URINARY TRACT INFECTION AMONG UNDERGRADUATE STUDENTS RESIDING IN THE HOSTEL OF THE FEDERAL UNIVERSITY OF AGRICULTURE ABEOKUTA, OGUN STATE, NIGERIA

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ABSTRACT

The prevalence of urinary tract infection was assessed among the male and female students residing on campus in the Federal University of Agriculture, Abeokuta Ogun state, Nigeria. One hundred and twenty four (124) clean catch mid-stream urine samples were assayed microbiologically, cultured on MacConkey agar and sensitivity test were carried out on the isolates. The overall prevalence of infection was 56(45.2%). The highest infection was among the age group 15-20 years 40 (32.3%) followed by the age group 21-25 years with 9 (7.3%) and the least was among the age group 26-30 years 7 (5.6%). There was no significant difference between age group and urinary tract infection (P = 0.288). Although more females 38(30.7%) were infected than males 18(14.5%) but there was no significant difference between sex and infection, (P = 0.127). The highest isolate was Escherichia coli (23%) followed by Klebsiella pneumonia (16.94%) and Proteus mirabilis (4.84%). Most of the isolates were sensitive to Ciprofloxacin, Sparfloxacin Augumetin, Streptomycin, Perfloxacin, Ofloxacin and Gentamycin but resistant to Septrin and Amoxacillin.

Keywords: Prevalence, *E.coli*, Urinary tract infection, male, female

1.0 INTRODUCTION

Urinary tract infections (UTIs) occur when there is anatomical or functional break in the host defence system allowing for the adherence, multiplication and persistence of bacteria in part of the urinary tract or a microbial infection usually caused by bacteria of any part of the urinary tract i.e. it may involve the parenchyma of the kidney, the renal pelvis, the ureter, the bladder, the urethra or combinations of the urinary system. (Medilexicon Medical Dictionary).

UTIs are widespread in both males and females; nevertheless, females are more susceptible than males (Mohsin and Siddiqui, 2010; McGregor *et al*., 2013).

Urinary tract infections (UTI) represent serious threats to human health all around the world affecting millions of people each year (Reed and Kemmerly, 2009).

These infections could as well be described as the microbial colonization of the urine and infection of the urinary tract. It can be further categorized as ascending and descending (Ojo *et al*., 2004). These infections are majorly caused by bacteria called *Escherichia coli*. Normally urine can contain range of salts, fluids and waste products but does not usually have bacteria in it, bacteria entering the bladder or kidney can reproduce rapidly in the urine causing Urinary tract infections. Urinary tract infection (UTI) is the commonest bacterial infectious disease in community practice with a high rate of morbidity and financial cost. It has been estimated that 150 million people were infected with UTI per annum worldwide which costing global economy more than 6 billion US dollars. (Kolawole *et al*., 2009).

UTI can affect lower and sometimes both lower and upper urinary tracts. The term cystitis has been used to define the lower UTI infection and is characterized by symptoms such as dysuria, frequency, urgency, and suprapubic tenderness. These bacteria infection could affect the lower urinary tract which is known as a simple cystitis (a bladder infection), alternatively, it may involve the upper urinary tract and such descending urinary tract infection causes severe kidney infection, a condition known as PYELONEPHRITIS (Ojo *et al*., 2004).

If the urine contains significant bacteria but there are no symptoms, the condition is known as asymptomatic bacteriuria and when symptoms are present, it is called symptomatic bacteriuria (Lane, D.R *et al*., 2011).

In children or mostly among teenagers, when urinary tract infection is associated with a fever, it is deemed to be an upper urinary tract infection (Bhat, R.G. *et al*., 2011). Urine may contain PUS cells (a condition known as pyuria) as seen from persons with sepsis consequent of urinary tract infections. The most common symptoms are burning with urination and having to urinate frequently with significant pain (Nicolle, L.E. *et al*., 2008). The symptoms may vary from mild to severe, patient experiencing an upper urinary tract infection or PYELONEPHRITIS may experience flank pain, fever or nausea and vomiting in addition to the classic symptoms of a lower urinary tract infection (Lane, D.R. *et al*., 2011).

Escherichia coli is the cause of 80-85% of urinary tract infection, with S*taphylococcus saprophyticus* being the cause in 5-10%. Rarely they may be due to viral or fungal infections (Salvatore, S.S. *et al*., 2011).

Other bacteria that can cause urinary tract infections are Klebsiellae Proteus, Pseudomonas and Enterobacter. These are uncommon and typically related to abnormalities of the urine system or urinary catheterization (Salvatore, S.S. *et al*., 2011).

Among children and teenagers, urinary tract infection are the most common in uncircumcised males less than three months of age; followed by females less than one year. (Lane, D.R, 2011).

Females are significantly more likely to develop a urinary tract infection than males. Females have a shorter Urethra making the distance to the bladder shorter an d the likelihood of the infection moving upwards to the bladder greater.

Urinary tract infections (UTI) represent serious threats to human health all around the world affecting millions of people each year (Reed and Kemmerly, 2009).

Urinary tract infections (UTIs) has been reported in both sexes and age group. UTIs are widespread in both males and females; nevertheless, females are more susceptible than males (Mohsin and Siddiqui, 2010; McGregor *et al*., 2013).

UTIs are caused by the presence of bacteria in urine, although fungi and viruses could be involved. Majority of women have recurrent infection within one year than men (Siiri *et al*., 2009). *Enterococcus* and other gram negative rods other than *E. coli* have also been implicated in some cases (Benjamin *et al*., 2009). Escherichia coli is responsible 75- 90% of uncomplicated UTI's (Karen *et al*., 2006), whereas Staphylococcus saprophyticus causes an estimated 5 - 15% of UTI's frequently in younger women (Micheal *et al*., 2007).

Every woman has a 60% lifetime risk of developing bacterial cystitis, which develops mostly before the age of 24. By contrast, men have a lifetime risk of only 13% (Nicole W, *et al*., 2008).

In children approximately 5% of girls and 1% of boys have a UTI by 11 years of age (Jenson B.H., *et al*) It is also the most common cause of nosocomial infections in adults. Urinary tract infection is said to exist when pathogenic microorganisms are detected in the urine, urethra, bladder, kidney, or prostate with or without the presence of specific symptoms. In most instances, growth of more than 105 organisms per milliliter from a properly collected midstream "clean-catch" urine sample indicates infection. However, significant bacteriuria is lacking in some cases of true UTI, especially in symptomatic patients, a smaller number of bacteria (102 to 104/mL) may signify infection. The vast majority of uncomplicated UTIs are caused by the Gram-negative bacillus Escherichia coli, with other pathogens including Enterococci, Staphylococcus saprophyticus, Klebsiella spp. and Proteus mirabilis (Blondeau J.M., 2004).

The extensive and inappropriate use of antimicrobial agents has invariably resulted in the development of antibiotic resistance which, in recent years, has become a major problem worldwide (Goldstein F.W, 2000). In patients with suspected UTI, antibiotic treatment is usually started empirically, before urine culture results are available. To ensure appropriate treatment, knowledge of the organisms that cause UTI and their antibiotic susceptibility is mandatory. As both temporal and local variables can modify these data, they need to be constantly re-evaluated to achieve a maximal clinical response before the antibiotic susceptibility the isolate is known.

OBJECTIVES OF THE STUDY

(a). Determine the prevalence of the urinary tract infection among undergraduate students of the Federal University of Agriculture Abeokuta, Ogun State residing in the school Hostel.

(b). Determine prevalence among the sexes in the Hall of residence

(c). Determine the bacteria pathogens causing urinary tract infection among these students and how it is influenced by social and hygienic habits within the halls of residence.

(d). Determine the antimicrobial sensitivity patterns of the pathogens and suggest the appropriate empirical microbial agents for use in such cases.

2.0 MATERIALS AND METHOD

2.1 STUDY AREA

This study was carried out in the residential house of students of The Federal University of Agriculture, Abeokuta., The capital city of Ogun State in South west of Nigeria.

2.2 STUDY POPULATION AND SAMPLE COLLECTION

124 Clean-voided, mid-stream urine (msu) specimens were collected from total population of 780 male and female students residing in the campus of the Federal University of Agriculture, Abeokuta. Each of the students was instructed on the mode of collection of the msu that is, during forceful urination after the first 10 - 20 ml has been voided. Subjects were adequately educated on precautions to prevent contamination of specimen. The specimens were collected into sterilized, wide necked, leak proof, plastic universal containers.

2.3 MACROSCOPIC ANALYSIS

The colour and appearance of each urine sample was observed. A turbid urine sample is suspected to be infected while a clear sample of urine may not be infected.

2.4 MICROSCOPIC ANALYSIS

Ten (10) mls of each urine sample was centrifuged at two thousand (2000) revolutions per minutes (rpm) for five (5) minutes. The supernatant was discarded and a few drops of the sediments were placed on the slides and viewed under microscope. This was to check for the presence and amount of pus cells, epithelial cells, yeast cells, red blood cells, white blood cells, crystals, cast and most especially *Trichomonas vaginalis* in each urine.

2.5 PREPARATION OF MEDIUM CULTURE

2.5.1 PREPARATION OF NUTRIENT AGAR

Following the manufacturer's instructions, Twenty five (25) grams of the agar powder was weighed and suspended in one (1) litre of distilled water in a conical flask. The mixture was placed in boiling water for complete dissolution and was sterilized by autoclaving at $121^{O}C$ for fifteen (15) at fifteen (15) pounds per square inch. It was allowed to cool slightly before dispensing into sterile petri dishes and left to set (solidify) at room temperature. The media are stored at $4^{O}C$ in refrigerator until it was to be used.

2.5.2 PREPARATION OF MACCONKEY AGAR

Fifty two (52) grams of the agar powder was weighed and suspended in one (1) litre of distilled water in a conical flask and thoroughly mixed. Complete dissolution was ensured, the mixture was placed in boiling water for few minutes and was sterilized by autoclaving at $121^{O}C$ for fifteen (15) at fifteen (15) pounds per square inch. It was allowed to cool slightly before dispensing into sterile Petri dishes and left to set (solidify) at room temperature. The media are stored at $4^{O}C$ in refrigerator until it was to be used. All media used were prepared according to the manufacturer's instructions.

2.6 MICROBIOLOGICAL ANALYSIS

All the urine samples collected were handled and assayed aseptically within five hours of collection. Primary isolation was done on nutrient agar. However, plates that did not show growth were recorded as negative.

2.7 IDENTIFICATION OF ORGANISMS

All bacterial isolates were characterized on the basis of colonial characterization and pigmentation.

2.8 CULTURING FOR ISOLATION

Each urine sample was streaked with a sterilized platinum wire loop and innoculated on MacConkey and Nutrient Agar plates. The plates were incubated at $35^{o}C$ for 18 to 24 hours to isolate growing microorganisms. Representatives of growing colonies were later picked with a sterilized wire loop and pure cultures were made with repeated streaking on fresh MacConkev and Nutrient agar plates. Resulting pure cultures obtained were used for biochemical tests aimed at identifying the bacteria isolates Isolated were particularly subjected to Gram-staining, Urea Methyl-red Oxidative fermentation and Quelling reactions (Ojo *et al*., 2004) and also Serelogy test.

2.9 GRAM-STAINING TECHNIQUES

The smear of each isolated colony was prepared on a microscopic slide and heat—fixed. It was then stained with crystal violet for a minute and rinsed with tap water and blood –dried. It was then decolourized with 75% alcohol for 30 seconds and rinsed with tap water. The slide was then counter stained with a secondary stain (Saffranin solution) for 30 seconds rinsed with tap water. It was then allowed to drain and air-dried after which it was examined microscopically under oil-immersion objective lens. The organism that picked-up pink colour are gram negative bacteria.

MOTILITY TEST

A drop of the suspension was placed on a slide and covered with a cover slip. Hanging drop preparation was achieved by placing a drop of the suspension on a cover slip and inverting this over a cavity slide. Then the preparation sealed with molten jelly to prevent it from dying out. The preparation was examined microscopically for motile organism using X_{10} and X_{40} objective lens. The movement of the bacterium was shown when the organism moves itself in different directions or in a single direction. When this occurred, the mobility test of the organism is positive.

2.10 BIOCHEMICAL TESTS

The following biochemical test were done according Clinical laboratory standard guildlines to further confirm the isolates from the urine samples.

COAGULASE TEST

Using an inoculating loop, a heavy milky suspension of the organism was made on a microscope slide. The organisms were homogenized using a drop of distilled water. A flame cooled sterile loop was used to make a loopful of rabbit plasma to the suspension and mixed. Coagulase production is denoted by almost immediate clumping of the suspension.

CATALASE TEST

A drop of 3% hydrogen peroxide was added to a microscopic slide. A loopful of organism isolated is touched to the drop of hydrogen peroxide. Foaming or bubbling will indicate a positive test due to evolution of water and oxygen.

UREASE TEST

Urea agar was inoculated and incubated at 30^{o}C for 24 hours. Urease activity was observed by change of colour (red) of the indicator as a result of production of ammonia. Positive test (pink colour) in 2-4 hours on the urea agar at 30^{o}C usually is a confirmatory test for Proteus species while it is 2-4 hours for *Klebsiella pneumoniae*. No colour change observation indicates Urease negative.

METHYL RED TEST

Dextrose broth medium was inoculated with the suspension colonies for 48 hours to 96 hours. After incubation, 5 drops of methyl red was added, red colour indicates positive test while yellow colour indicates negative result immediately after addition of the indicator.

VOGES- PROSKAUER TEST 1

mil of 10% KOH was added to a 2 day dextrose broth culture of the organisms under test. This was then left at room temperature for 1 hour in the colour. Pink colour indicates positive reaction while no change in colour indicates negative reaction.

OXIDASE TEST

A loopful of the reagent (1% tetramethyl-phenylene diamine aqueous solution) stored in dark bottle at 4^{o}C was added to a filter paper in a petri dish. With the aid of a platinum loop, the suspected colony was smeared across the moist paper, then the colour change for positive reaction was indicated by a purple colour appearing across the filter paper within 10 seconds.

INDOLE TEST

The organism was grown in peptone water for 1 day. 1 ml of Erlich reagent (i.e. indole reagent) was then added by running down the side of the tube. Rose pink colour shows positive result while no change in colour indicates negative result.

CITRATE UTILIZATION TEST

The organism was inoculated onto Simmon's citrate agar. The medium is then incubated at the optimum temperature. Blue colour in this medium indicates positive result (Citrate utilized).

SUGAR FERMENTATION TEST

1% of the sugar was prepared by dissolving 1 gram of the sugar in distilled water. 1ml of peptone was then prepared by dissolving 1.5g of peptone into 100ml of phenol red into the prepared peptone water. Then 9ml of the mixture of the solution of peptone water and phenol red was pipette into each test tube and later 1ml of sugar solution was also added to each test tube . Each test tube was corked with cotton wool and then autoclaved.

After autoclaving, the medium was allowed to cool and organisms to be tested were then inoculated using flamed inoculating loop into each test tube. The media were incubated at 37^{o}C for 48 hours.

The change in the medium from red colour to yellow is indication of fermentation process (positive) while no change means negative.

2.11 SENSITIVITY TEST

The sensitivity test were carried out on the isolated bacteria in each urine specimen with a view of knowing the antibiotics, the organism is sensitive or resistant to. This was done by using gram negative sensitivity disc containing known amount of particular antibiotic, the disc was placed using sterile forceps onto nutrient agar plate that has been inoculated with bacterial isolate using streaking method and each plate was incubated for 1 at 37^{o}C. The clear zone of growth inhibition around the disc showed that the organism is sensitive to the drug and this was recorded as 'S' (Sensitive), while no zone of growth inhibition after incubation indicates that the organism is resistant to such drug and this was recorder as 'R' (Resistance).

The multi-disc used in this project contains the following antibiotics with given concentration:

Abbreviation	**Antibiotics**	**Concentration**
SXT	Septrin	10 µg
AU	Augmetin	30µg
CH	Chloranphenicol	10 µg
CN	Gentamycin	10 µg
CPX	Ciprofloxacin	10µg
OFX	Ofloxacin	5µg
PEF	Pefloxacin	5 µg
SP	Sparfloxacin	30 µg
S	Streptomycin	5 µg
AM	Amoxacillin	10 µg

3.0 RESULT AND DISCUSSION

3.1 RESULTS

One hundred and twenty four (124) samples of urine were collected and aseptically assayed microbiologically among the male and female undergraduate students residing in the hall of residence of the campus of the Federal University of Agriculture, Abeokuta, Ogun State. The overall prevalence of positive to infection was 56(42%).

Table1 shows the Age distribution and urinary tract infection among students residing on campus of Federal University of Agriculture, Abeokuta, Ogun State. Of the total number of students examined, 40(32.3%) were in the age group of 15-20 years, 9(12.90%) were in the age group of 26-30 years. The highest prevalence was recorded among students within the age group of 15-20 40(32.3%)) and the smallest prevalence was recorded among of the age group of 26-30 years (7(5.64%)). The computed chi-square statistics for the study between age and urinary tract infection had a value of 0.249 and statistically significant at less than 1% leading to rejection of null hypothesis of association.

Table 2 shows urinary tract infection by sex. More females 38(30.65%) were infected than males 31(25.0%). The computed Chi square for the test of no association between sex and statistically insignificant at less than 1% level which shows that the null hypothesis of no association is

accepted. The highest isolated bacteria among the students examined was *Escherichia coli* 29(23.39%) followed by Klebsiella pneumonia 21(16.9%) and Proteus mirabilis 6(4.8%).

Table 3 show the result of antibiotic sensitivity pattern of the bacteria isolates. It was found that most of the isolates were sensitive to Ciprofloxacin, Sparfloxacin, Perfloxacin, Gentamycin, Augumetin, Chloranphenicol, Streptomycin, Ofloxacin.
Table 4 shows the various biochemical test used for the identification of the isolated bacteria in this study.

Table 1: Age – Urinary Tract Infection among students in FUNAAB Hostel

AGE (Years)	Number Examined	Urinary Tract Infection	
		Positive N (%)	Negative N (%)
15-20	85	40 (32.3)	45 (36.3)
21-25	27	9 (12.90)	18 (14.5)
26-30	12	7 (5.64)	5 (4.0)
Total	124	56 (45.2)	68 (54.8)

P = 0.288
X^2 = 2.489

TABLE 2 : SEX - URINARY TRACT INFECTION

SEX	Total	Urinary Tract Infection	
		Positive N (%)	Negative N (%)
Male	49	31 (25.0)	18 (14.5)
Female	75	38 (30.6)	37 (29.8)
Total	124	56 (45.2)	68 (54.8)

P = 0.127
X^2 = 2.323

TABLE 3: Antibiotics sensitivity pattern of microbial isolate

Microbial Isolates	Total Number	Sensitivity									
		AU	**CH**	**CN**	**CPX**	**OFX**	**PEF**	**SP**	**SXT**	**S**	**AM**
EC	29	7	0	6	17	1	8	6	0	5	0
KP	21	1	5	3	7	0	2	10	0	0	0
PM	6	0	0	0	5	0	3	4	0	0	0
NG	68	0	0	0	0	0	0	0	0	0	0

Antibiotics

SXT - Septrin
AU - Augmetin
CH - Chloranphenicol
CN - Gentamycin
CPX - Ciprofloxacin
OFX - Ofloxacin
PEF - Pefloxacin
SP - Sparfloxacin
S - Streptomycin
AM - Amoxacillin

Microorganisms Present

EC – Escherichia coli
KP – Klebsiella pneumoniae
PM – Proteus mirabilis
NG – No growth

Table 4: Biochemical Reaction of isolated Microorganisms

Biochemical Test	Escherichia coli	Klebsiiella pneumonia	Proteus mirabilis
Citrate test	-	+	+
Motility test	+	-	+
Catalase test	+	-	+
Coagulase test	-	-	-
Urease test	-	+	+
Methyl red test	+	-	-
Indole test	+	-	-
Voges poskauer	-	-	+
Oxidase test	-	+	-
Lactose test	+	+	-
Sucrose test	(+)	(+)	-
Glucose test	(+)	(+)	+

"+" – Refers to positive reaction
"-" – Refers to negative reaction
(+) – Refers to positive reaction with gas production.

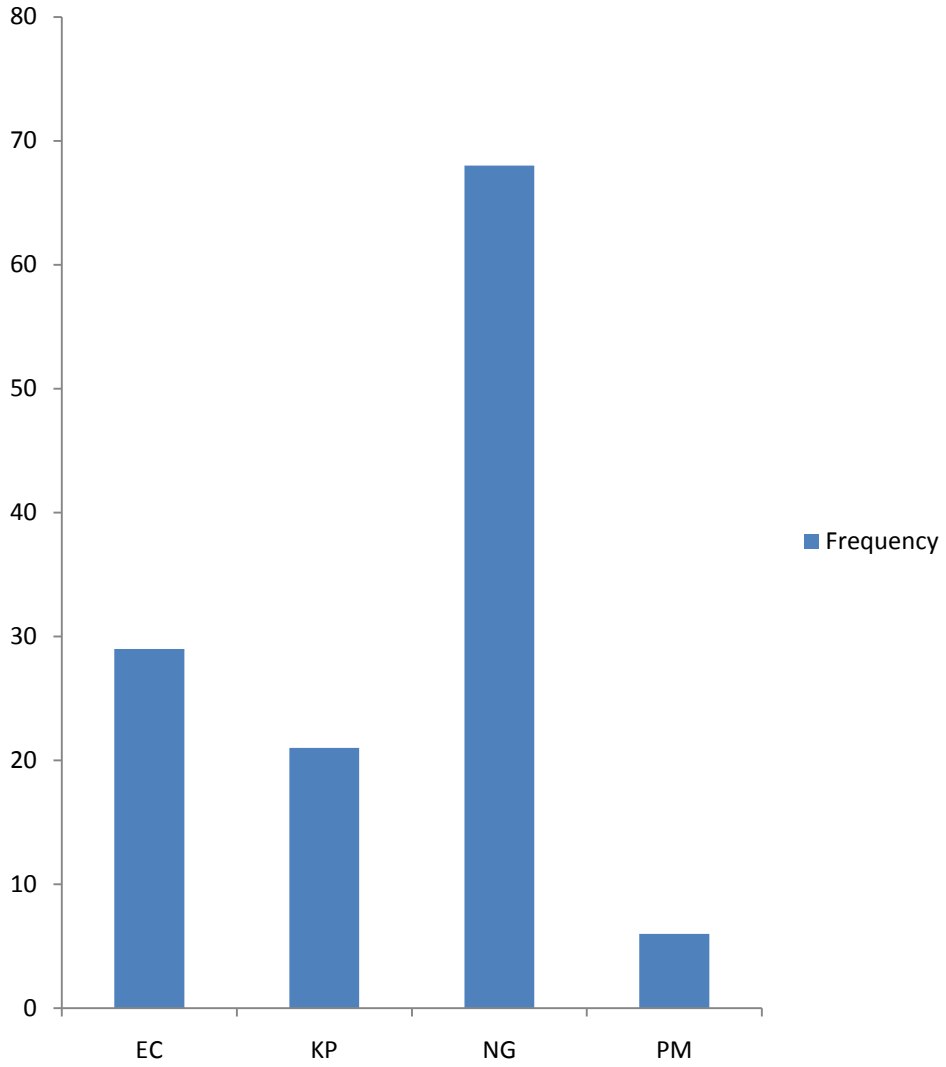

Figure 1: Frequency Distribution of Microbial Isolates

RESULT

In this study, The overall prevalence of UTI – Urinary tract infection among the University students residing on campus was 56(45.23%) which is lesser than previous research done by Ojo *et al.* in the same institution. The difference may be due to attitudinal changes of the subjects to the factors that have predispose them to the infection and effectiveness of the prescribed antibiotics and better handing of toilet facilities in the hostel plus certain intervention like replacement of bad toilet seat in both male and female hostel of the University hall of residence. The use of infected water can be a very viable source of infection, as among the pathogen disseminated in water sources, enteric pathogens are the frequently encountered. This is in agreement with previous reports (Onyango and Angieda, 2010 and Uyigue and Anukan, 2011).

There is also a possible link between the prevalence of UTI among students and the level of personal hygiene or the state of toilet facilities in the hostels. Most of the students examined rated the hostel toilets as fair. Fair, in this context implies that there is no adequate supply of water to clean and flush the toilets regularly. When dirty therefore, there is an accumulation of urine

sediments forming a thick scum. In this case students could become infected during urination. Sexual activity is another factor that predisposes people to UTI.

According to Amali, *et al*, 2009 in their research, Hygiene factor such as hand washing practice, the use of bubble baths or scented soap which may contain irritants, squatting over the toilet seat which makes a person susceptible to Urinary Tract infection not urinating frequently during the day and also after intercourse and wiping from the back to the front which leads to the transfer of faecal matter from the renal region most especially among teenagers. The study implicated six microorganisms as possible etiological agents of the urinary tract infection cases observed. These organisms *Escherichia coli*, *Proteus mirabilis* and *Klebsiella pneumonia* are the common causative agents of urinary tract infection as earlier reported by (Wagenlehner F.M *et al*; 2008 and Usman *et al*, 2008). In this study, the highest prevalence was recorded among students within the age group of 15-20 years 40 (32.3%) which is in agreement with previous studies.

Also in this study, *Escherichia coli* was the most prevalent among the causative organisms (51.79%) may be due to faecal contamination, the predilection of the organism from the toilets and the shortness of female urethra (Meadow *et al*, 2008).

In this study, more female 38(30.6%) than male 18(14.5%) showed susceptibility to UTI compared to their male counterpart in the student's residence . Although there was no significant difference between sex and the infection. The higher prevalence observed among the female may be due to the fact that exogenous infections in females spread from the anus due to poor anal cleaning to the vagina where the bladder might be infected (Meadow *et al*, 2008).

It was also observed that the susceptibility of the isolates to the nine (9) antibiotics differs with the species. Remarkable result was obtained with Ciprofloxacin and Sparfloxacin. Earlier researches also revealed the success of ciprofloxacin has a broad spectrum activities and that its bactericidal activities on organisms both in replicating and resting state and its ability to disrupt DNA functions leading to the death of the bacterium. Drugs like perfloxacin and gentamycin have a relatively far activities on isolate with 13 and % respectively. The resistance observed among the most microorganisms against the antibiotics used may be due to abuse and indiscriminate use of antibiotics through self medication (Ibeawuchi and Mbata, 2007). Also, the low prevalence of urinary tract infections need to be maintained and possibly cut-down through constant awareness creation and intensive maintenance of the hostel toilet facilities, constant supply of water to the toilets and orientation of the cleanliness of the hostels.

CONCLUSION

Conclusively, a low incidence of urinary tract infection was demonstrated among the student residing on campus of the Federal University of Agriculture, Abeokuta Nigeria. Those with non significant urinary tract infections as the time of this assay were low while those that are negative were 68 (54.8%). As earlier reported by several workers Escherichia coli was also implicated as the most common causative organism of urinary tract infection among the studies of the University. I therefore recommend that factors such that promote the occurrence of UTI in our campus should be addressed promptly to prevent recurrent cases and emergence of resistant strains. Below are my recommendations.

RECOMMENDATION

In order to reduce the incidence of urinary tract infections, awareness on the importance of proper personal hygiene, routine medical laboratory investigation should be encouraged among parent for their wards especially the female children as they are more prone to geno-urinary tract infection while taking note of their environmental risk factors.

Adequate consideration should also be given to water and toilet facilities in the hall of residence by the school management to ensure that the infections be minimized by environmental factors.

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