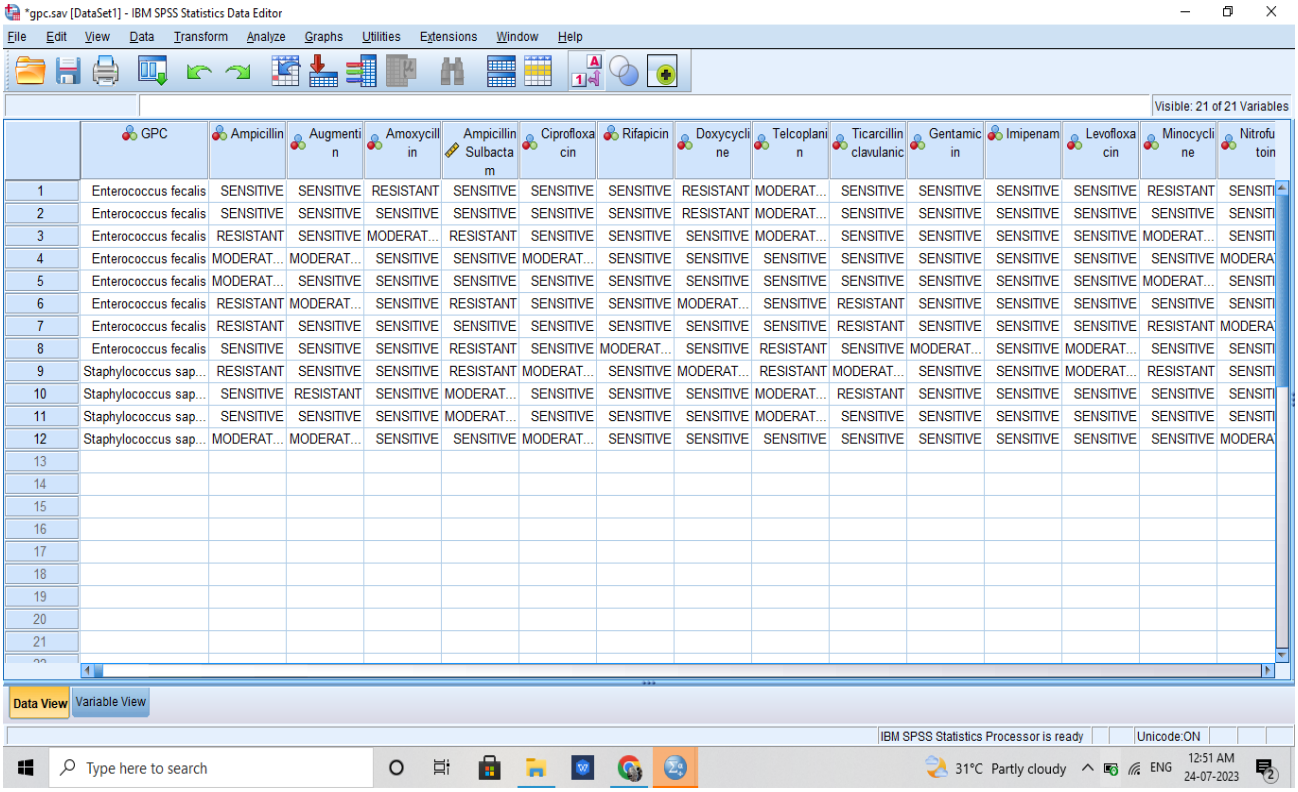
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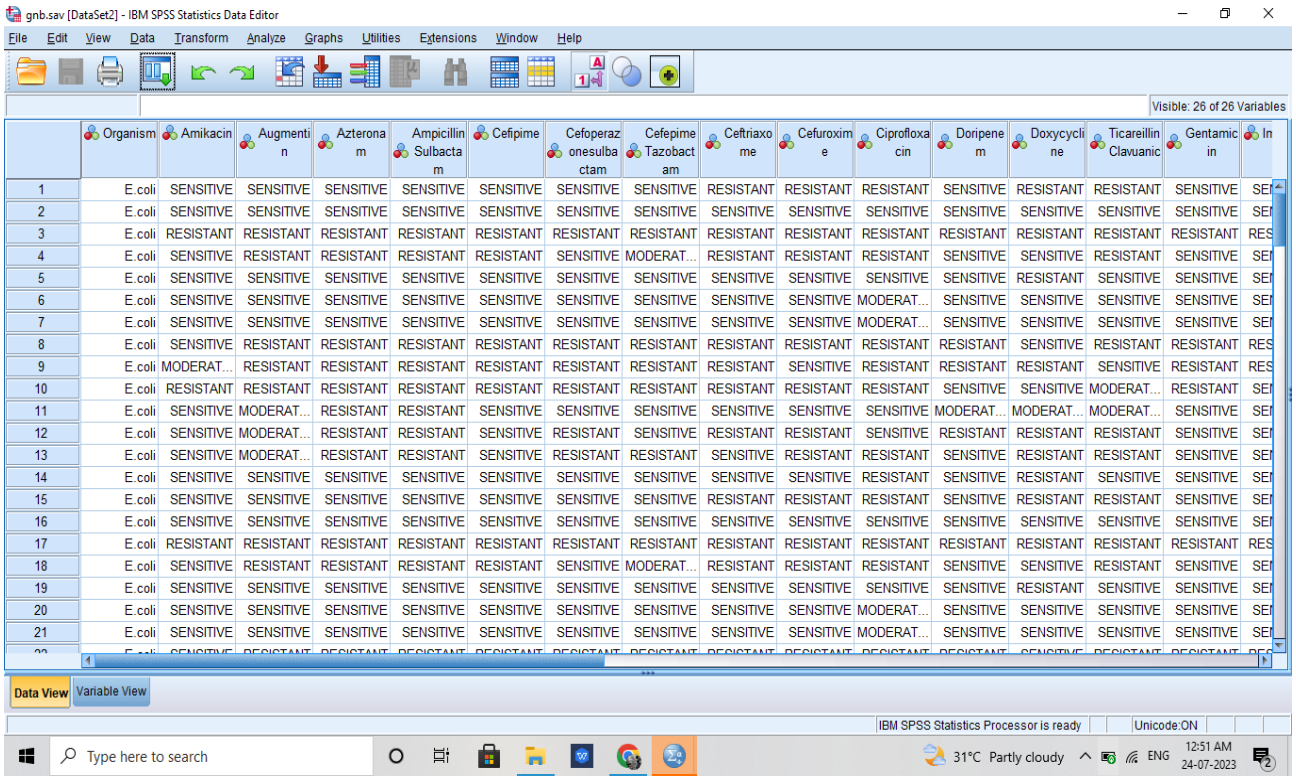
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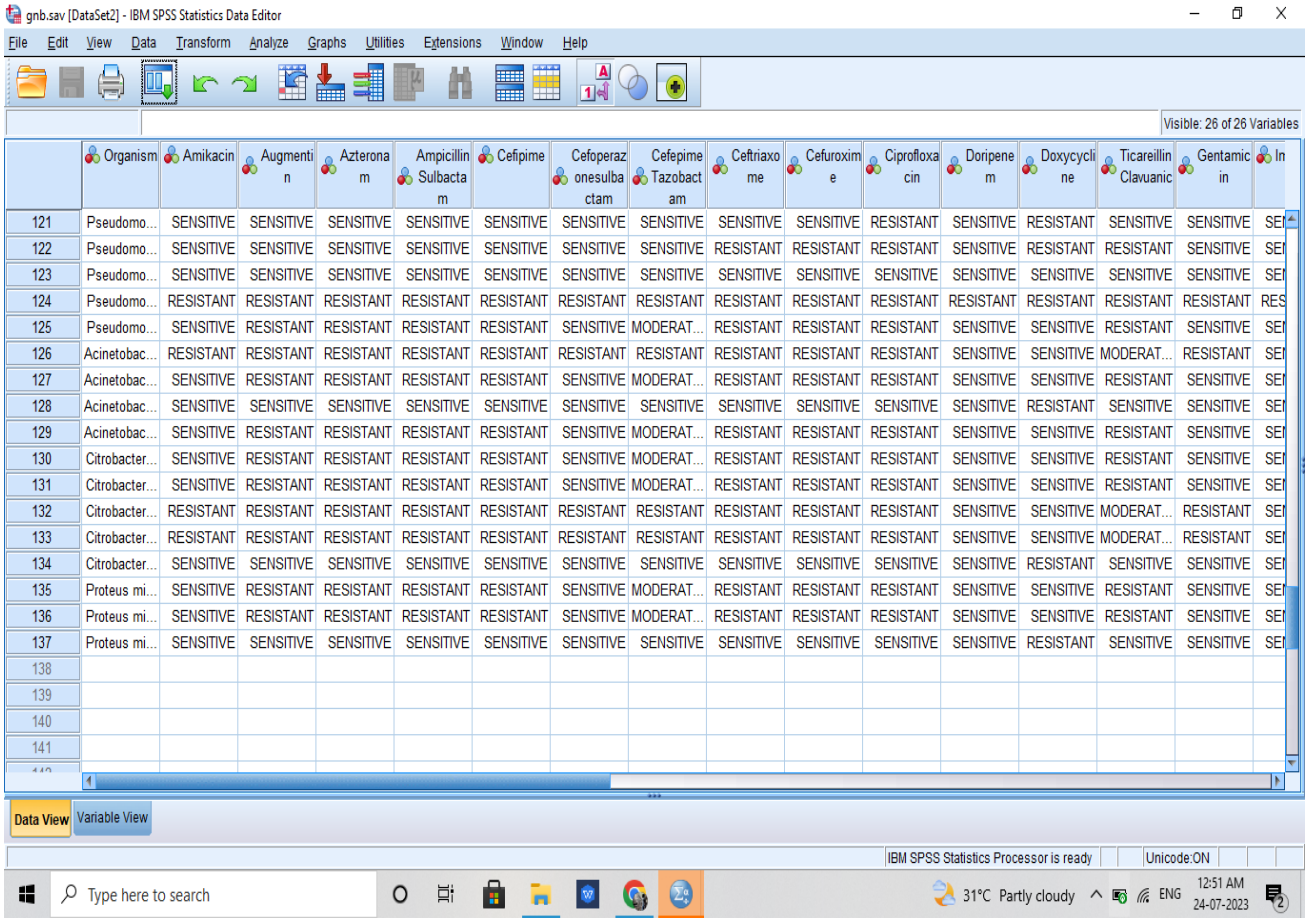
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