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Antimicrobial Resistance Profile of Uropathogenic *Escherichia coli* Isolated in Garaku, Keffi and Mararaban-Gurku Healthcentres, Nasarawa-West Senatorial District, Nasarawa State, Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. Author NYB' designed the study. Author NIH performed the statistical analysis. Author EKO wrote the protocol and first draft of the manuscript. Author ARH managed the analyses of the study. Author DDW managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Aims: This Study is aimed at studying the Antimicrobial Resistance profile of Uropathogenic *Escherichia coli* isolated in Garaku, Keffi and Mararaban-gurku Healthcentres, Nasarawa-West Senatorial District, Nasarawa State, Nigeria.

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Study Design: is a survey research.
Place and Duration of Study: Department of Microbiology, Nasarawa State University, Keffi, between June, 2021 and January,2024**.**
Methodology: 384 urine samples of patients with suspected cases of UTIs were collected and *E. coli* was isolated and identified using standard microbiological methods. Antimicrobial Susceptibility Testing of the isolates was carried out in accordance with the Clinical and Laboratory Standards Institute (CLSI) method.
Results: The occurrence of *E. coli* was 92(24%). The isolates were generally more resistant to Ampicillin (AMP) with 75.0%. Streptomycin (S) 70.7% Cefotaxime (CTX) 68.5% but less resistant to Ciprofloxacin (9.8%) followed by Gentamicin 17.4%. The commonest resistance phenotype was AMC-AMP-CAZ-CTX-S-SXT (5.4%). Most of the isolates showed multiple antibiotic resistance (MAR) Index of above 0.2 with the commonest MAR Index at GHK, GHG and MCM-g of 0.7(21.4%), 0.4(28.0%) and 0.3(23.1%) respectively. The antibiotics resistant *E. coli* isolates were grouped into different categories of antibiotic resistance namely: Non Multiple Drug Resistance (NMDR); Excessive Drug Resistance (XDR); Multiple Drug Resistance (MDR) and Pan Drug Resistance (PDR). The occurrence of classes of antibiotic resistance was of the orderMDR75(81.5%) > NMDR9(9.8%) >XDR7(7.6%) > PDR 1(1.1%).
Conclusion: with the results from this research, *E. coli* being non susceptible to many antimicrobials is a clear indication that, prescription of these antimicrobials by physicians and usage by patients must be done with diligence and utmost care and vigorous campaign by stakeholders must be step up to bring to the barest minimum incidences of Antimicrobial resistance.

Keywords: Escherichia coli; Urine; Antimicrobial; Resistance; susceptibility

1. INTRODUCTION

Gram-positive species, such as *Staphylococcus* spp and *Streptococcus* spp and the Enterobacteriaceae, such as *Escherichia coli, Klebsiella pneumoniae* and *Proteus mirabilis*, are the common etiological agents of UTIs [1,2].

After Respiratory infection disease, Urinary tract infections (UTI) is next to reasons why patients in both developed and developing countries visit health facilities [2]. *E. coli* is the most implicated agent in UTIs. Treatment and control of UTIs are achieved through therapy with different classes of antibiotics [2]. The β-lactam, fluoroquinolones, aminoglycosides and sulfamethoxazole /trimethoprim [2] have greater activity against gram-negative bacteria, Resistance developed against these classes of antimicrobial agents and others by bacteria have limited their successful application to manage UTIs.

The increasing therapeutic failure observed in empirical treatment using antimicrobial agents has become important to identify the pattern of susceptibility and resistance of bacterial agents, through *in vitro* antimicrobial susceptibility testing, which can guide the therapeutic approach [2].

Reports from some parts of Nigeria on antimicrobial resistance among *E. coli* from urine of suspected UTIs cases are available [3-5].There is no known study on the resistance profile of *E. coli* or other common agents of UTI in the study area that is known to the author. This informed the choice of the Study area (Nasarawa-West Senatorial District, Nasarawa state, Nigeria) having the three (3) health facilities; General Hospital Keffi (GHK); General Hospital Garaku (GHG) and Medical Centre Mararaban-gurku (MCM-g) as study centres. Understanding the profile of resistance to antimicrobial agents recovered from this study centres will guide the facilities managers in their choice of antimicrobials for empirical treatment of their patients.

2. MATERIALS AND METHODS

2.1 Study Location

The study was carried out in the following health facilities in Nasarawa State, Nigeria, namely: General Hospital Garaku (GHG), General Hospital Keffi (GHK), and Medical Centre Mararaban-Gurku (MCM-g). Fig. 1-3 shows respectively, Map of Nigeria showing the Map of Nasarawa State located in Central Nigeria, Map of Nasarawa State showing the three Senatorial Districts and the Nasarawa-West senatorial where the three health facilities are located. The choice of the three study centres is premise on them being the most populated towns within the Nasarawa-West Senatorial Districts with good

patients turn out as well as serving as referral Centres by the nearby towns and villages' health facilities because of availability of qualify health professionals as well as equipments and facilities.

2.2Study Population

The targeted population in the Nasarawa-West Senatorial District in this research was about 716,802 being the last population figure (Nigeria 2006 Census - Nasarawa State - Wikipediahttps://en.wikipedia.org) using General Hospital Garaku (GHG), General Hospital Keffi (GHK) and Medical Centre Mararaban-gurku (MCM-g) as study Centres. See Table 1 (https://nasarawastate.gov.ng/map-of-nasarawa-state/)

Table 1. Nasarawa-West Senatorial Zones, Nasarawa State, Nigeria

Nasarawa-West senatorial district	716,802
KARU	205,477
KEFFI	92,664
KOKONA	109,749
NASARAWA	189,835
TOTO	119,077

https://nasarawastate.gov.ng/map-of-nasarawa-state/

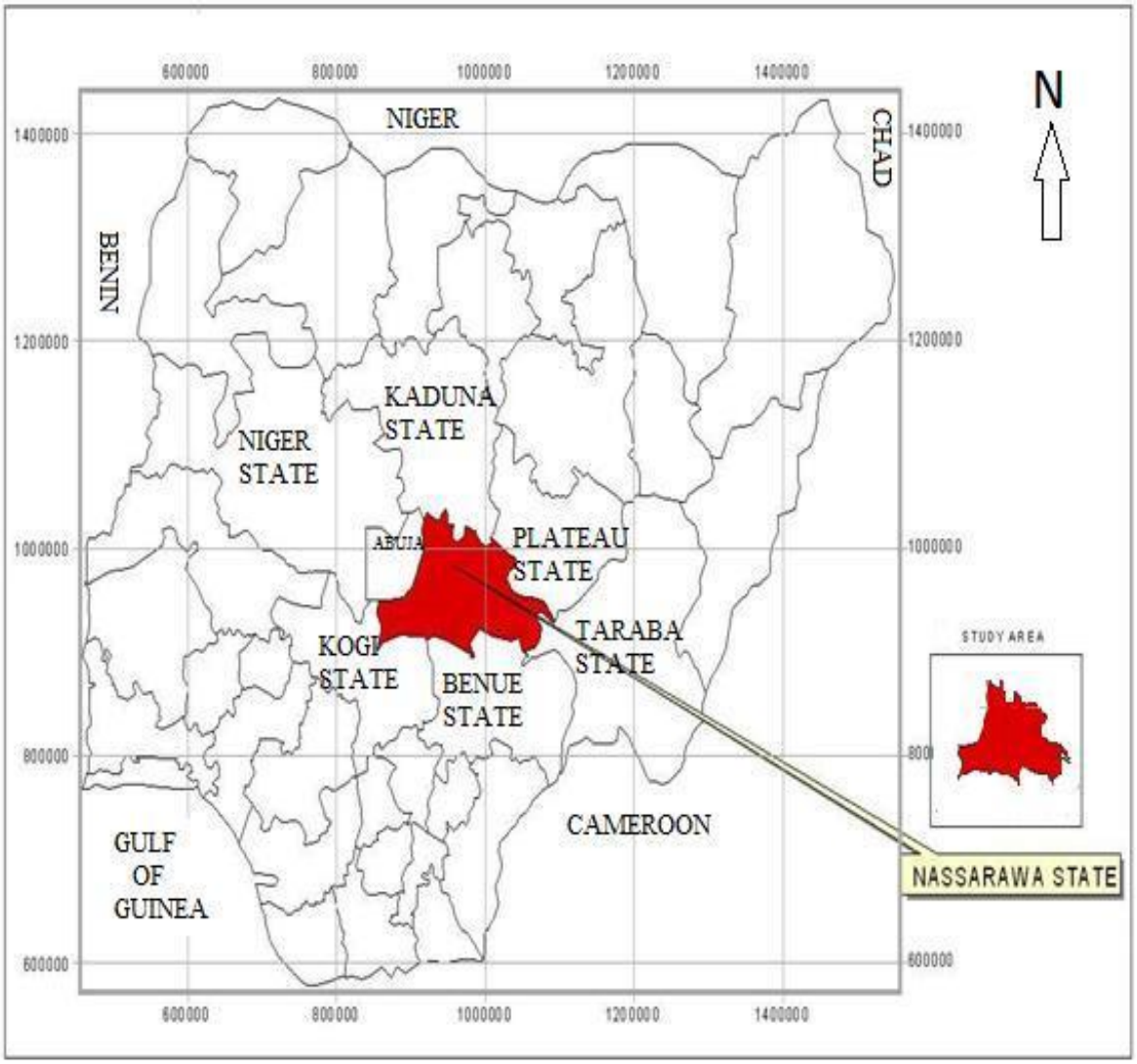

Fig. 1. Map of Nigeria showing the map of Nasarawa State located in Central Nigeria (Source: https://www.researchgate.net/figure/Map-of-Nigeria-Showing-Nasarawa-State-the- studied-Area_fig1_316622675)

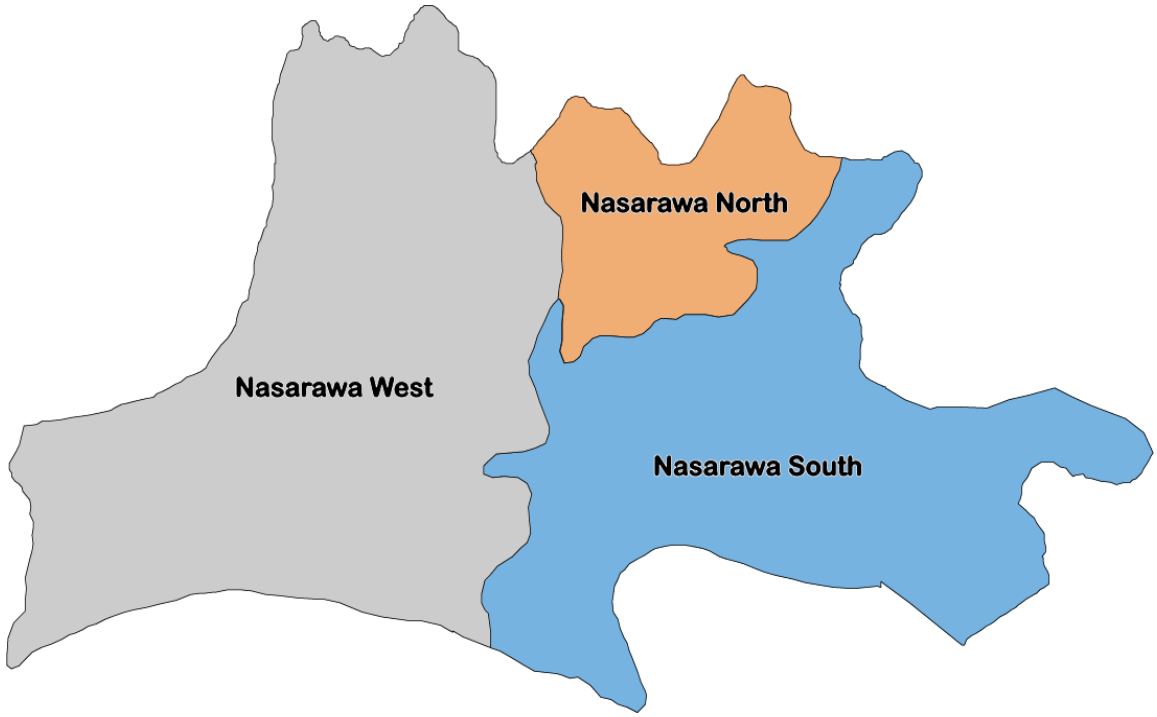

Fig.2. Map of Nasarawa State showing the three Senatorial Districts (Source: https://en.wikipedia.org/wiki/2023_Nigerian_Senate_elections_in_Nasarawa_State#/media/File: 2023_NasarawaSenate_pre-election_situation.png)

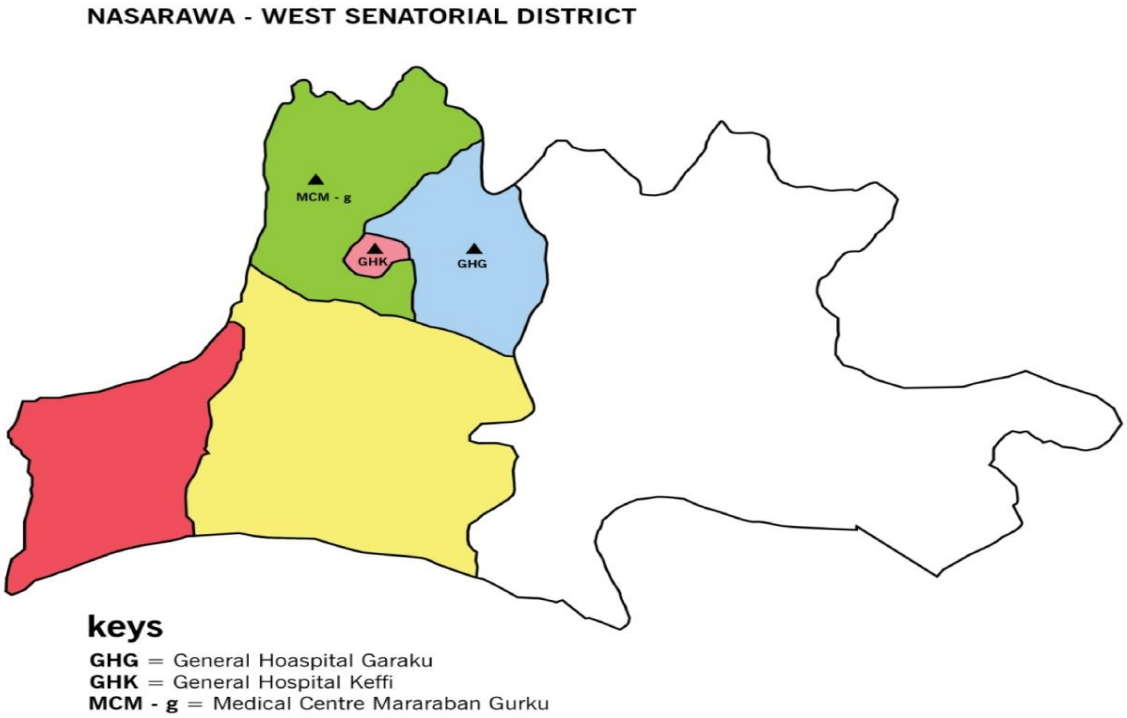

Fig. 3. Map of Nasarawa West Senatorial Districts showing the three study centres (Source: This)

2.3Sample Determination and Size

The sample size for this research was determined using the formula as provided by Cochran, which is considered appropriate in situations with large populations as in this research (Population greater than 10,000) (https://www.statisticshowto.com/probability-and-statistics/find-sample-size/).

The Cochran formula is:

$$n_0 = \frac{Z^2pq}{e^2}$$

Where:

n_0 = the sample size

e = the desired level of precision (i.e. the margin of error),

p = assuming half of the population posses the investigated character. This gives us maximum variability. So p = 0.5.

q = 1 – p

Z-value = 1.96 (Z value is found in the Z-table. Which for 95% confidence level, that is probability of 0.05, gives us 1.96 on the Z-table)

Substituting the values in the formula:

Z^2 = 1.96 x 1.96 = 3.8416
P = 0.5
q = 1 – 0.5 = 0.5
e = 0.5 x 0.5 = 0.0025

$$n0 = \frac{3.8416\ x\ 0.5\ x\ 0.5}{0.0025}$$

$$n0 = \frac{0.9604}{0.0025}$$

$$n0 = 384.16 = 384$$

2.4Sample Collection

One hundred and twenty eight (128) of urine samples were collected from each collection centres, namely General Hospital Garaku (GHG), General Hospital Keffi (GHK), and Medical Centre Mararaban-Gurku (MCM-g) being study Centres in Nasarawa-West Senatorial District.

2.5 Isolation and Identification of *Escherichia coli*

Isolates of *E. coli* were obtained from the urine samples of patients with suspected cases of Urinary tract infections as follows; With the aid of a wire loop, the urine sample was streaked on MacConkey Agar plate and incubated at 37°C for 24 h. Pinkish colonies that grew on MacConkey agar were further inoculated on Eosin Methylene Blue agar and incubated at 37°C for 24 h. Greenish metallic sheen colonies that grew on the Eosin Methylene Blue agar plate were selected as presumptive *E. coli.*

2.6 Antimicrobial Susceptibility Testing

The antimicrobial susceptibility testing of the bacterial isolates was carried out as described by Clinical and Laboratory Standards Institute (CLSI, 2017). Briefly, three (3) pure colonies of the isolates were inoculated in to 5 ml sterile 0.85% (w/v) NaCl (normal saline) and the turbidity of the bacteria suspension was adjusted to the turbidity equivalent to 0.5 McFarland's standard. The McFarland standard was prepared as follows: 0.5 ml of 1.172% (w/v) $BaCl_2.2H_2O$ was added into 99.5 ml of 1% (w/v) H_2SO_4.

A sterile swab stick was soaked in standardized bacteria suspension and streaked on Mueller-Hinton agar plates and the antibiotic discs was aseptically placed at the center of the plates and allowed to stand for 1 h for pre-diffusion. The plates were incubated at 37°C for 24 h. The diameter zone of inhibition in millimeter was measured and the result interpreted in accordance with the susceptibility break point as described by CLSI (CLSI, 2017).

2.7 Determination of Multiple Antibiotic Resistance (MAR) Index

The MAR index of the isolates was determined using the formula: MAR Index = No. antibiotics isolate is resistant to/No. of antibiotics tested as described previously [6].

2.8 Classification of Antibiotic Resistance

Antibiotic resistance in the isolates were classified into: Non multidrug resistance (NMDR: Non-susceptible to ≤ 1 antimicrobial categories agent); (XDR: non-susceptible to ≥1 agent in all but ≤2 antimicrobial categories); (MDR: non-susceptible to ≥3 but less than antimicrobial

categories); Pan drug resistance (PDR: non-susceptible to all antimicrobial listed) [7].

3. RESULTS AND DISCUSSION

3.1 Isolation and Identification of *Escherichia coli*

The cultural, microscopical and biochemical characteristics of the isolates are as shown in Table 1. Pinkish colonies on MacConkey agar that grew with greenish metallic sheen on Eosin Methylene Blue agar and were Gram negative, Indole positive, Methyl red positive, Voges-Proskauer negative, Citrate negative, ONPG positive, Nitrate positive, Lysine positive, Ornithin positive, etc were taken as confirmed *E. coli*.

3.2 Occurrence of *Escherichia coli*

The occurrence of *E. coli* isolates in relation to the total sample size of 384 was 92(24%) as shown in Fig. 4. At the GHK, the occurrence was 28 (21.9%), GHG had 25(19.5%) occurrence while MCM-g had 39(30.5%).

3.3 Antimicrobial Resistance Profile

The antimicrobial resistance profile of the isolates is shown in Table 3. The isolates were more resistant to Ampicillin (75.0%), streptomycin (70.7%), Cefotaxime (68.5%), but less resistant to, Ciprofloxacin (9.8%), Gentamicin (17.4%), and Nitrofurantoin (20.7%) respectively.

3.4 Antimicrobial Resistance Phenotypes

The isolates were distributed into different antimicrobial resistance phenotypes as shown in Table 3 with the commonest resistance phenotype AMC-AMP-CAZ-CTX-S-SXT with 5.4% occurrence.

3.5 Multiple Antibiotic Resistance (MAR) Index

The MAR Index of *E. coli* isolates from urine of patients with suspected UTI's in the three health facilities: GHK, GHG and MCM-g is as shown in Table 4. Most of the *E. coli* isolates showed MAR Index of ≥0.2 and the commonest MAR Index in GHK was 0.7 and the percentage of its occurrence was (21.4%). GHG has its commonest MAR Index of 0.4 with percentage occurrence of (28.0%), while that of MCM-g commonest MAR Index was 0.3 with percentage occurrence of (23.1%).

3.6 Classes of Antibiotic Resistance

The antibiotics resistant *E. coli* isolates were categorized into different categories of antibiotic resistance namely: Non Multiple Drug Resistance (NMDR); Excessive Drug Resistance (XDR); Multiple Drug Resistance (MDR) and Pan Drug Resistance (PDR).The occurrence of MDR in

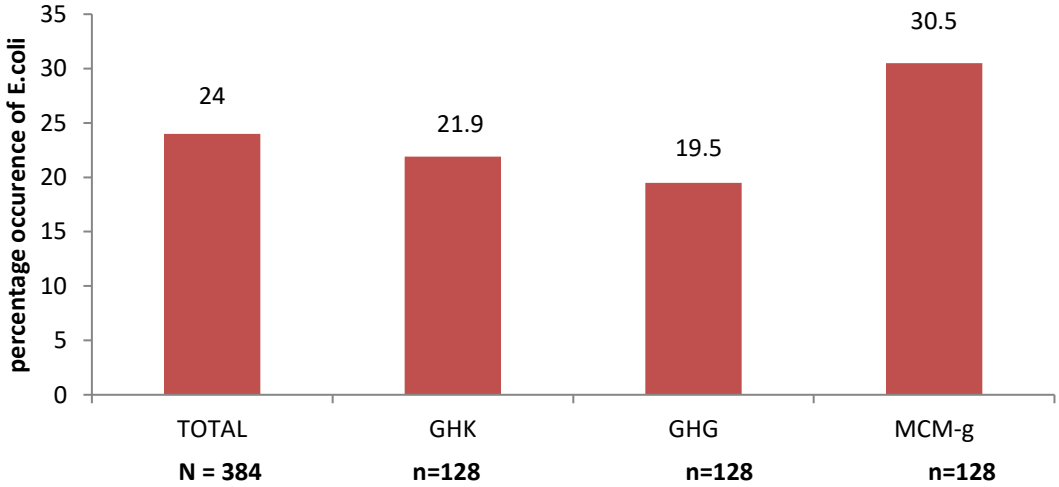

Fig. 4. Percentage occurrence of *Escherichia coli* isolated from healthCentres in GHK, GHG, and MCM-g, Nasarawa State, Nigeria (GHK= General Hospital Keffi; GHG= General Hospital Garaku; MCM-g= Medical Centre Mararaban-Gurku)

the study sites was found out to be highest with 81.5% while NMDR was low with 9.8%. The occurrence of MDR isolates in the selected hospitals was highest in Mararaban-Gurku Medical Centre having 77.8% while General Hospital Keffi (GHK) had the lowest with 50.0%. Medical Centre Mararaban-Gurku has the highest XDR (16.7%) while General Hospital Garaku (20.0%) being the lowest. General Hospital Keffi has the highest of the NMDR (30.0%) while Medical Centre Mararaban-Gurku has the lowest (5.6%) as shown in Fig. 6

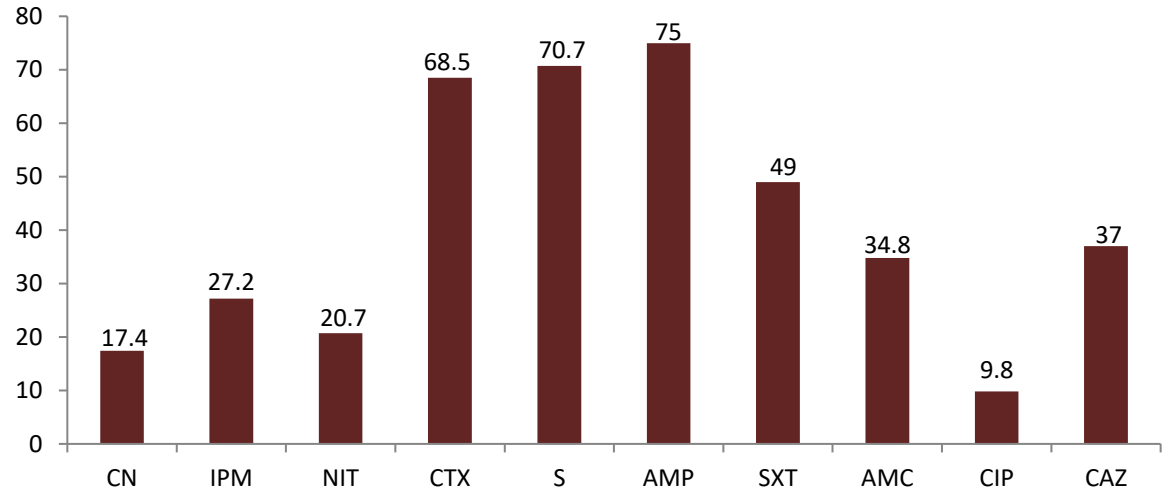

Fig. 5. Average Antibiotics Resistance Profile of *Escherichia coli* isolated from healthcentres in Garaku, Keffi, and Mararaban-Gurku townships, Nasarawa State, Nigeria (AMC=Amoxicillin/Clavulanate; AMP = Ampicillin; CAZ= Ceftazidime; CIP= Ciprofloxacin; CN= Gentamicin; CTX= Cefotaxime; IPM= Imipenam; NIT= Nitrofurantoin; S= Streptomycin; SXT= Co-trimoxazole)

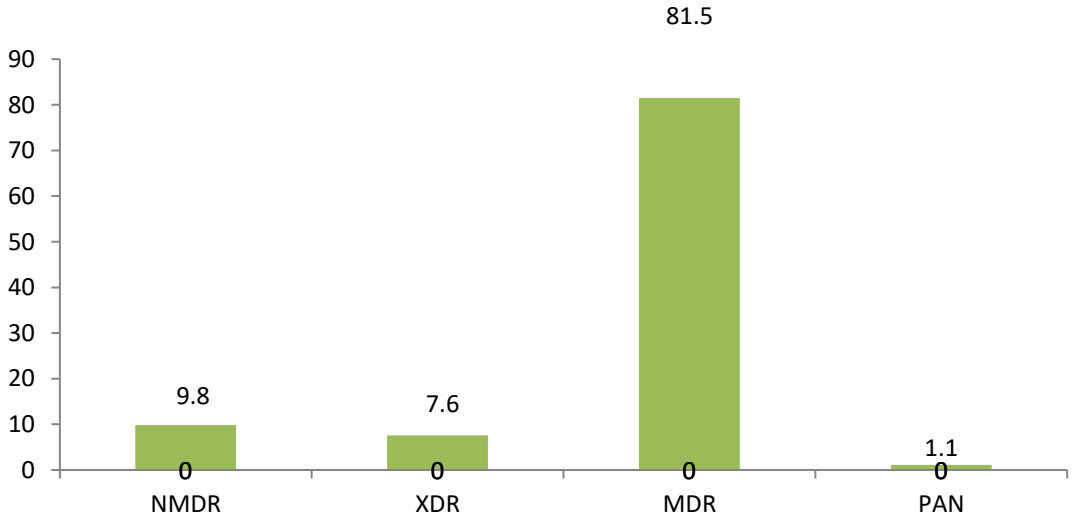

Fig. 6. Categories of antibiotics resistance of *Escherichia coli* isolated from healthcentres in Keffi, Garaku, and Mararaban-Gurku townships, Nasarawa State, Nigeria

Table 2. Cultural, morphological and biochemical characteristics of *Escherichia coli* from Healthcentres of Garaku, Keffi and Maraban-Gurku townships, Nasarawa State, Nigeria

Cultural Characteristics	Morphological Characteristics		Biochemical Characteristics												Inference
	Gram Reaction	Morphology	Ind	Mr	Vp	Ct	TDA	ONPG	Lys	ORN	Ur	Nt	H_2S	Mal	
Pinkish colonies on MCA and Greenish Metallic Sheen on EMB Agar	-	Rod Shape	+	+	-	-	-	+	+	+	-	+	-	-	*E. coli*

Key: + = Positive; - = Negative; IND = Indole; MR = Methyl Red; VP = Voges-Proskauer; CT = Citrate; TDA = Tryptophan Deaminase, ONPG = Ortho-Nitrophenyl-β-galactoside, LYS = Lysine; ORN = Ornithine, UR = Urease, NT = Nitrate, H_2S = Hydrogen Sulphide; Mal = Malonate

Table 3. Antibiotic resistance phenotypes of *Escherichia coli* isolated from healthcentres in Garaku, Keffi, and Mararaban-Gurku townships, Nasarawa State, Nigeria

Antibiotics Resistance Phenotype	Frequency (%)			
	GH Keffi (n= 28)	GH Garaku (n= 25)	Med. Centre M/Gurku (n= 39)	TOTAL (N= 92)
NIT	1 (3.6)	1 (4.0)	1(2.6)	3 (3.3)
AMP	1 (3.6)	1 (4.0)	0 (0.0)	2 (2.2)
CTX	2(7.1)	1 (4.0)	1(2.6)	4 (4.3)
IMP-S	0 (0.0)	1 (4.0)	0 (0.0)	1(1.1)
CTX-S	1 (3.6)	0 (0.0)	1(2.6)	2 (2.2)
CAZ-S	0 (0.0)	0 (0.0)	1(2.6)	1(1.1)
AMP-S	1 (3.6)	0 (0.0)	0 (0.0)	1(1.1)
AMP-CTX	0 (0.0)	1 (4.0)	1(2.6)	2 (2.2)
IMP-S-NIT	0 (0.0)	0 (0.0)	1(2.6)	1(1.1)
CIP-CTX-S	0 (0.0)	0 (0.0)	1(2.6)	1(1.1)
CTX-IMP-S	1 (3.6)	0 (0.0)	0 (0.0)	1(1.1)
AMP-NIT-S	0 (0.0)	0 (0.0)	1(2.6)	1(1.1)
AMP-IMP-S	0 (0.0)	0 (0.0)	1(2.6)	1(1.1)
CTX-S-SXT	0 (0.0)	1 (4.0)	0 (0.0)	1(1.1)
CAZ-CTX-S	0 (0.0)	1 (4.0)	0 (0.0)	1(1.1)
AMP-S-SXT	1 (3.6)	0 (0.0)	2(5.1)	3 (3.3)
AMP-CTX-S	0 (0.0)	0 (0.0)	2(5.1)	2 (2.2)
IMP-NIT-SXT	0 (0.0)	1 (4.0)	0 (0.0)	1(1.1)
AMP-CN-SXT	0 (0.0)	0 (0.0)	1(2.6)	1(1.1)
CIP-CTX-IMP	1 (3.6)	0 (0.0)	0 (0.0)	1(1.1)
AMP-CTX-IMP	1 (3.6)	0 (0.0)	0 (0.0)	1(1.1)
CTX-IMP-S-SXT	0 (0.0)	1 (4.0)	0 (0.0)	1(1.1)
AMP-CIP-S-SXT	0(0.0)	1 (4.0)	0 (0.0)	1(1.1)
AMP-NIT-S-SXT	0 (0.0)	0 (0.0)	1(2.6)	1(1.1)
AMP-IPM-NIT-S	0 (0.0)	1 (4.0)	0 (0.0)	1(1.1)
AMP-CAZ-NIT-S	0 (0.0)	0 (0.0)	1(2.6)	1(1.1)
AMP-CAZ-IMP-S	0 (0.0)	1 (4.0)	0 (0.0)	1(1.1)
AMC-CAZ-S-SXT	0 (0.0)	1 (4.0)	1(2.6)	2 (2.2)
AMP-CTX-S-SXT	1 (3.6)	0 (0.0)	0 (0.0)	1(1.1)
AMC-AMP-IMP-S	0 (0.0)	0 (0.0)	1(2.6)	1(1.1)
AMC-AMP-CAZ-S	0 (0.0)	1 (4.0)	0 (0.0)	1(1.1)
CAZ-CN-CTX-IMP	0 (0.0)	0 (0.0)	1(2.6)	1(1.1)
AMP-CN-CTX-IMP	0 (0.0)	0 (0.0)	1(2.6))	1(1.1)
AMC-AMP-CTX-IMP	0 (0.0)	0 (0.0)	1(2.6)	1(1.1)
CAZ-CIP-NIT-S-SXT	0(0.0)	1 (4.0)	0(0.0)	1(1.1)
CAZ-CIP-CTX-IMP-S	0 (0.0)	0 (0.0)	1(2.6)	1(1.1)
AMC-CN-CTX-S-STX	0 (0.0)	0 (0.0)	1(2.6)	1(1.1)
AMC-AMP-CIP-S-SXT	1 (3.6)	0(0.0)	0(0.0)	1(1.1)
AMC-AMP-CAZ-CIP-S	0 (0.0)	1 (4.0)	0 (0.0)	1(1.1)
AMP-CAZ-CTX-S-STX	2 (7.1)	0 (0.0)	0(0.0)	2 (2.2)
AMC-AMP-CAZ-IPM-S	0 (0.0)	1 (4.0)	1(2.6)	2 (2.2)
AMC-AMP-CTX-IMP-S	0 (0.0)	0 (0.0)	1(2.6)	1(1.1)
AMC-AMP-CTX-S-SXT	1 (3.6)	0 (0.0)	1(2.6)	2 (2.2)
AMC-AMP-CAZ-CTX-SXT	0 (0.0)	1 (4.0)	0 (0.0)	1(1.1)
AMP-CIP-CTX-NIT-S-STX	0(0.0)	1 (4.0)	0(0.0)	1(1.1)
AMP-CAZ-CIP-CTX-S-SXT	2 (7.1)	0 (0.0)	0 (0.0)	2 (2.2)
AMP-CTX-IMP-NIT-S-SXT	0 (0.0)	0 (0.0)	1(2.6)	1(1.1)
AMP-CAZ-CTX-NIT-S-SXT	0 (0.0)	0 (0.0)	1(2.6)	1(1.1)
AMP-CAZ-CTX-IPM-S-SXT	0 (0.0)	0 (0.0)	1(2.6)	1(1.1)

Antibiotics Resistance Phenotype	Frequency (%)			
	GH Keffi (n= 28)	GH Garaku (n= 25)	Med. Centre M/Gurku (n= 39)	TOTAL (N= 92)
AMC-AMP-CAZ-CN-CTX-S	1 (3.6)	0 (0.0)	0 (0.0)	1(1.1)
AMC-AMP-CIP-CTX-IMP-S	0 (0.0)	0 (0.0)	1(2.6)	1(1.1)
AMC-AMP-CTX-IMP-S-SXT	0 (0.0)	0 (0.0)	1(2.6)	1(1.1)
AMC-AMP-CAZ-CTX-S-SXT	2(7.1)	1 (4.0)	2 (5.1)	5 (5.4)
AMC-AMP-CAZ-CIP-CTX-SXT	0(0.0)	0(0.0)	1(1.20	1(1.1)
AMP-CN-CTX-IPM-NIT-S-SXT	0 (0.0)	0 (0.0)	1(2.6)	1(1.1)
AMP-CAZ-CN-CTX-NIT-S-SXT	1 (3.6)	0 (0.0)	0 (0.0)	1(1.1)
AMP-CAZ-CIP-CN-CTX-S-SXT	1 (3.6)	0(0.0)	0(0.0)	1(1.1)
AMC-CAZ-CIP-CN-CTX-IMP-S	0 (0.0)	1 (4.0)	0 (0.0)	1(1.1)
AMC-AMP-CN-CTX-NIT-S-SXT	0 (0.0)	2 (8.0)	0 (0.0)	2 (2.2)
AMC-AMP-CAZ-CTX-NIT-S-SXT	1 (3.6)	0 (0.0)	0 (0.0)	1(1.1)
AMC-AMP-CAZ-CIP-CTX-S-SXT	3(10.7)	0(0.0)	0(0.0)	3 (3.3)
AMC-AMP-CAZ-CIP-CTX-NIT-SXT	0 (0.0)	0 (0.0)	1(2.6)	1(1.1)
AMC-AMP-CAZ-CIP-CN-CTX-NIT-S	1(0.0)	0(0.0	0(0.0)	1(1.1)
AMC-AMP-CAZ-CIP-CN-CTX-S-SXT	0(0.0)	1 (4.0)	0(0.0)	1(1.1)
AMC-AMP-CAZ-CN-CTX-IPM-S-SXT	0(0.0)	1 (4.0)	0 (0.0)	1(1.1)
AMC-AMP-CAZ-CIP-CTX-NIT-S-SXT	1 (3.6)	0(0.0)	2(5.1)	3 (3.3)
AMC-AMP-CAZ-CIP-CN-CTX-IPM-NIT -S-SXT	0(0.0)	0 (0.0)	1(2.6)	1(1.1)

(GH= General Hospital; Med. Centre= Medical Centre; M/Gurku= Mararaban-Gurku; AMC= Amoxicillin/Clavulanate; AMP= Ampicillin; CAZ= Ceftazidime; CIP= Ciprofloxacin; CN= Gentamicin; CTX= Cefotaxime; IPM= Imipenam; NIT= Nitrofurantoin; S= Streptomycin; SXT= Co-trimoxazole)

Table 4. Multiple Antibiotic Resistance (MAR) Index of antibiotic resistant *E.coli* Isolated from healthcentres in Keffi, Garaku, and Mararaban-Gurku townships, Nasarawa State, Nigeria

No of Antibiotics Resistance	No of Antibiotics Tested	MAR	No. (%) of Resistance		
			GH Keffi (n= 28)	GH Garaku (n= 25)	Med. Centre M/Gurku (n=39)
10	10	1.0	0 (0.0)	0 (0.0)	1 (2.6)
9	10	0.9	0 (0.0)	0 (0.0)	0 (0.0)
8	10	0.8	2 (1.1)	2 (8.0)	2 (5.1)
7	10	0.7	6 (21.4)	3 (12.0)	2 (5.1)
6	10	0.6	5 (17.7)	2 (8.0)	8 (20.5)
5	10	0.5	4(14.3)	3 (12.0)	5 (12.8)
4	10	0.4	1 (3.6)	7 (28.0)	7 (18.0)
3	10	0.3	4 (14.3)	3 (12.0)	9(23.1)
2	10	0.2	2 (7.1)	2 (8.0)	3 (7.7)
1	10	0.1	4 (14.3)	3 (12.0)	2 (5.1)

GH= General Hospital; Med. Centre= Medical Centre; M/Gurku= Mararaban-Gurku

4. DISCUSSION

E. coli is one of the most common etiological agents of both community and hospital acquired urinary tract infections worldwide [7]. This study focused on antimicrobial resistance profile of Urinary *E. coli* of patients with suspected UTIs in the study area. The observed percentage occurrence of *E. coli* from urine of the patients was expected, in agreement with the study previously described by Gopal *et al*., [8-11]. However, the percentage occurrences of *E. coli* from urine of the patients observed in this study was less than 58.8% and 23.1 % as reported by Adenipekun *et al*., [12] and Wemambu and Ifajeunnu [13] but greater than 11.5% reported by Ezeh *et al*., [14]. The isolation of *E. coli*from urine of the patients is an indication that this organism may be responsible for the UTIs.

The high resistance of the isolate to Ampicillin, Streptomycin, and Ceftazidime, observed in this study was not surprising and this may be due to inappropriate use of antibiotics [6, 15]. The percentage resistance of the isolates to Cefotaxime and Ceftazidime was higher than 40% and 41.6% reported by Shakya *et al*., [7]. The resistance of isolates to Cefotaxime and Ceftazidime observed in this study may be due to the production of Extended Spectrum Beta-lactamases (ESBL), although the production of ESBL in resistance isolates was not evaluated in this study, but Nkene *et al*., [16] reported the isolation of urinary *E. coli* resistant to both Cefotaxime and Ceftazidime. Also, the resistance of the isolates to Ampicillin and Ceftazidime observed in this study was also higher than 59.1% and 2.4% previously reported by Adenipekum *et al*., [11].

The low resistance of the isolates to Ciprofloxacin and Gentamicin observed was not different from the study earlier described by Shakya *et al*., [7] and Azeez *et al*., [17]. The percentage resistance of the isolates to Gentamicin and ciprofloxacin was less than 10.6%, 13.9% respectively as reported by Shakya *et al*., [7]. The low resistance of isolates to the Ciprofloxacin and Gentamicin could be suggestive to their effectiveness against the urinary *E. coli* and may be used for effective therapy of UTIs caused by this organism.

The urinary *E. coli* from this study was distributed into different classes of antibiotics resistance and the most common class observed in this study was multi-drug resistance (MDR). The high occurrence of MDR isolates observed in this study is similar with the study earlier reported by Parajuli *et al*., [17] and Hashemizadeh *et al.,* [18]. The percentage occurrence of MDR isolates observed in this study was higher than 56.1% and 64.9% reported by Parajuli *et al*., [17] and Hashemizadeh *et al*., [18]. The isolates of MDR urinary isolates in this study suggest that the isolates may likely be responsible for UTIs that may be difficult to be treated using conventional or common antibiotics usually prescribed for treatment of UTIs since MDR Enterobacteriaceae have been reported to cause life threatening UTIs that is difficult to be treated [18].

5. CONCLUSION

The percentage occurrence of *E. coli* isolated from urine of suspected UTIs patient in the study centers was less than 25%.The antibiotics namely; Ciprofloxacin, Gentamicin and Nitrofurantoin were the most effective antibiotics against the isolates. Most of the *E. coli* were multi-drug resistant isolates. The commonest resistance phenotype was AMC-AMP-CAZ-CTX-S-SXT with an occurrence of 5.4%. Most of the *E. coli* isolates showed MAR Index of ≥0.2. GHK, GHG and MCM-g had 0.7. 0.4 and 0.3 as their MAR index and 6(21.4%), 7(28%) and 9(23.1%) respectively as their percentage occurrences. The order of occurrence of classes of antibiotic resistance was: MDR (81.5%) > NMDR (9.8%) > XDR (7.6%) > PDR (1.1%).Therefore advocating on “Prescribe only when it compulsory on antimicrobials” should be intensified as the consequences of drug resistance as a major leading cause of mortality globally aside the increase in hospital bills. Public Health awareness should be increased, as it is known that, prevention is far better than cure.

CONSENT

All patients gave in their written consent by endorsing the consent form provided.

ETHICAL APPROVAL

An ethical approval for this study was obtained from the Research and Ethical Committee of Ministry Health, Nasarawa State, Nigeria prior to start of the research and is available for review.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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