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Determination Antibiotic Sensitivity Profile of Bacterial Isolates among Reproductive Aged Non-Pregnant Women Attending Thika Level 5 Hospital

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Abstract

Introduction: Bacteriuria is commonly found in women and about thirty three percent (33%) of adult women have encountered an incidence of symptomatic cystitis at least once in their life time. In case the uropathogens are unidentified and management undertaken, bacteriuria may cause more dangerous and adversed complications, including nephritis and renal failure. Majority of studies done in Kenya have focused on pregnant women with no documented information available on the sexually active non pregnant women population despite a heightened risk of bacteriuria in this age group. The objectives of this study were to determine the occurrence of bacteriuria, to isolate bacterial pathogens associated with the bacteriuria, and to determine antibiotic susceptibility profile on the isolated bacterial pathogens in sexually active non pregnant women attending Thika Level 5 Hospital, Kiambu County, Kenya. **Materials and Methods:** The study employed a cross sectional design and random sampling technique. Three hundred and eighty four (384) mid-stream urine samples were collected from reproductive aged non pregnant women of attending Thika Level 5 Hospital between January 2018 to December 2018. The positive samples were cultured on Cystine Lactose Electrolyte Deficient (CLED) media and Antibiotic susceptibility test was done using muller hinton agar. Antibiotic susceptibility testing was done on the antibiotics recommended for bacteriuria by the Ministry of Health. Antibiotic susceptibility tests were analyzed using Pearson's Chi-square test at a confidence interval of 95%. **Results:** Out of 384 urine samples tested, 311 (81%) samples had significant growth (P = 0.001) and 73 (19%) had no growth (P = 0.056). Bacterial pathogens isolated were *Escherichia coli* (41.48%), *Staphylococcus saprophyticus* (30.55%), *Proteus mirabilis* (13.85%), *Pseudomonas aeruginosa* (8.68%) and *Klebsiella aerogenes* (5.47%). Among the ten antibiotics tested, bacterial isolates were sensitive to Cefuroxime at 93.2% (χ^2

=29.809, P = 0.001) and resistant to Trimethoprim/Sulfamethoxazole at 89.7% (χ^2 = 62.791, P = 0.001). **Conclusion:** This study concluded that, Cefuroxime antibiotic is the drug of choice against bacteriuria and Trimethoprim/Sulfamethoxazole antibiotic should not be used in bacteriuria therapy. This study recommended that, since antibiotic resistance among the uropathogens is evolving problem, a routine surveillance to monitor the etiologic agents of bacteriuria and the resistance pattern should be carried out timely to choose the most effective empirical treatment by the physicians. Data obtained from this study is important in appropriate management and treatment of bacteriuria. This will help in proper prescription of the appropriate antibiotic for the treatment of bacteriuria.

Subject Areas

Women's Health

Keywords

Bacteriuria, Antibiotic Susceptibility, Non Pregnant, Thika

1. Introduction

Bacteriuria is a common contagious infection among women due to their physiology [1]. Bacteriuria is responsible for urinary tract infection which is the fourth most healthcare associated infection in hospitals [2]. With many community acquired infections, antibiotic resistance to uropathogens that cause bacteriuria complications is alarming and is a serious health concern in the treatment of urinary tract infection [3]. Antibiotic resistance has become a great concern worldwide to uropathogens particularly to *E. coli*, the major causative agent of urinary tract infection (UTI) [4]. Antibiotic remedy is the main treatment for UTIs, with the main goal being the elimination of bacteria growth in the urinary tract through safe and cost-effective antibiotic usage. Antibiotic resistance among uropathogens to the commonly used drugs impairs the effective management of ever increasing range of UTI. Bacteriuria requires intervention across all government sectors and society since it is a serious threat to global public health. The health care for resistant infection is costly compared to non-resistant infections due to prolonged illness, additional investigations and use of high costly drugs [5] [6].

In Kenya, there is no published study on reproductive aged non-pregnant women that identified the bacteria and their antibiotic sensitivity profile. Therefore, the present study is the first study to be carried out in Kenya and intends to determine the antibiotic sensitivity test profile on bacteriuria uropathogens among reproductive aged non pregnant women.

2. Material and Methods

2.1. Study Design

A cross-sectional study design was adopted among the Reproductive aged non-

pregnant women aged 18 to 48 attending Thika level five hospital.

2.2. Sample Size Determination

The sample size was determined by using the Fischer *et al.*, 2002 formula with the bacteriuria prevalence of 50%. Prevalence of 50 % was considered since the prevalence of bacteriuria in reproductive aged non-pregnant women aged 18 - 48 years is not known in Kenya.

$$N = \frac{Z^2 P(1-P)}{D^2}$$

where:

N = Minimum sample required;

Z = 1.96 standard error;

P = Prevalence 50%;

D = the desired degree of accuracy at 95% confidence level = 0.05.

There by:

$$N = \frac{1.96^2 \times 0.5(0.5)}{0.05^2} = 384.$$

Therefore, 384 samples were collected in this study.

2.3. Sampling Technique

Purposive sampling technique was adopted among the reproductive aged non-pregnant women attending Thika Level 5 Hospital in January 2018 to December 2018 with symptomatic and asymptomatic bacteriuria . Every second patient was sampled among the patients seen by the clinical officer after examination and referred to the laboratory for diagnosis. This was due to the fact that the estimated number of urinary tract infections at Thika Level 5 Hospital is 831 [7]. So this number was divided by the study sample size (384) to get an interval of two.

2.4. Laboratory Procedure

2.4.1. Sample Collection

For the purposes of the study, mid stream urine samples were collected from 384 reproductive non pregnant women who attended Thika Level 5 Hospital. All urine samples collected were analyzed for bacteriuria through microscopy, culture, Gram staining technique, biochemical tests and drug sensitivity for the bacteria isolated.

2.4.2. Bacterial Culture Method

All the 384 midstream urine samples were mixed properly by turning gently the specimen container up and down. Briefly, a 0.002 ml loopful of urine sample was inoculated onto Cystine Lactose Electrolyte Deficient (CLED) agar using a standard calibrated sterile wire loop. Streak method was used to spread each urine sample onto the agar using the procedure of [8]. The plates were labeled in correspondent to the urine sample reference number and then incubated aerobically at

35 ˚C - 37˚C overnight. This helped in isolation of pure growth plates and those with colonies $\geq 10^5$ for both biochemical test and drug sensitivity testing after the incubation time.

2.4.3. Antibiotic Sensitivity Testing

The test was carried out on the identified bacterial isolates using sensitivity media Mueller-Hinton agar by modified disc diffusion technique of Kirby-Bauer [8] [9]. This was based on the current Clinical Laboratory Standards Institute (CLSI) guideline for BSAC Disc Diffusion Method on Antimicrobial Susceptibility Testing [10] [11].

The antibiotics tested were Amikacin (30 mcg), Cefalexin (30 mcg), Gentamycin (10 mcg), Norfloxacin (10 mcg), Nitrofurantoin (300 mcg), Cefuroxime (30 mcg), Nalidixic acid (30 mcg), Amoxicillin-clavulanic acid (20/10 mcg), Trimethoprim/Sulfamethoxazole (30 mcg) and Ofloxacin (2 mcg) which are commonly prescribed for the treatment of bacteriuria at Thika Level 5 Hospital.

Briefly, one to five colonies from every pure culture plate were picked with a standard wire loop. These colonies were emulsified into sterile 5 mls saline solution in a test tube. The picked colonies were mixed uniformly with the saline by stirring with the wireloop. The saline turbidity was adjusted to match the standard McFarland 0.5 suspension. Using a sterile cotton swab, a sample of the mixture was picked and the excess saline was removed by pressing the swab against the test tube, this was gently inoculated onto the surface of the Mueller-Hinton agar [12]. Impregnated antibiotic discs were placed on the agar surface using sterile forceps, at a minimum distant of 10 mm apart between antibiotic discs, 15 mm from the edge of the plate and a maximum of 5 discs per plate was used. The inoculated culture plates were incubated aerobically at 35˚C - 37˚C for 16 - 18 hours. Quality control was performed using the CLSI recommended quality control strains *Escherichia coli* ATCC 25922 and *Pseudomonas aeruginosa* ATCC 27853. The diameter of zones of inhibition around each disc was measured using a ruler and interpreted using CLSI guidelines. Results were reported as sensitive or resistant for each antibiotic used according to CLSI standards.

2.5. Data Analysis

All collected data was introduced into SPSS Data Editor. Antibiotic sensitivity profile for the different bacteria species on different antibiotics to establish any variations was analyzed using pearson's Chi Square. Data on Resistant and Sensitive antibiotics to different bacterial isolates was analyzed using percentages and presented in tables. All statistical analysis of the results was done using SPSS version 23 computer package.

3. Results

3.1. Occurrence of Bacteriuria

Out of the three hundred and eighty four (384) patient samples, three hundred

and eleven, 311 (81%) samples tested had significant bacterial growth and 73 (19%) urine samples had no significant bacterial growth (Table 1).

Table 1. Occurrence of bacteriuria among reproductive aged non pregnant women attending Thika Level 5 Hospital.

Status	No. of non pregnant women (N)	Percentage (%)
Bacterial growth	311	81
No bacterial growth	73	19
Total (N)	384	100

Significant bacterial growth obtained was 81%.

Among the 311 urine samples with bacterial growth, five bacterial pathogens were isolated and identified by their biochemical reactions and appearance of their colonies characteristics on CLED agar. Two hundred and sixteen, 216 (69.5%) of the bacterial isolates were gram negative while 95 (30.5%) of bacterial isolates were gram positive. The results showed *Escherichia coli* as the most frequent isolated bacterial pathogen with 129 (41.48%, $\chi^2 = 147.73$, P value 0.001) causing bacteriuria among sexually active non pregnant women attending Thika Level 5 Hospital. The second most frequent pathogen was *Staphylococcus saprophyticus* with 95 (30.55%), the third most bacterial isolate was *Proteus mirabilis* with 43 (13.83%), *Pseudomonas aeruginosa* was fourth with 27 (8.68%) and *Klebsiella aerogenes* was the least with 17 (5.47%) of the bacterial isolates.

3.2. Determination of Antibiotic Sensitivity Test Profile on Bacteriuria Uropathogens among Reproductive Aged Non Pregnant Women Attending Thika Level 5 Hospital

Three hundred and eleven (311) urine samples from reproductive aged non pregnant women with significant bacterial growth were tested for antibiotic sensitivity in this study. Ten antibiotic discs commonly recommended by Ministry Of Health for treatment of UTI were tested. These included; Cefuroxime (30 mcg), Amikacin (30 mcg), Gentamycin (10 mcg), Ofloxacon (2 mcg), Trimethoprim/Sulfamethoxazole (30 mcg), Norfloxacin (10 mcg), Cefalexin (30 mcg), Nalidixic acid (30 mcg), Nitrofurantoin (300 mcg) and Amoxyclav (30 mcg). It was observed that all the isolated bacterial pathogens were sensitive to Gentamycin 83% and Cefalexin 78.1%. Although Cefuroxime antibiotic showed to be the most effective antibiotic with 93.2%, it was resistant to *Pseudomonas aeruginosa* 63%. Antibiotic which showed effectiveness to most of the isolated bacterial pathogens were Cefuroxime 93.2% ($\chi^2 = 87.206$, P = 0.001), Amikacin 84.6% ($\chi^2 = 78.714$, P = 0.001), Gentamycin 83% ($\chi^2 = 90.154$, P = 0.001) and Cefalexin 78.1% ($\chi^2 = 114.183$, P = 0.001) as shown in Table 2.

Some of the tested antibiotics were sensitive to one of the isolated bacterial pathogens. Amoxyclav was sensitive to *Proteus mirabilis* ($\chi^2 = 8.91$, P = 0.03), Nitrofurantoin antibiotic was sensitive to *Escherichia coli* ($\chi^2 = 34.62$, P = 0.03),

Nalidixic acid antibiotic was sensitive to *Pseudomonas aeruginosa*, Norfloxacin was sensitive to *Proteus mirabilis*, Ofloxacin antibiotic was sensitive to *Pseudomonas aeruginosa.* The overall antibiotic profile pattern of these antibiotics which showed to be resistant to many bacterial isolates were as follows; Nalidixic acid 86.5% (χ^2 = 27.741, P = 0.001), Amoxyclav 78.5% (x^2 = 54.297, P = 0.001), Norfloxacin 76.2% (χ^2 = 56.309, P = 0.001), Nitrofurantoin, 66.6% and Ofloxacin, 66.6% resistance. Trimethoprim/Sulfamethoxazole showed a resistance of 89.7% (χ^2 = 62.791, P = 0.001). It was observed that it was the only tested antibiotic against the isolated bacterial pathogens which was resistant to all pathogens. Five of the tested antibiotics were resistant to four of the isolated bacterial pathogens.

Table 2. Antibiotics sensitivity profile based on age groups among reproductive aged non-pregant women attending Thika Level 5 Hospital.

Antibiotic	Antibiotic susceptibility	Overall sensitivity %	Chi-square (χ^2)	P value
Cefuroxime	Sensitive	93.2%	87.206	0.001
	Resistant	6.8%		
Amoxyclav	Sensitive	21.5%	81.837	0.035
	Resistant	78.5%		
Nitrofurantoin	Sensitive	33.4%	76.152	0.001
	Resistant	66.6%		
Nalidixicacid	Sensitive	13.5%	21.499	0.001
	Resistant	86.5%		
Cefalexin	Sensitive	78.1%	114.183	0.001
	Resistant	21.9%		
Norfloxacin	Sensitive	23.8%	0.598	0.742
	Resistant	76.2%		
Ofloxacin	Sensitive	33.4%	2.426	0.297
	Resistant	66.6%		
Trimethoprim/ Sulfamethoxazole	Sensitive	10.3%	1.392	0.498
	Resistant	89.7%		
Amikacin	Sensitive	84.6%	78.714	0.001
	Resistant	15.4%		
Gentamycin	Sensitive	83.0%	90.154	0.001
	Resistant	17.0%		

Nalidixic acid had an overall resistant of 86.5% to *E. coli*, *P. mirabilis*, *K. aerogenes* and *S. saprophyticus*. Amoxyclav had an overall resistant of 78.5% to *E. coli, K. aerogenes*, *S. saprophyticus* and *P. aeruginosa*. Norfloxacin had an overall resistant of 76.2% to *E. coli, K. aerogenes*, *S. saprophyticus* and *P. aeruginosa.* Nitrofurantoin had an overall resistant of 66.6% to *S. saprophyticus, P. aeruginosa,*

P. mirabilis and *K. aerogenes* and Ofloxacin had an overall resistant of 66.6% to *E. coli*, *P. mirabilis*, *K. aerogenes* and *S. saprophyticus*. Some antibiotic showed 100% sensitive to some of the isolated pathogens. Cefuroxime was 100% sensitive (x^2 = 15.25, P = 0.001) to *P. mirabilis*, *K. aerogenes* and *S. saprophyticus*. Amikacin was sensitive to *K. aerogenes.* Cefalexin was sensitive to *K. aerogenes* with P = 0.001 (Table 3).

Table 3. Distribution of Antibiotic susceptibility pattern by the isolated bacterial pathogens.

Antibiotic susceptibility pattern of bacterial isolates					
	Pathogen isolates				
Tested antibiotic sensitivity pattern	*E. coli*	*S. saprophyticus*	*K. aerogenes*	*P. aeroginosa*	*P. mirabilis*
Cefuroxime	S	S	S	R	S
Amoxyclav	R	R	R	R	S
Nitrofurantoin	S	R	R	R	R
Nalidixic acid	R	R	R	S	R
Cefalexin	S	S	S	S	S
Norfloxacin	R	R	R	R	S
Ofloxacin	R	R	R	S	R
Trimethoprim/ Sulfamethoxazole	R	R	R	R	R
Amikacin	S	S	S	R	S
Gentamycin	S	S	S	S	S

S = sensitive; R = Resistant. Gentamycin and Cefalexin were sensitive to all isolated pathogens while Trimethoprim/Sulfamethoxazole was resistant to all the isolates.

Klebsiella pneumonia was resistance to Nitrofurantoin, Nalidixic acid, Norfloxacin and Trimethoprim/Sulfamethoxazole while *Staphylococcus saprophyticus* was resistant to Ceftazidime, Amoxyclav and Nalidixic acid, (χ^2 = 2.32, P = 0.95). Nalidixic acid and Trimethoprim/Sulfamethoxazole antibiotics were 100% resistant to *Staphylococcus saprophyticus* and *Klebsiella pneumoniae*. Some isolates like *Pseudomonas aerogenosa* had a unique sensitivity pattern whereby it was sensitive to Nalidixic acid, Ofloxacin, Cefalexein and Gentamycin while it was resistant to Cefuroxime 63.0% (χ^2 = 5.130, P = 0.163) and Amikacin 51.9% (χ^2 = 4.569, P = 0.206) which were highly sensitive to other bacterial isolates.

4. Discussion

4.1. Patients

The study was conducted at Thika Level 5 Hospital, Kiambu County, Kenya. Reproductive aged non pregnant women who attended Thika Level 5 Hospital were

involved in this study. Most of these women were from the nearby Thika slums.

4.2. Antibiotic Sensitivity Profile of the Isolated Bacterial Pathogens

In this study, ten antibiotics commonly prescribed as first line and second line antibiotics for treatment of urinary tract infection by the Ministry of Health were tested *in vitro* against all isolated bacterial pathogens to determine their susceptibility. The choice of antibiotics in any infection treatment must be individualized on the basis of the patient's allergy history, local practice methods, occurrence of antibiotic resistance, availability, cost of medicine, and patient compliance to treatment [13]. The most sensitive antibiotic was Cefuroxime with overall sensitivity rate of 93.2% (P = 0.001). Its sensitivity rate was 96.9%, 100%, 100% and 100% for *E. coli*, *S. saprophyticus*, *K. aerogenes* and *P. mirabilis* respectively. Cefuroxime was only resistant to *Pseudomonas aeroginosa* with resistance rate of 63.0% (**Table 3**). *Pseudomonas aeroginosa* is resistant to most commonly used antibiotics. Antibiotics that usually show activity against *Pseudomonas aeroginosa* include Aminoglycosides, Polymyxin, some Penicillins and some Cephalosporins.

Pseudomonas aeruginosa evades antibiotic activities and cause diseases due to its ability to produce a destructive IgA protease antibody that neutralizes or destroys defense mechanism activity [7]. Cefuroxime is a broad spectrum antibiotic against a wide variety of bacteria. It is administered through intravenous route and no oral administration available. It is well absorbed and expensive. These factors reduce the chances of the antibiotic from losing its potency therefore the sensitivity of Cefuroxime in high against a wide variety of bacterial pathogen. This finding compares well with a study by [14] from western region of Nepal reported sensitivity of 94%.

The second most sensitive drug was Amikacin with an overall sensitivity rate of 84.6%. It was sensitive to *E. coli* 88.4%, *S. saprophyticus* with 97.9%, *K. aerogenes* with 100% and *P. mirabilis* with 60.5%. The drug showed intrinsic resistance to *P. aeruginosa* of 51.9%. Amikacin is administered parenteral intravenously in I.V fluids so oral administration forms are unavailable. This mode of administration in fact minimizes the chances of drug abuse because over the counter use is minimal and it's not suitable for outpatient treatment. This compares well with a study done by [15] in Bangladesh reported sensitivity of 86.4%. The next most sensitive antibiotic was Gentamycin with an overall sensitivity of 83%. It was sensitive to *E. coli* 78.3%, *S. saprophyticus* 96.8%, *K. aerogenes* 52.9%, *P. aeruginosa* 63% and *P. mirabilis* 90.7%. Gentamycin antibiotic was sensitive to all isolated bacterial pathogens (**Table 2**). Gentamycin antibiotic mainly requires parenteral route of administration and therefore, will not be suitable for treating out patients.

Amikacin and Gentamycin belong to aminoglycosides group of antibiotics. Mostly aminogycosides are used as second line regimen for UTIs. The mode of administration of Aminogycosides antibiotics mainly is through parenteral route

which minimizes their chances of antibiotic abuse therefore the drug potency is maintained. This compares well with other studies by [14] [15] who reported Gentamycin sensitivity rate of 78.5% and 81.2% respectively.

In this study, Cefalexin had an overall sensitivity of 78.1%. It was sensitive to *P. aeruginosa* with 85.2% and *P. mirabilis* with 62.8%. This study noted that Cefalexin was sensitive to all the isolated bacterial pathogens. Cefalexin is a broad spectrum antiobiotic that is active against a wide variety of bacteria. Cefalexin is first generation cephalosporins beta lactam antibiotic mainly administered though oral route. Cefalexin is well absorbed that provide adequate serum and tissue concentration levels with oral administration, cost effective, short duration of treatment and availability of the antibiotic in local markets. These factors could have attributed to the effectiveness of this antibiotic to the isolated bacterial uropathogen. This study is in consistent with other studies elsewhere [15] [16] reported sensitivity of 74.2% and 80% respectively.

Antibiotic resistance varies over time and by patient population in different geographic locations. The most resistant antibiotic was Trimethoprim/Sulfamethoxazole with an overall resistant rate of 89.7%. It was 79.8% resistant to *E. coli,* 100% resistant to *S. saprophyticus,* 100% resistant to *K. aerogenes*, 88.9% resistant to *P. aeruginosa* and 93% resistant to *P. mirabilis.* The high resistance of this antibiotic could be associated with repeated use of the antibiotic, prolonged exposure of uropathogens to the antibiotic and low cost making the drug subject to abuse. These factors could have attributed to the reduced antibiotic potency. A similar trend was reported by [17] in Ethiopia. Amoxiclav had an overall resistant of 78.5%. It was resistant to *E. coli* with 81.4%, *S. saprophyticus* 100%, *K. aerogenes* 58.8% and *P. aeruginosa* with 74.1%. It was sensitive only to *P. mirabilis* with 67.4%. The resistance of this antibiotic could be associated with the ability of the isolated pathogen to produce beta-lactamase enzyme which destroys the beta lactam ring of penicillin (Amoxiclav) which inactivates the antibiotic. A similar trend was reported by [15] which showed a resistance of 88.2%.

Nitrofurantoin, Nalidixic acid, Norfloxacin and Ofloxacin had a resistant rate of 66.6%, 86.5%, 76.2% and 66.6% respectively. These antibiotics were sensitive to only one isolated pathogen. Nitrofurantoin was 62.8% sensitive to *E. coli*, the reliability and increased susceptibility levels of *E. coli* to Nitrofurantoin could have been attributed to Nitrofurantoin narrow spectrum activity, narrow tissue distribution and restricted contact with bacteria outside urinary tract. A similar result was found by [18] for nitrofurantoin with the same susceptibility pattern for *E. coli* but low for non-*E. coli*, although they analyzed male and female patients. Nitrofurantoin is known to have no activity against *Proteus* spp. and *Pseudomonas aeruginosa*. This compares well with recent study in India which showed that Nitrofurantoin having the best *invitro* susceptibity profile against *E. coli.* This finding is contradictory to other studies by [14] who reported Ofloxacin and Nitrofurantoin as highly sensitive drug against similar bacterial isolates in this study with sensitivity of 80.1% and 70.4% respectively. In the study by [16] reported Nitrofurantoin sensitivity rate to be over 90% in Mulago Hospital, Uganda. The difference

in sensitivity rate of Ofloxacin and Nitrofurantoin in this study from [14] [16] might be due to over the counter use of antibiotics leading to inappropriate antibiotic use, sub optimal dosages and incomplete dose course.

Nalidixic acid and Ofloxacin were sensitive to *P. aeruginosa* with a sensitivity of 55.6% and 70.4% respectively. Nofloxacin was sensitive *to P. mirabilis* with 51.2%. The widely available and commonly prescribed antibiotics are Norfloxacin, Nalidixic acid and Ofloxacin which have confirmed a rather low overall *in vitro* sensitivity of 23.8%, 13.5% and 33.4% respectively for all isolated bacterial pathogens. In Africa, earlier study by [17] [19] reported very high sensitivity of uropathogens to Norfloxacin, Nalidixic acid and Ofloxacin with over 90% sensitivity rate. However, the sensitivity of these drugs in this study were 33.4% ($P = 0.184$), 23.8% ($P = 0.170$) and 13.5% ($P = 0.185$) for Ofloxacin, Norfloxacin and Nalidixic acid respectively as opposed to studies by [17] [19]. Recently, over the counter use of these drugs most probably has lead to such reduced level of sensitivity. Resistance of the isolates to some of the antibiotics is not only due to drug abuse, it could be also due to their vulnerable cell wall that is protected by an outer membrane that prevents permeation of the antibiotics [20].

In this study, antibiotic resistant is high to the commonly prescribed antibiotics which in earlier studies were effective against a variety of pathogen. Antibiotic resistance is a serious public health concern particularly in developing countries where there is high level of poverty, illiteracy and poor hygienic practices. High prevalence of fake and spurious antibiotics of questionable quality in circulation that are easily available in the community without prescriptions and low cost makes these drugs subject to abuse. These factors could have attributed to unnecessary use or misuse of these antibiotics leading to decreased antibiotic effectiveness.

In a study by [14] reported Norfloxacin and Ofloxacin with sensitivity rate of 85% and 91% respectively and resistant rate of Nalidixic acid was 87.2%. In study by [15] reported Norfloxacin having a sensitivity of 40%, Amoxyclav sensitivity of 11.8%, Nalidixic acid sensitivity of 34.6% and Trimethoprim/Sulfamethoxazole sensitivity of 11.4%.

5. Conclusion

This study showed Cefuroxime as the drug of choice for bacteriuria. The most resistant antibiotics were Trimethoprim/Sulfamethoxazole. Since antibiotic resistance among the uropathogens is an evolving process, a routine surveillance to monitor the etiologic agents of UTI and the resistance pattern should be carried out timely to choose the most effective empirical treatment by the physicians. Information obtained from this study is important for the Ministry of Health for improvement in management and treatment of bacterial infections.

Limitation of the Study

Culture media, culture plates discs, antibiotic sensitivity disc and reagents sometimes

ran out so I had to wait for re-stocking. This of course increased the time of study but I managed to eventually finish the data collection.

Study Approval, Ethical Consideration and Informed Consent

The study was approved by Kenyatta University and Thika Level 5 Hospital. Ethical consideration was obtained from the Hospital Ethical Review Committee. The consent form was read and explained to the reproductive aged non pregnant women. After the women agreed to participate they signed the consent form.

Authors' Contributions

All authors made substantial contributions to this article: Purity Musili conceived and designed the study, acquisition of data and analysis, interpreted the analysed data and drafted the article. Dr Nelson Menza and Dr. Margaret Muturi supervised, reviewed and interpreted the analysed data. All authors revised the article for intellectual content and approved it for submission.

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Conflicts of Interest

The authors declare no conflicts of interest.

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