International Journal of Science and Research Archive
eISSN: 2582-8185
Cross Ref DOI: 10.30574/ijsra
Journal homepage: https://ijsra.net/

(RESEARCH ARTICLE)

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PREVALENCE OF UROPATHOGENIC *KLEBSIELLA* SPECIES IN WOMEN ATTENDING GYNECOLOGICAL CLINIC AT FEDERAL MEDICAL CENTER MAKURDI, BENUE STATE, NIGERIA

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International Journal of Science and Research Archive, 2026, 21(02), 108–113

Publication history: Received on 20 September 2026; revised on 02 November 2026; accepted on 04 November 2026

Article DOI: https://doi.org/10.30574/ijsra.2026.21.2.1974

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ABSTRACT

The study aimed to determine the prevalence of Klebsiella species in women attending gynecological clinic at Federal Medical Center, Benue state. A total of 400 urine samples were collected from women attending gynecological clinic for analysis. Standard microbiological methods were employed for the isolation and identification of bacteria. Also, antibiotic susceptibility test was carried out using Kirby-Bauer disk diffusion method. Data generated were analyzed using SPSS and presented as descriptive statistics with statistical significance set at $P<0.05$. Out of the 400 urine samples, 14(11%) samples were positive to Klebsiella. The study proved that there is no significant different in the association of uropathogenic Klebsiella with ages (P=0.682) and employment status (P=0.611) of the women attending gynaecological clinic however, significant differences were reported in marital status (P=0.001) of the women. The risk of recent hospitalization (P=0.003), use of antibiotic (P=0.003) and direction of anal cleaning ($(\chi^2 = 36.006$, df = 1, $p < 0.001)$ has significant differences in association with uropathogenic infections. The study demonstrated gentamicin (100%) susceptibility on uropathogenic Klebsiella isolates.

Keywords: *Klebsiella*, ggynecology, Hypervirulence, Uropathogenic and Urinary Tract infections.

1 INTRODUCTION

Klebsiella species are rod-shaped, non-motile, capsulated genus of Gram-negative bacteria [1]. Variant strains of *Klebsiella* include *Klebsiella pneumonia*, *K. quasipneumonia*, *K. varicola*, *K. aerogenes*, *K. ozaenea*, *K. rhinoscleromatis*, *and K. granulomatis*. However, the most common uropathogenic strain include *K. pneumonia*, *K. quasipneumonia*, *K. aerogenes*, *and K. oxytoca* [2]. Uropathogenic *Klebsiella* species are reported as the causative agent of chorioaminitis which lead to Preterm Premature Rupture of Membrane (PPROM) [3]. Hypervirulent strains of *Klebsiella* causes uterine abscess and postpartum endometritis as well as granuloma inguinale [3]. It is very important to understand the risk factors, preventive measures,

therapeutic options and genetic diversity of uropathogenic strains of *Klebsiella*. The study determine the prevalence of uropathogenic *Klebsiella* in women attending gynecological clinic at Federal Medical Center Makurdi, Benue State Nigeria.

2 MATERIALS AND METHODS

2.1 Study area

The study was carried out at Federal Medical Center (FMC) Makurdi. It is a tertiary hospital with high standard gynecological unit. The hospital is located in Makurdi, the capital of Benue state North Central of Nigeria.

2.2 Sample size determination

The minimum sample size (n) of 400 required was estimated using the formula $N=4pq/d^2$ [4]. N=required sample size. P (reported prevalence rate) = 6/6%. Q (the degree of precision) = 1-p. D=0.05. Therefore, the sample size (n) $=1.96^2 \times 0.25$ (1-0, 25)^2 / $(0.05)^2$ =289. Even though 289 samples were estimated, however, 400 urine samples were collected to increase precision and account for missing data.

2.3 Sample collection

Urine samples (400) were collected in urine samples bottles from women attending gynecological clinic at Federal Medical Center Makurdi, Benue State. The urine samples were labelled accordingly and transported for isolation and analysis of *Klebsiella* isolates [5]

2.4 Bacteriological sample analysis

The urine samples were serially diluted and inoculated on MacConkey agar plates. The plates were incubated at a temperature of 37 ^{o} C for 18-24hours. The single colonies that appeared mucoid and pink were picked and streaked on the plate of fleshly prepared media. Sub-culturing was done until a pure culture containing only *Klebsiella* colonies were produced. Gram's stain reaction and relevant biochemical tests such as rapid spot test, Voges-proskauer test, catalase test, urease test, oxidase test, and motility test were carried out [5]

2.5 Antibiotic susceptibility test by Kirby-Bauer method

An antibiotic impregnated disc was placed on the surface of pure colonies of *Klebsiella* on the pure culture. The plates were incubated at a temperature of 37 ^{o} C for 18 hours favorable for their growth. Appearance of clear zone of inhibition indicated antibiotic susceptibility of the *Klebsiella* isolates however absence of clear zone of inhibition indicated antibiotic resistance of the uropathogenic *Klebsiella* isolates. Therefore, the area of zone of inhibition was measured in millimeter [5].

2.6 Data analysis

The result from the sample analysis were entered into a spreadsheet and encrypted for data security. Backup-up copies were stored in a hard disc for reserve. Data cleaning was carried out to improve data quality. Descriptive analysis was done during which data was presented in bar charts, figures and tables for easy comprehension of the data. The results were also expressed using frequency and percentages. The data analysis was done using Statistical Product and Service Solution (SPSS) version 29. A chi-square test was employed and $P<0.05$ was considered to be statistically Significant [5].

3 RESULTS

A total of 400 urine samples were collected from women attending gynecological clinic and were screened for uropathogenic *Klebsiella*. Out of the urine samples, 44 (11.0%) were positive to uropathogenic species while 356 (89.0%) were negative.

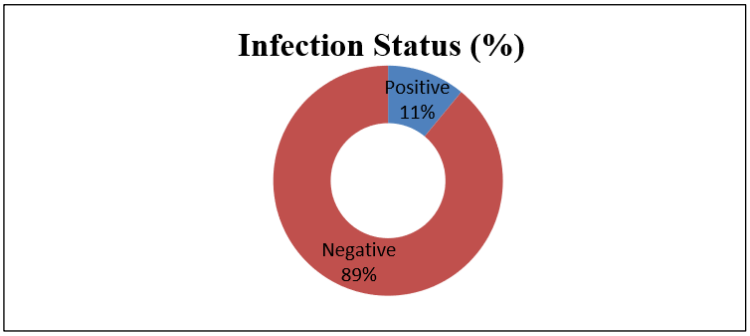


Figure 1: Doughnut chart showing the infection status among women attending the gynecological clinic.

3.1 Association between demographic characteristics and uropathogenic *Klebsiella*

The difference in prevalence across the age groups was not statistically significant (χ^2 = 2.295, df = 4, p = 0.682). Marital status showed a statistically significant association with uropathogenic *Klebsiella* (χ^2 = 28.028, df = 5, p = 0.001). The highest prevalence occurred among divorced and cohabiting women. Employment status was not significantly associated with uropathogenic *Klebsiella* positivity (χ^2 = 8.185, df = 4, p = 0.085).

3.2 Associated between the prevalence of uropathogenic *Klebsiella* species and risk factors in women attending gynecological clinic Federal Medical Center Makurdi.

A strong statistically significant association (p=0.001) was observed between recent hospitalization and uropathogenic *Klebsiella* positivity. No statistically significant difference was reported (χ^2 = 1.036, df = 1, p = 0.309) among women with recent catheter/speculum exposure. Also, no significant association was observed (χ^2 = 0.010, df = 1, p = 0.922) in women with a previous history of Urinary Tract Infection (UTI). Frequency of antibiotic use was significantly associated with uropathogenic *Klebsiella* positivity (χ^2 = 33.122, df = 2, p = 0.001). A significant association was observed between the direction of anal cleaning and uropathogenic *Klebsiella* positivity (χ^2 = 36.006, df = 1, **p < 0.001**).

3.3 Antibiotic susceptibility pattern of uropathogenic *Klebsiella* isolates

Gentamicin demonstrated 100% susceptibility, whereas all other tested antibiotics demonstrated 100% resistance among the 24 reported *Klebsiella* isolates

Table 1: Prevalence of Uropathogenic *Klebsiella* with respect to demographic characteristics in women attending gynecological clinic at Federal Medical Center, Makurdi

Variable	Category	Screened (n)	Positive n (%)	χ^2	df	p-value	Decision
Age	10–19	34	3 (8.82)				
	20–29	27	2 (7.41)				
	30–39	108	11 (10.19)				
	40–49	114	11 (9.65)	2.295	4	0.682	Not significant
	≥50	117	17 (14.53)				
Marital status	Single	144	15 (10.42)				
	Married	206	13 (6.31)				
	Divorced	5	2 (40.00)	28.028	5	0.001	Significant
	Separated	17	5 (29.41)				
	Cohabiting	5	2 (40.00)				
	Widow	23	7 (30.43)				
Employment status	Student	20	1 (5.00)				

	Self-employed	47	3 (6.38)	8.185	4	0.085	Not significant
	Private employed	146	16 (10.96)				
	Civil servant	10	1 (10.00)				
	Unemployed	177	23 (12.99)				

χ^2 = Pearson's chi-square; df = degrees of freedom. Statistical significance was assessed at $p < 0.05$.

Table 2: Associated between the prevalence of Uropathogenic *Klebsiella* species and risk factors in Women Attending Gynecological Clinic Federal Medical Center Makurdi.

Risk factors	Category	Screened (n)	Positive n (%)	χ^2	df	p-value	Decision
Recent hospitalization	Yes	32	22 (68.75)	—	—	0.000	Significant
	No	368	22 (5.98)				
Catheter/speculum	Yes	339	35 (10.32)	1.036	1	0.309	Not significant
	No	61	9 (14.75)				
Previous UTI	Yes	362	40 (11.05)	0.010	1	0.922	Not significant
	No	38	4 (10.53)				
Antibiotic use	Rarely	144	12 (8.33)	33.122	2	0.001	Significant
	Occasionally	250	27 (10.80)				
	Frequently	6	5 (83.33)				
Direction of anal cleaning	Back-to-front	81	24 (29.63)	36.006	1	0.001	Significant
	Front-to-back	319	20 (6.27)				

Exact tests are indicated where the cell frequencies are very small. Statistical significance was assessed at $p < 0.05$.

Table 3: Antibiotic susceptibility pattern of uropathogenic *Klebsiella* isolates

Antibiotic	Susceptible n (%)	Resistant n (%)
Ampicillin	0 (0.00)	24 (100.00)
Gentamicin	24 (100.00)	0 (0.00)
Amoxicillin-clavulanate	0 (0.00)	24 (100.00)
Cefuroxime	0 (0.00)	24 (100.00)
Ceftriaxone	0 (0.00)	24 (100.00)
Cefotaxime	0 (0.00)	24 (100.00)
Ciprofloxacin	0 (0.00)	24 (100.00)
Levofloxacin	0 (0.00)	24 (100.00)
Trimethoprim-sulfamethoxazole	0 (0.00)	24 (100.00)

4 DISCUSSION

The study reported significant prevalence of uropathogenic strains of *Klebsiella* in women attending gynecological clinic. Uropathogenic gynecological *Klebsiella* species can be transmitted through exogenous autoinoculation (hospital

environment) and endogenous autoinoculation (gastrointestinal tract and skin) [6]. The prevalence is consistent with the prevalence reported by [7] in community acquired urinary infection and agree with the prevalence reported [8].

However, the prevalence is lower compare to the prevalence reported by [9]. The difference in prevalence could be as result of target group, diagnostic procedure and geographical location [6]. Older women had higher prevalence than younger women and this could be due to menopausal physiological changes, reduce estrogen, high vaginal pH and reduced *Lactobacillus* associated with older women [10]. A significant association between divorced and uropathogenic *Klebsiella* species could be due to the risk of new untrusted sex partners [10]. The high prevalence in women with low-educational status could be ignorance, poor personal hygiene, poor health education, misuse of antibiotics and delayed treatment associated with illiterates [2]. A Significant association was reported in women with history of recent hospitalization and could be due to the role of *Klebsiella* in nosocomial transmission. Frequent use of antibiotic create biological environment that favor the growth of uropathogenic *Klebsiella* species. A statistical significant association with women that practice back to from anal cleaning might be the risk of transferring enteric *Klebsiella* species from anus into the vagina leading to uropathogenic *Klebsiella* infections.

5 CONCLUSION

The overall study reported a prevalence (11%) in women attending gynecological clinic at Federal Medical Center Makurdi. The study also conclude that uropathogenic species significantly contribute to gynecological illness in women. They increase gynecological problems such as pelvic inflammatory disease, infertility, urinary tract infection, chorioamnionitis and even morbidity.

STATEMENTS ON COMPLIANCE WITH ETHICAL STANDARDS

Acknowledgments

I appreciate my academic mentor Prof. P.T Aernan, Dr. M. Yaji and Dr. J. T Aondofa for their mentorship.

Disclosure of conflict of interest

The authors declare no conflicts of interest regarding this manuscript.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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