OCCURRENCE OF URINARY TRACT INFECTIONS IN SIX LOCAL GOVERNMENT AREAS OF NIGER STATE, NIGERIA.

BY

NA'UZO ABDULLAHI ALIYU

PG/M. TECH/ 99/2000/442

FEBRUARY 2004

OCCURRENCE OF URINARY TRACT INFECTIONS IN SIX LOCAL GOVERNMENT AREAS OF NIGER STATE, NIGERIA.

BY

NA'UZO ABDULLAHI ALIYU

PG/M. TECH/ 99/2000/442

A THESIS SUBMITTED TO THE POSTGRADUATE SCHOOL, FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA, IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE AWARD OF MASTER OF TECHNOLOGY (M.TECH) DEGREE IN PHARMACEUTICAL MICROBIOLOGY.

DEDICATION

This work is dedicated to the entire members of Na'uzo family.

CERTIFICATION

This thesis entitled "Occurrence of Urinary Track Infections in Six local Government Areas of Niger state, Nigeria" was examined and found to meet the regulations governing the award of the degree of Master of Technology (Pharmaceutical Microbiology) of the Federal University of Technology Minna, and is approved for its contribution to knowledge and literary presentation.

Dr. S. B. Oyeleke
(Main Supervisor)

25/02/04
Date

Head of Department

24th/5/04
Date

Prof. (Mrs.) H. O. Akanya
Dean, School of Science
And Science Education

24th/5/04
Date

Prof. J. A. Abalaka
Dean Post Graduate School

Date

Dr. K. B. Tanyigna
External Examiner

25/02/04
Date

DECLARATION

I hereby declare that this thesis is an original work of mine and has never been presented elsewhere for the award of any degree. References made to publish literature have been duly acknowledged.

25/02/04

Signature of student

Date

ACKNOWLEDGEMENTS

To Allah (SWT) be the Glory for the ability bestowed upon me to carry out this research. Peace and Blessings of Allah also be upon His Prophet Muhammed (SAW). My unreserved gratitude goes to my Supervisor, Dr. S.B. Oyeleke, who monitored the progress of this work, provided criticism, guidance and finally corrected my script. Similar gesture is also extended to my lecturers. Prof. T.A Gbodi, Prof. J.A. Abalaka, Prof. S.A Garba, Dr. U.J.J. Ijah, Dr. Ogbadoyi and Mallam Abdulrahman Hassan, for their encouragement and dedicated attention throughout the course of my studies. I have also benefited greatly from the laboratory technicians, Mallam Hamidu Abdullahi and Mallam Moh'd Kudu Bida, for providing me with relevance information and help during the course of my research.

I remain grateful to my mother, Hajiya Zainab and my father Alhaji Abubakar I. Maigishiri, for their dedication and genuine love at all times. I also express my gratitude to my uncle, Engineer Nuhu B. Nauzo for his unflinching moral and financial support; I recognize the effort of Hajiya Aishat B. Nauzo for her noble contributions, as well as prayers, which keep my academic spirit alive. My special appreciation goes to Dr. Yahaya B. Nauzo and his wife, Bilkisu Y. Nauzo, Alhaji Jibrin Maigishiri, Alhaji Iro Maigishiri Ummukhari Nauzo and Engineer Suleiman J. Nauzo, for their valuable advice and other froms of support they rendered to me. I wish to state here with all gratitude, the infinite help rendered to me by Pharmacist Salisu Nauzo, Director Nauzo Family Pharmacy, and his wife, Hadizat S. Nauzo, May Allah reward them abundantly.

I acknowledge the contribution of Dr. Moh'd Nauzo, Dr. Habiba Nauzo, Pharmacist Shehu Madaki, Yusuf Erana, and Habiba Marafa, for providing me with some relevant materials used in this research work. I am overwhelmingly grateful to all

my friends Mallam Aminu Umar, Ibrahim, S.S, Nasiru Abdullahi, Awal Mohammed, Pharmacist Attahiru A. Shehu, Kabiru Goro, Bala King, Dr. Suleiman Paret and too numerous to mention. I thank all members of my class, for sharing nice time together, and for their suggestions toward the success of this thesis.

NAUZO ABDULLAHI A.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBRIVIATIONS

A- Acid production

AG- Acid and gas production

BA- Blood agar

NA- Nutrient agar

- - Negative

+ - Positive

UTIs- Urinary tract infections

SS- Total sum of squares

Df- Degrees of freedom

Ms- Mean Square

Amp- Amplicilin

Cot- Cotrimoxazole

Cip- Ciprofloxacin

Ery- Erythromycin

Gen- Gentamycin

Tet- Tetracycline

L.G.A-Local Government Area

Kon- Kontagora

Mag- Magama

Mar- Mariga

Mas- Mashegu

Raf- Rafi

Rij- Rijau.

ABSTRACT

Six hundred urine samples were collected from patients attending, General Hospitals, Private medical centers, and Rural Hospitals in Mashegu, Magama, Mariga, Rafi, Kontagora and Rijau Local Government Areas of Niger State, Nigeria. The samples were screened for a significant bacteriuria. Three hundred and eighty one positive cases of urinary tract infections (UTIs), comprising 35.4% male and 64.6% female cases were established. The results revealed high incidence of urinary tract infections in females than in males. It also revealed that the disease mostly affected the age groups 16-40years in females and 41-60years in males. Statistical analysis revealed variation in the prevalence of UTIs in the LGAs studied. Organisms isolated and identified as agents of UTIs are *S. aureus,* (17.9%), *E. coli,* (22.2%), *Strep. faecalis,* (5.6%), *Klebsiella Species,* (14.1%), *Proteus vulgaris,* (9.2%) *Pseudomonas aeruginosa,* (5.3%), *Neisseria gonorrhea,* (3.8%) and *Candida albicans,* (10.9%). Six antibiotics commonly used in Nigeria, were tested against the bacterial isolates and the results revealed that *S. auerus, Pseu. aeruginosa, Strep. faecalis, Neisseria gonorrhea and Kleb.* species exhibited high resistance to Tetracycline, Erythromycin and Cotrimoxazole. In addition, *Proteus vulgaris* was found to be resistant to Ampicillin. It was however, observed that Ciprofloxacin and Gentamycin strongly inhibited the growth of the organisms tested. Thus, Ciprofloxacin or Gentamycin could be the drug of Choice in treating UTIs caused by these organisms.

CHAPTER ONE

1.0. INTRODUCTION

The urinary tract is composed of two kidneys, which produce urine, two ureters, which convey urine to bladder, the bladder, which serves as a reservoir for urine, and urethra which discharges urine from the bladder (Briggs, 1990). This tract like the respiratory and digestive tracts, ends on the body surface and therefore can never be sterile throughout its length. However, when the tract is anatomatically and physiologically normal, local and systematic defense mechanisms are intact, organisms are confined to the lower end of the urethra (More, 1991).

Infections of the urinary tract are among the most common of all bacterial infections, and have been referred to as common cold of the lower half of the body (Herold *et al*, 1982). The term urinary tract infection (UTI) is a description of the spectrum of urologic condition between which the common link is the presence of bacteria (Chisholum *et al*, 1990). A case of urinary tract infection (UTI) is established when there is a significant bacterial count of 10^5 per ml of urine (Jan, 1980).

In the normal individual, the act of urination is a defense against bacterial colonization of urinary tract, as urination washes bacteria out of the tract (Asschar, 1980). Slowing or obstruction of normal urine flow, incomplete micturition habits or impatient taking of medicines associated with urinary retention can result in the production of post-void urine residue. However, the residue impairs the wash out defense mechanism and also provides an excellent growth medium for the remaining bacteria to colonize (Prescott *et al*, 1990).

Urinary tract infections (UTIs) can be described as prostitis, cystitis, pyelonephritis or urethritis depending on the primary focus of the infection (Cattel, 1985). These diseases can be categorized as being asymptomatic or symptomatic, uncomplicated or complicated, initial or recurrent, and acute or chronic (Pelczer *et al*,1996). Urinary tract infections

develop in sequential step, firstly the anterior –urethra is colonize, the invading organisms then colonized the bladder and multiply to a great number (Kunin, 1980). Once any component of urinary tract becomes infected, the entire system is susceptible to bacterial invasion (More, 1991).

The male urethra is inhabited by *Staphylococcus, Streptococci Diptheriods* growing usually between 10 and 10^4 per ml of voided urine. Gram-negative enteric pathogens are rare in the male urethra, but appear more often under the foreskin of newborn and infants (Pfeu, 1990). The common bacteria floras of a female urethra as well as that of the vaginal vestibule and vagina consist largely of aerobic and anaerobic gram-positive lactic acid bacteria. These bacteria metabolize carbohydrate to acidic product, which lower the PH of the vagina (Pfeu, 1990). The lactic acid bacteria are predominantly members of the genus – *Lactobacillus* with smaller number of *Streptococcus agalactiae, Viridance Streptococcus and Peptopstreptococcus;* other microbes from the vagina include gram-negative rods, *Staphylococcus epidermidis, Diptheroids, Bacteroides,* Yeast and occasionally *Trichomonas vaginalis* (Asschar, 1986).

Most urinary tract infections (UTIs) are caused by opportunistic pathogens that infect the anterior urethra or ascend the urethra to infect the prostate gland in male (prostatis), the bladder (cystitis) or the kidney (pyelonephritis) (Roy, 1999). Over 80% of urinary tract infections are caused by *Escherichia coli* (Roy, 1999). This organism is able to colonize the urethra and establish an infection in part, because of its ability to resist the inhibitory effects of vaginal fluids, and its fimbriae enable it to attach to urethra epithelial cells (Herold *et al*, 1982). The remainders are due to *Proteus, Klebsiella,* and *Enterococcus faecalis.* Organisms such as *Corynebacterium, Fusobacterium, Gardnella vaginalis, Mycobacterium, Mycoplasma, Neisseria, Peptostreptococcus, Staphylococcus aureus, Streptococcus varidance, Candida albicans* and occasionally *Pseudomonas aeruginosa* are usually associated with underlying pathology or prolonged broad spectrum antibiotic therapy (Edward and Ewing, 1972; Roy, 1999).

Urinary tract infections (UTIs) is the most common bacterial infection in women occurring in about 2% of the female population at the age of 15-24 years and increasing 1-2% every decade to a prevalence rate of 10% in the 55-65 decade (Roy, 1999), thus about 4-6% women of child bearing age will have UTIs at any survey, and 10-20% of all women will experience urinary tract infection in their life time (Cattel, 1985). If the UTIs is symptomatic or not is of no significant, as a symptomatic infections become symptomatic at ificant, as a symptomatic infections become symptomatic at some stage (Stamey, 1986; Chisholum *et al*, 1990), and are therefore both integral part of the same disease entity, eg. Urinary tract infection in view of this fact and the finding that no serious renal disease occur in women screened for asymptomatic bacterial infection, the main intention which may interest physician should be directed to the management of the symptomatic UTIs. On exception however, in the early stage of pregnancy screening for UTIs may prevent recurrent infections (Reisenberger, 1983). The prevalence of UTIs in pregnant female is similar to that of the non-pregnant female at an average of about 4-7% but an average of one-third of these patients develop acute pyelonepharitis, which is significantly different incidence from that of the non-pregnant woman (Chisholum, 1990).

Urinary tract infections (UTIs) in pregnancy present a special problem as distinct from the non-pregnant women, due to anatomical and physiological alteration of pregnancy (Prescott *et al*, 1990). The early management of UTIs in the pregnant women is of major importance because she is at high risk of developing recurrent UTIs, pregnant women develop acute pyelonephritis in the third trimester, when hydronephrosis and stasis in the urinary tract are most pronounced (Kriangere, 1986). The bacteriuria mother, is able to transfer the maternal organisms to the newborn and cause significant neonatal disease. Further more, acute pyelonephritis during pregnancy may increase the risk of the maturity and prenatal mortality. Usually the human term labour is thought to be initiated by amniotic and chorion phospholipids of the uterine membranes, leading to production of prostaglandin E_2 and F_2, and the induction of spontaneous labour (Pfeu, 1986). The mechanisms of

premature labour developing in patient with symptomatic urinary tract infection are not clear but may be related partly to micro-organisms producing phospholipase E_2. Many bacteria including *E. coli* and other gram-negative bacteria can produce phospholipase E_2 that may then serve to trigger premature labour (Fowler and Stammey, 1987) though these occur under intra-amminicoritic infections. There are some evidence that bacteria may spread from the urinary tract to the amniotic fluid, thus causing aminionitis and leading to premature labour (Fowler and Stammey, 1987). Due to these aggravating factors pregnancy is probably the only time when screening for UTIs, becomes a worthwhile endeavuor (Stammey 1986).

In sharp contraindication, the incidence of UTIs in man is very low. At early stage in life, boys are affected more commonly than girls in the first few months. The incidence in males then fall to a low level at two years of age which is maintained until late adult life (Roy 1999). Ijah and Sar (1996) observed high infection rate of males between the age of 31-70 years and suggested that, the high rates of infection at this age range are probably due to the fact that males rather than females are the primary source of infections.

Urinary tract infections have been reported in children (Jan, 1980; Princewill and Obiete, 1991). In Port-Harcourt, Nigeria, Prince will and Obiete (1991), observed UTIs in children with 2.13% and 1.33% incidence in boys and girls respectively. Roy (1999) observed childhood urinary infection and concluded that by the age of 10 years, only 2% of urinary tract infections could be seen. During the infancy, the presentation is relatively non-specific with fever, associated with lethargy and poor feeding in late childhood, frequency and dysuria, or daytime wetting are the common presentation. Renal perenchymal involvement may occur without localizing symptoms. Urinary tract obstruction, vesicouratic reflux and neurophathic bladder disturbances are associated with renal parenchymal infection and renal scars surgery is usually indicated by obstruction and occasionally for the child with vasicouretic reflux, where prophylatic antibiotic have failed to prevent recurrent infections (Roy, 1999).

Two consecutive and closely interrelated processes are essential in the development of recurrent UTIs, in otherwise healthy premenospausal women with normal urinary tract. The first process presents a biologic problem, which permits the colonization of the vaginal introitus, vagina and urethra by gram-negative enteric bacteria from the rectal flora (Pfeu, 1986) as distinct from the women resistant to UTIs, whose vaginal introitus, vagina and urethre are usually devoid of such bacteria. Factors such as adherence of enterobacteria of the squamous epithelia cells from the mucosal surface, as well as an inadequate vaginal antibody response to bacteria from the faecal reservoir have been implicated in promoting vaginal and urethral colonization with urinary pathogens (Pfeu, 1986). However, presence of Gram-negative flora does not cause any clinical symptoms, as long as the women has no sexual intercourse, and neither does it change essentially the vaginal biology (Pfeu, 1986).

The second and subsequent necessary process in the development of UTI is sexual intercourse, which acts as an agent transferring the pre-existing pathogenic bacteria from the vulvae vaginal and urethral areas in to the bladder, precipitating the advent of a clinical urinary infection. Sexually transmitted disease (STDS) can be caused by over 30 pathogens, including bacteria, viruses, protozo, fungi and ectoparasites (Leigh, 1984; Hoffman, 1990). Some changes in the vaginal flora of women accompanied by excess bacteria such as *Gardnella vaginalis,* (known as bacterial vaginosis) and other endogenous infections caused by *Mycoplasma species* or *Candida albicans* may also be sexually acquired (Richard and David, 1983). The World Health Organization (WHO) estimated that 333 million new cases of non-viral STDS occur every year, of which 285million (86%) occur in developing countries (Hubley and Fresen, 1996).

Pfeu, (1986) reported that in the absence of the above two processes, recurrent UTIs will not develop in this population and the investigator suggested that pathogenesis was borne out by investigations of the premenopausal population with recurrent UTI, showing most women became symptomatic only after initiation of sexual activity and the abstention

from sexual activity prevented further appearance of UTI despite persistent introital colonization with Gram-negative enterobacteria.

Urinary tract infection may present an unexplained fever at any age but most likely in the infants and the elderly (Roy, 1999). Besides, nonspecific symptoms and signs may predominate in infants eg. poor feeding, prolonged vomiting and lower abdominal or loin pain (Reisenberger, 1983; Roy, 1999). Loin pain associated with fever strongly suggests the presence of renal parenchymal infection, the kidney may be affected in the absence of localizing symptoms, perineal, vulval or penoscrotal inflammation and irritation are usually due to UTI (Reisenberger,1983;Roy, 1999).

Urinary tract infections (UTIs) have over the years gained an increasing important place in human medicine. This could be due to serious nature and complications caused by these infections and also as a result of the increasing resistance of the aetiologic agents of urinary tract infections. Thus, this has been the case in Nigeria, as a consequence of poor sanitary habits, poor health delivery system and the rising rates of promiscuity by both the young and older citizens (Stamm and Turk, 1980; Richard *et al*,1983; Leigh, 1984; More, 1991). In Niger State, there are speculations, particularly by Hospitals and Diagnostic Laboratory workers that Urinary Tract Infections are a serious health problem and that the prevalence rate is high. There is therefore, the need to investigate the prevalence of UTIs in the State. Niger State has Twenty-six Local Government Areas (LGAs), most of which lack functional health facilities. The choice of the six LGAs in this study was based on geographical spread and the fact that health facilities are poor and grossly inadequate.

1.1. RESEARCH OBJECTIVES

The objectives of this study were as follows:

i. To investigate the incidence of urinary tract infections in six (6) selected local government areas of Niger State.

ii. To identify various aetiologic agents involved in the urinary tract infections.

iii. To screen the organisms for antibacterial sensitivity.

CHAPTER TWO

2.0 LITERATUE REVIEW

2.1 FACTORS PREDISPOSING TO URINARY TRACT INFECTIONS:

2.1.1. Stasis and Obstruction:

Bacteria are better able to gain a foothold if there is stasis or obstruction, as seen with distal urethral stenosis in little girls, enlarged prostate and vesicourteral reflux. Under these circumstances, pathogenic bacteria ascend to the bladder (Smith 1981; Fawcett *et al*; 1985). Constipation in children has been related to urinary tract infections in both sexes. Many have great difficulty in voiding; when the constipation is relieved most of the children cease having infection (Scott, 1995).

2.1.2 Presence of a foreign body:

A kidney containing a stone is apt to become infected even in the absence of obstruction; a foreign body introduced into the bladder (Eg. indwelling catheter) will lead to infection (Smith, 1981). How these infections develop in catheterized patient can be summarized (Mitchell and Gillespie, 1984) thus:

1. At the time of catheterization, infection may spread from the person inserting the catheter if aseptic procedures are not followed or organisms in the patients own urethra may be introduced.
2. Bacteria may spread upwards through the lumen of the catheter.
3 There may be entry of bacteria between the catheter and the urethra (Chisholum 1982; John, 1991), such objects seem to lower the normal resistance to successful invasion by bacteria (Smith, 1981).

2.1.3 Continuous source of infections:

This can occur from fistulas communicating between skins or bowel and urinary channels (Scott, 1995).

2.1.4 General body resistance:

Resistance may be lowered in the course of debilitating illness, periods of chronic or excessive fatigue, in which case infection gains a foothold more easily e.g. diabetes predisposes to urinary infection (Smith, 1981; Scott, 1995).

2.1.5 Sex:

It has been reported that urinary tract infections are common in female than in male of corresponding ages (Kunin, 1980; Leigh, 1984; Morse, 1987; More, 1997). Until now nothing has been known about how and why women are prone to recurrent urinary tract infections, Hoffman, (1990) suggested that women may be genetically programmed to infections of the urinary tract i.e. The anatomy of the female genital tract renders a woman far more vulnerable than a man to urinary tract infections.

2.1.6 Urinary tract epithelial cells defects;

Professor Schaeffer of the North Western University in the United States of America carried out a series of researches as reported by Hoffman (1990), and found that, in women prone to urinary tract infections, the epithelia cells lining the urinary tract has a biological defect, they had sticky surface glycoproteins that attracted *E. coli* and allowed them to colonize and cause infections.

2.1.7 Age:

Investigation carried out by Anderson (1982) suggested that urinary tract infections were most prevalent in the age groups of between 16 to 45 years in female, subsequent investigations by other researchers have however, shown that infection is possible at any age (Leigh,1984; More, 1991; Lokhoo, 1996). Kunin (1980), carried out studies on school children and found infection in 16-19 years old. Similarly, Prince will and Obiete (1991) carried out studies on school children in Port Harcourt, Nigeria and reported that the age

groups; 6-8 years 9-11 years and 12-14 years had significant bacteriuria representing 53.8%, 23-1% and 23.1% respectively.

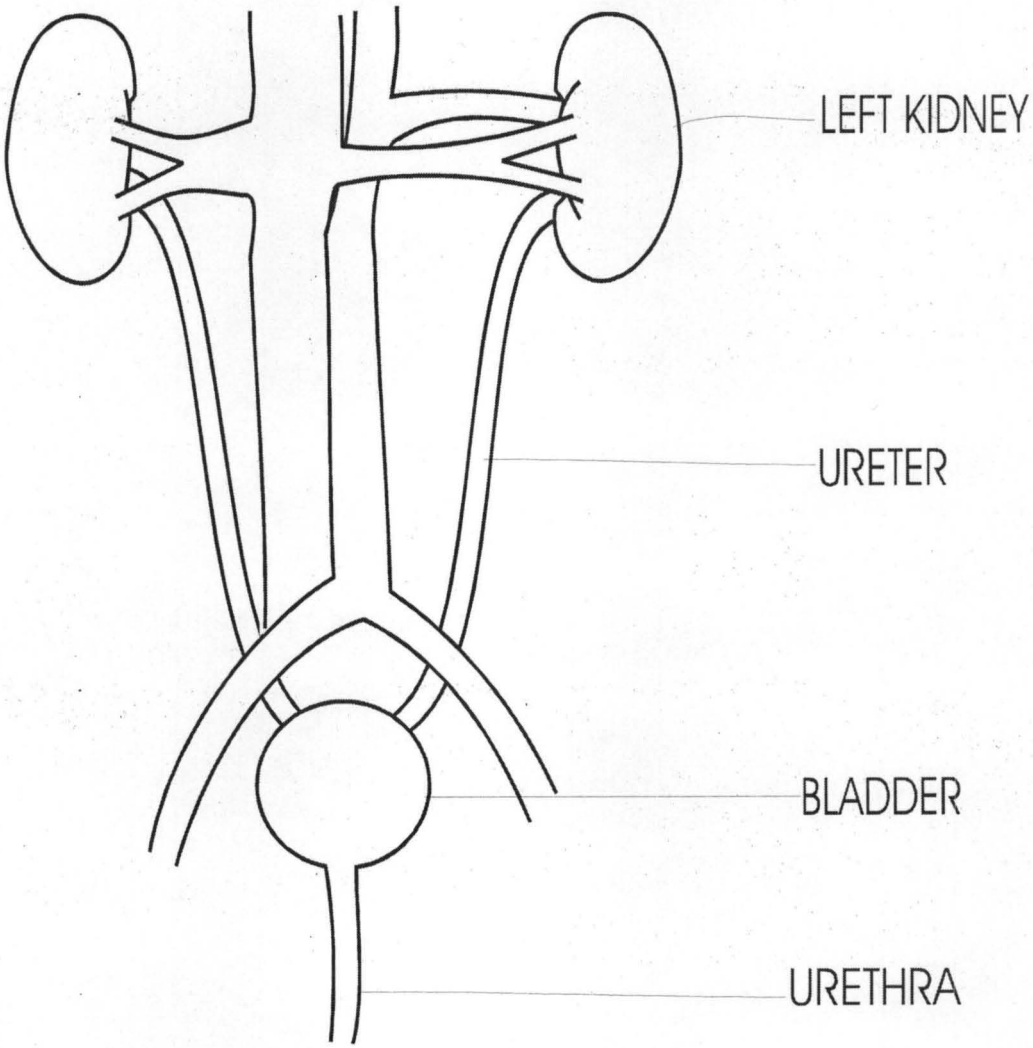
How age affects the incidence of urinary tract infections is still a matter of debate and research. However, Hoffman (1990) suggested that in the very young children, infection could be as a result of an undeveloped immune system, making such children prone to infection. He however stressed that; with the development of immune system in later years other conditions and activities came into play to trigger attacks of UTI such as sexual intercourse or practice such as the use of diaphragm.

2.1.8 Blood group:

Women in the blood B or AB are at a higher risk of contacting urinary tract infection. Also 85% of women who get recurrent urinary tract infections have been shown to have a specific red blood cell protein called PI which is negative. It is also possible that urinary tract infection prone women may have inherited weaker immune systems and weaker defenses against urinary tract pathogens (Hoffman, 1990).

Figure 2.1 shows the Urinary System of Man, the organs involved in UTI and the events that take place during UTI are described below:

Figure 2.1 THE URINARY SYSTEM (Herold *et al*, 1982)



2.3.0 ORGANS AND PATHWAYS OF INFECTION WITHIN THE URINARY TRACT.

2.2.1 Kidney:

It is becoming increasingly clear that the most common cause of renal infection is vesicouretic reflux. Reflux is found in association with most instances of atrophic pyelotephritis. Heamatogenous invasion is a rare route of infection (Anthony, 1996).

2.2.2 Bladder:

The bladder may become involved by bacteria descending form the kidney or more commonly ascending from the urethra or prostate. Direct blood stream invasion of the bladder is undoubtly rare. Lymphatogenous spread from cervical or uterine infection seems possible. Infections of the bowel may spread to the bladder by continuity (Anthony, 1996).

2.2.3 Prostate:

The prostate is mostly commonly infected by ascent of the urethral flora whose members are increased in urethritis, heamatogenous invasion is a possibility.

2.2.4 Urethra:

Ascending bacteria usually infects the urethra in both sexes. These infections are usually non-veneral (Smith, 1981). Deep ascent of these bacteria may cause cystitis and if there is urethral reflux, pyelonephritis, infection may also descend to the urethra from prostates or bladder.

2.2.5 Epididymis:

Infection usually reaches the epididymis by decent (reflux of urine) along the vasal or the perivasal lymphatic from an infected prostate (Anthony, 1996).

2.2.6 Testis:

The testis is commonly invaded heamatogenously by bacteria *(Pneumococci; Brucella,* etc or virus (mumps etc). occasionally, it becomes infected by direct extension from epididymal inflammation (both tuberculosis and non specific urinary tract infections) (Anthony, 1996).

2.3.0 SOME AETIOLOGIC AGENTS OF URINARY TRACT INFECTIONS.

2.3.1 ***Escherichial coli:***

These are gram-negative short rods, variously motile and possess peritrichous flagellation. It ferments glucose with gas production. The colony has pink colour, entire margin, raised and convex elevation on macconkey agar. Three groups of *E.coli* strains are associated with three types of intestinal diseases. The entrotoxingenic *E.coli* species cause diarrhea in piglets and calves (Duguid *et al,* 1987), travelers diarrhea in man and cholera like diseases in people living in warm climate of developing countries. Another group of *Escherichia coli* serotype which are related to certain serotype of Shigella is invasive with the epithelia like disease, which are usually associated with food borne disease (Obaseiki and Salami, 1983). The third group of special serotype is associated with diarrhea in institutionized infants in developed countries. These special interests have been called the enteropathogenic E. *coli* (Petterson and Andniole, 1987).

Most of the K antigens are polysaccharides but a few proteinecious fibrial antigens which confer adhesiveness on enterotoxigenic *E. coli* are presently listed as K antigen and may be established as a special group of antigen (F antigens). Since many O, K, and H antigens can be combined in different ways the number of possible serotype is very high.

2.3.2 *Staphylococcus aureus:*

Staphylococcus aureus are spherical cells, about 1nm in diameter, arranged in irregular cluster; single *cocci,* pairs, tetrads and chains are also seen in liquid cultures. Young cocci stain strongly gram-negative (Obaseiki and Salami, 1983). *Staphylococcus aureus* are non motile and do not form spores under the influence of certain chemicals eg penicillin. *Staphylococci* are lysed or changed into L form, but they are affected by bile (Pelczer *et al*, 1986).

The Peptidoglycan of *S. aureus* cell wall is characterized by unique pentaglycine bridge that link the tetrapeptides attached to the muramic acid residue. On solid media most strains of *S. aureus,* produce a characteristic golden yellow (aureus) carotenoid pigment. However, colonial coloration may vary from white to orange. Therefore, the occurrence and extent of heamolysis depend upon both the strain and the source of blood (More, 1991).

2.3.2 ***Pseudomonas aeruginosa:***

Microscopically, *Pseudomonas aeruginosa* is a slender non-sporulating, usually non-capsulated rod bearing a single polar flagellum. This bacterium presents three types of colonies. The most `common on a 24 hours blood agar plates is low convex to flat and 1 to 5mm in diameter with a rough or frosted glass surface and an undulated or erase periphery. It may show β heamolysis on a 24 hours plate and usually shows β heamolysis on a 48 hours plate (Duguid et-al 1987). Most strains form a water and chloroform soluble phenazine pigment, pyocyanin (from the brake, blue pus) that usually imparts a green or blue green colour to the medium surrounding the colony.

Pseudomonas aeruginosa; is aetiologically significant in many disease and particularly associated with post burn sepsis and other nosocomial infections, cystic fibrous and septicemia, in patients with immune deficiencies. The organism is obligate aerobic

gram-negative, oxidase positive and non-sporulating motile rod. It grows in media such as centrumide agar, and blood agar media (Morse, 1987; Van depitte, 1991).

2.3.4 *Proteus species:*

Members of the genus *Proteus* occur widely in nature and in man as part of the bacterial flora (Morse, 1987). *Proteus* species have peritrichous flagella, highly motile and so grow in swarms on nutrient agar plates. *Proteus mirabillis, Proteus morganie proteus vulgaris* and *Proteus rottagii* have been implicated in urinary tract-infections (Stamm and Turk, 1980). *Proteus mirabilis* and *Proteus vulgaris,* produce large amounts of hydrogen sulphide gas, liqiufy gelatin and are greatly motile. *Proteus morganie* and *Proteus rottegii* have been shown to be more susceptible to antibiotics than other species, which are difficult to eliminate using common antibiotics (Obaseiki and Salami, 1983).

Proteus species are important pathogens of urinary tract as a result of their ability to rapidly form ammonia may promote infection while in the pelvics and bladder, the alkalinity causes the deposition of phosphate stones which promotes infection by increasing the retention of urine (Duguid *et al,* 1987).

2.3.5 *Klebsiella* species:

Klebsiella strains are mostly saprophytic but display opportunistic pathogenesis in man, causing respiratory tract infections, urinary tract infections and endemic infections in hospitals (Nitzan *et al,* 1983). *Klebsiella* species share the characteristics of the other members of the entrobacteriaceae, but are never motile. Most ferment lactose and so give pink cultures on MacConkey agar. They produce extra cellular slime so that the colonies appeared mucoid. Seventy-two (72) stereotypes of *Klebsiella* have been documented; however, serotypes 8, 9 and 10 have been shown to be most prevalent in urinary tract infection (Nitzan *et al*, 1983).

2.4.0 SYMPTOMS OF URINARY TRACT INFECTIONS.

The signs and symptoms of urinary tract infection may be classified into two (1) Generalized signs and symptoms (2) Specific signs and symptoms (Scoth, 1995).

2. 4.1 Generalized signs and symptoms:

In generalized signs and symptoms, the patient with urinary tract infection may experience the following: Pyrexia, malaise, headache, anorexia, vomiting, and rigors/ night sweats.

2.4.2 Specific sign and symptoms:

Frequency of urination, nocturia, straguty, heamaturia, dysuria are noted with patient suffering from urinary tract infection. Local pains may also be noted in the upper tract superapubic, bladder and perineal – prostrate (Scott, 1995).

2.5.0. DIAGNOSIS OF URINARY TRACT INFECTIONS:

The standard and most reliable method of demonstrating the presence or absence of a UTI is the culture and sensitivity testing of a properly collected urine sample (Gillie and Dotts,1984; Hoffman, 1990). This urine is clear amber coloured fluid formed by the kidney and carrying waste products of nitrogenous metabolism out of the body. Urine is 95% water in which urea: uric acid, mineral salt, toxins and other waste product are dissolved. It may also contain ordinary substance used by the body but excreted by the kidney when excessive amounts are present in the blood stream (Cattel,1985; Bakar *et al,* 1985; Briggs, 1990).

Microscopic and chemical examination of urine may yield useful information in many abnormal conditions; infections of the kidneys, ureter, bladder, and urethra may result in the presence of pus, red blood cells and organisms in the urine (Baker *et al,* 1985). The

demonstration of bacteria on urinalysis and or by gram stain examination cannot be relied upon since contamination of urine by organisms of the vaginal vestibule or perineal area can occur during the voiding process. To reduce this contamination four major ways of proper collection of urine sample can be employed (Scott, 1995). The suprapubic needle aspiration, single in and out catheterization, whole void collection and clean void mid stream catch technique are the most commonly use techniques in urinary collection (More, 1991). Organisms are isolated in the positive urine sample on MaCconkey and blood agar, which can further be subcultured on nutrient agar. The positive cultures only reflect the presence of infection in the urinary tract and since the presentation of UTI is usually not classic, localization studies to differentiate between upper and lower tract infections may be performed. The most reliable localization study is the antibody coated bacteria test, in upper tract infection bacteria became coated with antibodies while in UTI's confined to the lower tract, bacterial remain uncoated (More, 1991).

2.6.0 DISEASES OF URINARY TRACT:

The diseases of urinary tract can be classified in to specific and non specific infection as described by Smith (1981) and Scott (1995).

2.6.1. NONSPECIFIC INFECTIONS OF THE URINARY TRACT:

The non-specific infections of the urinary tract are caused by gram-negative rods e.g. *Escherichia coli, Proteus vulgaris* and gram-positive cocci (*Staphylococci* and *Streptococci*) (Smith, 1981). Non-specific infection can involve any of the urinary organs (or genital organs in male) and can spread from a given locus to any or all of the others. Renal infections are of the greatest importance because of the parenchymal destruction they cause. Isolation of pure coccal organisms in the patient's urine sample suggests renal stone (Scott, 1995).

2.6.1.1 NONE SPECIFIC INFECTION OF THE KIDNEY:

i. Acute and chronic pyelonephritis.

Acute pyelonephritis is probably the most common disease of the kidney, it is an inflammation of one or both kidneys, involving the tubules it is generally not considered as primary infection but rather a complication brought on, by an infectious process, such as respiratory diseases or sepsis else where in the body (Owen, 1982). E.coli causes about 80% of acute pyelonephritis, and most causes are blood borne, and the disease appears to occur more often in female lower urinary tract than in male. However, majority of the cases are harmless, lesion usually heal spontaneously leaving only small scars in the kidney tissue. The kidney becomes smaller and the edge irregular in the past; these radiographic findings have been called chronic pyelonephritis. This is not correct, since the appearance of scar is an evidence of previous infection, and such a patient may have had sterile urine for many years.

The symptoms of acute pyelonephritis involve severe and constant ache over one or both kidney (Flank and Back), nocturia, urgency and burning on urination. The patient is quite prostrated; nausea and vomiting are usually present (Smith, 1981). The patient appears to be quite sick, intermittent high fever with chills is to be expected. If the infection is due to *E.coli* the palse rate may be only 90/min, with *Staphylococcus aureus* it may reach 140/min. Tenderness is present over the affected kidney (Scoth, 1995; Roy, 1999).

Chronic pyelonephritis implies the persistent presence of bacteria in the kidney; the symptoms of chronic pyelonephritis may include mild discomfort over the kidney and some degree of vesicle irritability. These however, may be entirely absent and vague gastro intestinal complaint may be noted, particularly in children. Unexplained low-grade fever or anemia may only be due to presence of the disease. Hypertension is common, particularly in children (Scott, 1995; Roy, 1999).

ii. Bacteremic shock

The genitourinary tract is one of the common sources of bacteria. Bacteria may develop spontaneously following obstruction or instrumentation of infected prostates, urethra or vesical bacteria may be forced up through incompetent ureterovesical valves under the hydrostatic pressure of an irrigating solution (Chisholum *et al*, 1990).

There is an increased incidence of bacteremic shock, wherever antibiotic are used indiscriminately. Patients receiving immunosuppressive drug, and those with diabetes, cirrhosis, cancer burns and pentollitis are at greater risk (James, 2000). Most cases of septic shock are seen in patients over age 40 years, although it is not uncommon following septic abortion. An increasing incidence of shock caused by *Serratia* and *Candida* infections has been observed (Aneke *et al*, 1987).

Shock is caused by cardiac decomposition or inadequate circulating blood volume it reflects a failure of blood flow, to the cells. The development of hypertension is secondary. Perhaps 30% of patient with gram-negative bacteria will go into shock. The immediate cause is liberation of endotoxin from the walls of dead bacteria; septic shock is relatively rare in gram-positive infection since these organisms liberate an exotoxin (Aneke *et al*, 1987).

Patient with bacteremic shock develop fever ranging from 38.5 to 40^0 C and associated chills, Anxiety may be present, followed by apathy as the process continues (Smith, 1981) cloudy mentation is usual when hypertension supervenes, pale skin, respiration are shallow and rapid, the blood pressure is about 70/40mmHg or 25mmHg below the hypertension patients normal systolic pressure. In laboratory findings, leucopoenia is usually observed in infants, the white count is elevated with a shift to the left. The number of platelets, is diminished because of consumption coagulapathy. The PCV is

usually increased as a result of loss of plasma into the intenstinal tissues. Blood volume studies may be misleading (Roy, 1999).

iii. Necrotizing papillitis

This is an uncommon type of renal inflammation; though Harrow believes that the necrosis is primary and the infection secondary. Formerly it was usually a complication of pyelonepharitis in diabetes or in patient's suffering from urinary obstruction (Smith, 1981), today most patient suffering from Necrotizing papillitis given a history of excessive and prolonged ingestion of analgesics containing phencetin and aspirin for the relief of migraine or arthritis pain (Smith 1981).

The major symptoms in rare fulminating type of papillitis include, severe sepsis, renal pain, oligauria with uremic coma may develop rapidly culminating in death. In acute papillitis, the patients develop high fever and prostration, renal tenderness may be noted, while in chronic papillitis no abnormal signs are usually elicited. At the time of febrile blore-up renal tenderness maybe found (Smith, 1981).

iv. Renal Abscess

An abscess caused by *S. aureus* develops from hematagenous spread of the organisms from a primary skin lesion. Multiple cortical abscesses develop that are usually focal. They coalesce to form a multilocular– abscess. The more common type of renal abscess, is secondary to long- standing renal infection caused by chronic urethral obstruction or more commonly claculies disease such as calculous pyelonephritis (More, 1991).

Staphylococcal renal abscess usually has an abrupt on set with fever, chills and localized costo-vertebral pain. In most patients, there is a long history of recurrent urinary tract infection with exacerbations, previous passage of stones may be noted. In the early

state of the disease urinalysis is usually negative, although urine culture may reveal the organisms (Kunin, 1980; Stamm and Turk, 1980).

2.6.1.2 VAGINITIS:

Both the normal flora and opportunistic microbes can cause vaginal inflammation called vaginitis. *Candida albicans* and *Trichomonas vaginalis* are common causes of vaginitis. Together with non-specific cause they account for 90% of the case (Gayle, 2001). *Candida* is a yeast commonly present in the vagina and on the skin, changes in the vaginal environment enable it to out grow the normal flora and cause *Candida vaginitis* characterized by the cheesy discharge inducing to this infection can occur during pregnancy (Owen, 1982; Gayle, 2001; Graeme, 2001).

Women with non-specific vaginitis often complain of malodorous discharge although *Gardenella vaginalis* is isolated from virtually all cases of non specific vaginatis, it is also present in 40% of normal women (Herod *et al,* 1982).

2.6.1.3 PUPERAL SEPSIS:

Puperal sepsis usually called childbirth fever was once the cause of a tremendous number of maternal deaths (Richard and David, 1983). It was not until the middle of the nineteenth century when Ignaz, Semmelises and Oliver Wandell Holmes in Boston simultaneously discovered the underlying causes of this dreaded fever associated with childbirth. The obstetricians and medical student routinely performed both deliveries and autopsies without washing their hands between these tasks the newly delivered women were thus being heavily contaminated by *Streptococcus pyogenes* and died from the resulting septicemia (Smith, 1981).

2.6.1.4 UREGENITAL MYCOPLASMAL INFECTION:

Ureplasma urealyticum is a wall-less bacterium found in the genital tract of sexually active adults. This organism colonizes 80% of sexually active sex partners. *Ureplasma urealyticum* has been implicated as a cause of nongonococcal, non-chlamydial urethraitis. However, since many asymptomatic persons are colonized by this bacterium, it is difficult to associate the microbe with any specific disease. *Mycoplasma hominis* also inhabits the urogenital tract, and in females is associated with 10% of cases of post abortion and postpartum fever. This bacterium may also be associated with pelvic inflammatory disease (Petterson and Andniol, 1987; James, 2000).

2.6.1.5 NON SPECIFIC INFECTION OF THE BLADDER:

(i) Acute and chronic cystitis

Cystitis is far more common in women than in men (Kunin, 1980; More 1991; Roy 1999). In women cystitis is caused by ascent of bacteria from the urethra, symptoms usually develop 36-48hours after intercourse. Many women have difficulty in urinating. In acute cystitis the bladder is diffusely reddened or contains multiple foci of submucosal hemorrhage, Superficial ulcer is occasionally seen (Scott, 1995).

The symptoms include burning on urination, urgency to the point of incontinence, nocturia and often heamaturia. Fever is low grade or absent, unless prostatic or renal infection is present. Little malaise and suprapubic discomfort occurs. In woman the attack usually follows intercourse (honeymoon cystitis), while in men quiescent prostatis may be activated by sexual excitement or alcoholic indulgence, and this causes secondary cystitis (Smith, 1981; Scott, 1985; Roy, 1999). Pelvic examination on the patient having cystitis reveal urethra deverticulum vaginitis (including, Trichmonal vaginitis or cystacele with residual urine) as causes of cystitis. The urethra may be markedly tender. There could be

vaginal discharge (Owen, 1982; Petterson and Andniole, 1987). Chronic infection of the bladder is often secondary to chronic infection of the upper tract it may be due to residual urine, urethral reflux or urethral stenosis. Too frequently, it is the result of incomplete treatment of simple acute cystitis (Richard and David,1983).

Non-specific infection of the prostate is usually complicated by acute cystitis and even by acute urinary retention (Smith, 1981). It may resolve (especially with proper medication). *Neisseria gonorrhea* was considered as the common organisms causing inflammation of the prostrate gland, and occasionally *E coli, P. aeruginosa, Staphylococcus* and *Streptococcus spp* (Sexual Transmitted Disease, Treatment Guard line, 1982). Bacterial pathogens reach the prostate by heamatogenous routes or through ascending bacteria. The symptoms include vesicle irritability (burning, frequency, urgency and nocturia), which is occasionally seen in children and has been observed in the neonatal period. The patient ordinarily is not prostrated, but fever may be high. Urethral discharge may be present. (Peterson and Andniole, 1987). Chronic prostatitis manifests itself most commonly in middle aged males. It usually follows an acute infection of the gland. The bacteria producing this condition are similar to those associated with acute prostatis (Owen, 1982).

2.6.2.0. SPECIFIC INFECTION OF THE URINARY TRACT:

2.6.2.1. Urinary tuberculosis:

Tubercle bacilli may invade one or more of the organs of the genitourinary tract, and cause a chronic granulomatous infection, which shows the same characteristic as tuberculosis in other organs. Urinary tuberculosis is a disease of young adult, 60% of the patient, are between the ages of 20 and 40, and is a little more common in males than in females (Smith, 1981).

The infecting organism is *Mycobaterium tuberculosis,* which reaches the genitourinary organs by the heamatogenous route from the lungs (Kriegere, 1986, Scott 1995). The primary site is often root symptomatic or apparent. Kidney and possibly the prostate is the primary site of tuberculosis infection in genitourinary tract. All other genitourinary organs become involved by ascent (prostate to bladder) or decent (Kidney to bladder) (prostate to epididymis). The tests may become involve by direct extension from epididymal infection (Smith, 1981).

Tuberculosis of the genitourinary tract should be considered in the presence of any of the following:

(1) Chronic cystitis that refuses to respond to adequate therapy

(2) The finding of pus without bacteria in a methylene blue stain or culture of the urinary sediment, (3) Gross or microscopic heamaturia,

(4) A non tender, enlarge epididymis with a leaded or thickened vas, or (5) indurations or nodulation of the prostrate and thickenings of one of both seminal vesicles as seen in young adult (Smith, 1981; Scott, 1995). There is no classic clinical picture of renal tuberculosis, symptoms of the disease include, generalized malaise, persistent fever, and night sweats. Even vesical irritability may be absent in which case only proper collection and examination of the urine will afford the clue (Cattel, 1985).

General approach in the treatment and management of UTIs is routine screening of predisposed patients with urine culture and sensitivity testing (Princewill and Obiete, 1991; Umeh, 1993). However, the goal of eradicative forms of therapy is sterilization of the urinary tract, and is indicated when an infection has occurred (Kunin, 1980). The success or failure of eradicative therapy is more dependent on the host and host environment, than the drug selected. Methods of drug selection is an integrative process, patient variables, such as

age, sex, race, allergy history, renal and hepatic function, history of previous UTIs, immunologic status, concurrent disease state, whether the infection is hospital or community acquired (Prescott *et al,* 1990; Roy, 1999). More (1991) reported that adjustment of urine PH, using either urinary alkalizing or acidifying agents has a tremendous effect on cure rate. In prostatic infections, the efficacy of eradicative therapy is dependent on the ability of the drug to penetrate the prostate and its effectiveness against the causative organism (Pfeu, 1990). Only trimethoprim and erythromycin achieve high prostatic concentrations, even though erythromycin is infective against the usual causative organism (Gram-negative bacteria). However, the usefulness of erythromycin is compromised by the acid medium found within the prostatic gland (Pfeu, 1990; Umeh, 1993).

Princewill and Obiete (1991) and Umeh (1993) observed that the aetiologic agents of UTIs especially the Gram positive bacteria were sensitive to ampicillin, nalixidic acid and furadantin. Graeme (2001) reported that the use of vaginal imidazole, nystatin, ketoconazole, fluconozole and itraconazole as effective in the treatment of urinary tract infection caused by *Candida* species. There are however, speculations that certain Gram-negative organisms such as *Klebsiella, Proteus* and *Pseudomonace* species involved in UTIs in Nigeria are increasingly resistant to antibiotics commonly use in the country.

CHAPTER THREE

2.2 MATERIALS AND METHODS

3.1 Collection of urine samples:

Mid-stream urine samples were collected from suspected cases of urinary tract infection in sterile universal bottles, from non-residential patients attending General Hospitals, Rural Hospitals and Private Medical diagnostic Centres in Rafi, Mashegu, Mariga, Magama, Kontagora and Rijau Local Government Areas of Niger State, Nigeria. The samples were transported to the laboratory in an icebox for analysis. Ages and sexes of the patients were noted.

3.2 Processing of urine samples:

Using a sterile wire loop a drop of urine sample was withdrawn from the sample container and spread uniformly on to Mac Conkey and blood agar (Oxoid) plates. The plates were incubated under aerobic and anaerobic condition at 37°C for 24 hours. Plates with colony counts of 400 were obtained and were taken as indicative of infection (Baker and Silverton, 1985; Vandepittes *et al,* 1991). From the MacConkey and Blood Agar plates, discrete colonies were sub-cultured on to nutrient agar (oxoid) plates and incubated at 37^0C for 24 hours for pure isolates. This procedure was carried out repeatedly to ensure that a pure culture was obtained. The pure cultures were maintained on nutrient agar slants for further studies.

3.3 Characterizations and identification of isolates:

The isolates were characterized, based on colonial morphology, cultural characteristics and biochemical tests. The biochemical tests carried out included Gram stain, production of Catalase, Urease, Coagulase and indole, Citrate utilization, Methylred Voges Proskauer (MR-VP), starch hydrolysis and fermentation of the following sugars; glucose, lactose, fructose, manitol, and sorbitol. The isolates were identified by comparing their

characteristics with those of known taxa using the scheme of Cowan (1974). Some of the biochemical tests carried out are described below:

3.3.1 Gram-stain:

A small portion of each of the isolates was picked with sterile wire loop and emulsified in a drop of distilled water placed on a clean slide and spread uniformly over the surface of the slide to form a dried smear.0.5% crystal violet was added to the smear, for 60 seconds and lugol's iodine was applied as a mordent for 1 minute. The smear was then washed with 70% alcohol until the original visible colour of the initial dyes had disappeared and the smear was rinsed with water. The smear was than counter stained with safranin for 30 seconds after which it was rinsed with water and blot dried with filter paper. The stained smear was examined under the light microscope, using oil immersion objective. Gram-positive organisms retained the original colour of the initial dye and appeared dark blue while the gram-negative organisms, appeared pink red in colour.

3.3.2 Catalase test:

Sterilized glass slides were placed on clean staining racks; on a table and a drop of 3% hydrogen peroxide (H_2O_2) was placed on the centre of each slide. Then using sterile inoculating loop, a portion of the isolates was aseptically transferred onto the slide with a drop of hydrogen peroxide (each isolate for different slides). The evolution (effervescence) of oxygen gas bubbles indicated a positive reaction.

3.3.3 Oxidase test:

Sterile filter papers were aseptically placed on clean petri dishes, 2 to 3 drops of oxidase reagent were added using a piece of sterile wooden stick, the test organisms were smeared on each of the filter paper (Baker and Silverton, 1982; Vande pitte *et al,* 1991 ;Ogbulie *et al,* 1998). The appearance of a blue purple colour within 10 seconds indicated a positive reaction, while absence of blue purple colour within 10 seconds shows a negative reaction.

3.3.4 Indole production:

To two-day overnight cultures of the isolates in 1% phosphate peptone broth in test tubes 0.5.mls of the Kovac's indole reagent was added. The tube was shaken gently and allowed to stand. Development of very deep red colour in the presence of indole, which separates out in the alcohol interphase, indicated positive test while orange or yellow colour showed a negative result.

3.3.5 MR/ V-P test:

Bacterial isolates were inoculated into 2ml of sterile glucose phosphate peptone water and incubated at 37°C for 48 hours. Using pasteurs pipette four (4) drops of methyl red reagent, was added and mixed. The immediate appearance of bright red colour indicated a positive test, while yellow colour indicated a negative test (Ogbulie *et al,* 1998). For V-P bacterial isolates were inoculated in test tubes containing 1ml of 4% KOH and 3 ml of 5% alcoholic alpha-naphthol and mixed thoroughly. Appearance of pink colour within 2 –5 minutes shows a positive reaction

3.3.6 Urease test:

Slants of Christensen's urea agar medium was inoculated with the test organisms in duplicates and incubated at 35°C for 72 hours, the slants were examined over 12 hours after 24 hours. Urease production was indicated by colour change in the medium from yellow to pink, while the negative result indicated no change in colour i.e. maintained the original yellow colour.

3.3.7 Coagulase test:

Using pasteurs pipette, one drop of physiological saline was added to grease free slides and the colony of the test organism were emulsified in each drop to make a thick suspension of the organism. To each suspension, one drop of blood plasma was added and mixed gently. The appearance of clumping within 10 seconds was an indicative of positive test, while no clumping showed a negative reaction.

3.3.8 Citrate utilization:

An overnight culture of each test isolate was inoculated into 3ml of sterile Kosers citrate medium using a sterile straight wire, and incubated at 37°C for 4 days, observing it daily. Citrate utilization resulted in an alkaline reaction, which changed the colour of the indicator (bromothymol blue) from green to blue. In addition to the colour change utilization of citrate was indicated by increase turbidity of the medium, thus, a positive result was indicated by (growth) and blue colour while lack of turbidity and greenish colour indicated a negative result.

3.3.9 Sugar fermentation:

Six duplicate sterile phenol red fermentation medium containing lactose, sucrose, fructose, glucose, maltose and starch were prepared. Each of the duplicate mediums was aseptically inoculate with the test organisms, leaving others as control. Durham tubes were inverted in to each test tube; the inoculated tubes and uninoculated tubes (control) were incubated at 35°C for 24 hours. The tubes were later observed for turbidity, colour change and gas formation.

3.4.0 ANTIBIOTIC SENSITIVITY TESTS:

3.4.1. Disc preparation:

Disc diffusion method was used in this test as described by Bauer (1966) and modified by Vandepitte *et al,* (1991). Six-millilitre paper disc were prepared using whatman No 1 filter paper and impregnated different concentrations of the antibiotic. The antibiotics and their concentrations used were as follows: Ampicillin 10µg, Tetracycline 30µg, Co-trimoxazole 25µg, Gentamycin 10µg, Erythromycin 15µg, and Ciprofloxacin 100µg, prepared in accordance with the National Committee for Clinical Laboratory Standards (N.C.C.L.S, 1988). The drugs used in this test were chosen to reflect the range of drugs commonly prescribed for the treatment of UTI in Niger State. The antibiotic discs when prepared were stored in the refrigerator at -20^{0}C until required (Appendix B).

3.4.2 Preparation of swabs and inoculation of the test organisms.

Cotton wool swabs on wooden applicator sticks were prepared and sterilized by dry heat (Vandepitte *et al,* 1991). Colonies of the test organisms were transferred into tubes containing physiological normal saline, to form a suspension. Prepared nutrient agar plates were inoculated with the test organisms (*Staphylococcus aureus*, *E. coli, Proteus spp*, *Klebsiella spp, Pseudomonas aeruginosa,* and *Neisseria spp)* by dipping the sterile swab into the inoculum and removing excess inoculum by pressing and rotating the swab firmly against the side of the tube. The inocula were streaked all over the surface of the medium, three times, rotating the plates through an angle of 60^o after each application (Vandepitte *et al,* 1991). The inoculated plates were allowed to dry for a few minutes at room temperature with the lid closed.

The prepared antibiotic discs stored in refrigerator at 20^{o}C were kept at room temperature for one hour before use. The antibiotics discs were later placed on the inoculated plates using a pair of sterile forceps. Each disc was gently pressed down to

ensure even contact with the medium. The plates were incubated at 37°C for 24 hours. At the end of the incubation period, the results were recorded as sensitive or resistance based on the occurrence of zone of inhibition or no zone of inhibition respectively.

3.5.0 PREPARATION OF MEDIA

3.51 NUTRIENT AGAR

Nutrient agar (oxoid) contain:

Peptone	5.0g
Beef extract	3.0g
Agar	15.g
Distilled water 1000mls	1000(1Litre)

3.5.2 MAcCONKEY AGAR

Macconkey agar (oxoid) contain:

Peptone	20.g
Lactose	10.0g
Bile Salt	5.0g
Sodium Chloride	5.0g
Neutral red	0.075g
Agar	12.0g
Distilled water	1.01

Each ingredient were dissolved in 1 litre of distilled water and autoclave at 121°c for 15 minutes, for Blood agar medium 10mls of Blood serum were added to already prepared Nutrient agar medium. The agar media were dispense accordingly and allowed to set.

3.6.0 METHOD OF DATA ANALYSIS.

The following Research questions were established from the overall results.

1. Is there any significant difference between the incidences of UTIs in males as compared with the incidence of UTIs in females?
2. At what age range is the incidence of urinary tract infections most Significant?
3. Is there any significant difference between the results obtained on the incidence of UTIs in each of the six local government areas investigated?

To answer these questions, the data were subjected to analysis. MINITAB statistical package under MINITAB RELEASE 9.2 computer statistical programme using TWO WAY ANALYSIS OF VARIANCE was used to test the hypotheses.

CHAPTER FOUR

4.0 RESULTS

4.1 URINARY TRACT INFECTIONS IN RELATION TO AGE, SEX AND LOCAL GOVERNMENT AREAS EXAMINED

The results obtained on the incidence of urinary tract infections in the six local government areas (LGAs) of Niger State, Nigeria are summarized in Table 4.1. The results revealed that it could be seen from the table that, a total of 600 urine samples were collected from the patients, and screened for a significant bacteriuria. Three hundred and Eighty one (381) positive cases with bacterial counts of 10^5/ml of urine sample were established, this represents 63.3% infection rate. One hundred and thirty five (35.4%) cases were in male while Two hundred and forty six (64.6%) cases were in female. 14.7% of the total number of cases was recorded for Rafi LGA, Mashegu 19.9%, Mariga 20.7%, Magama 18.4%, Kontagora and Rijau recorded 13.6% and 12.6% positive cases respectively (Table 4.1). Figure 4.1 is a histogram showing the total number of infected individuals in each local government area. Mariga had the highest number of infected individuals with a total of 79, positive cases, Mashegu had 76, Magama had 70, Rafi 56, Kontagora had 52, while Rijau LGA had 48 positive cases.

Table 4.2, shows the number of infected individuals in relation to age and sex. The most affected age group was between 31-40 years with 56.1% prevalence rate, while the least affected age group was between 61-70 years with 5.2% prevalence rate. Among the males the age range 41-50 years was most affected with 53 persons, while the age range 31-40 years was most affected with 78 persons in female (Table 4.2). The overall results on the incidence of urinary tract infection in relation to age and sex of patients investigated is illustrated in Figure 4.2.

TABLE 4.1. NUMBER OF POSITIVE CASES OF UTI RECORDED IN MALE AND FEMALE PATIENTS IN THE SIX L.G.As.

L.G.A	MALE		FEMALE		TOTAL	%TOTAL
	SCREENED SAMPLES.	POSITIVE CASES RECORDED.	SCREENED SAMPLES.	RECORDED.		
RAFI	50	19	50	37	56	14.7
MASHEGU	50	31	50	45	76	19.9
MARIGA	50	30	50	49	79	20.7
MAGAMA	50	24	50	46	70	18.4
KONTAGORA	50	19	50	33	52	13.6
RIJAU	50	12	50	36	48	12.6
TOTAL	300	132	300	246	381	

Sample size n = 600

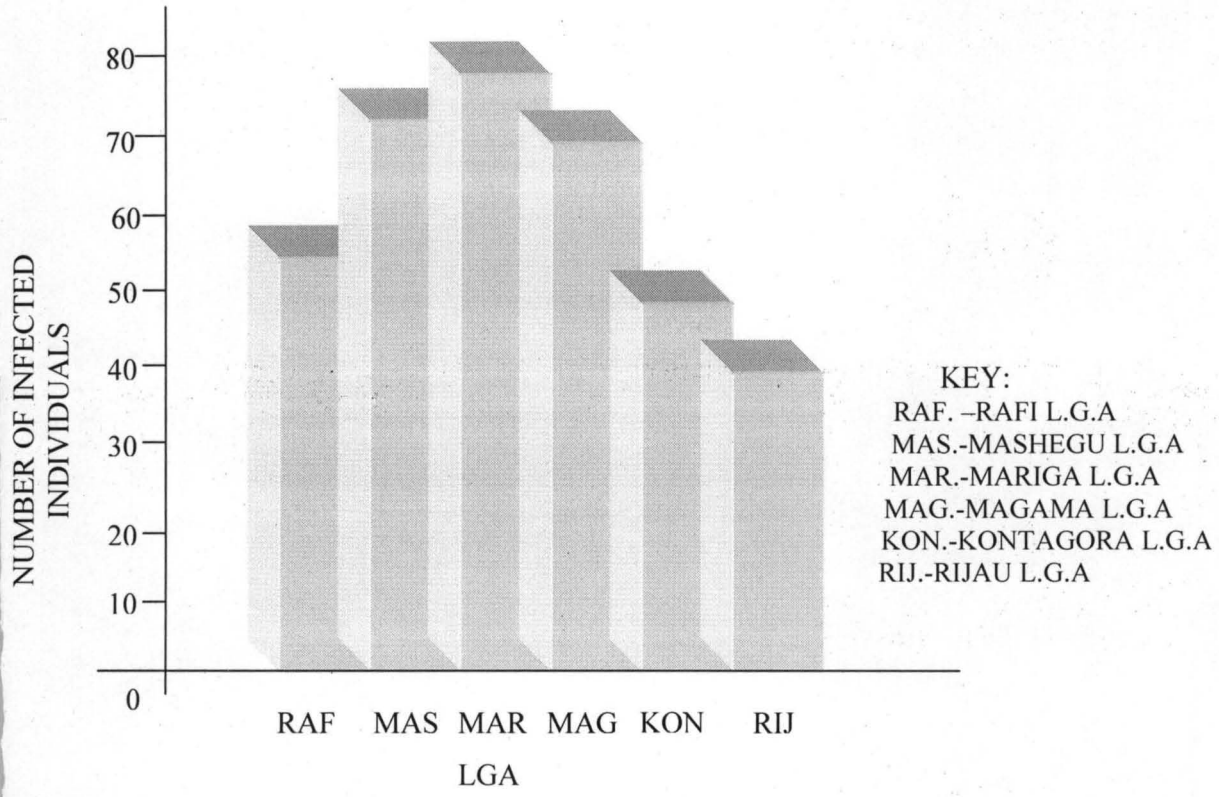


FIGURE 4.1 NUMBERS OF INFECTED INDIVIDUALS IN EACH LOCAL GOVERNMENT AREA

TABLE 4. 2. URINARY TRACT INFECTIONS IN RELATION TO AGE AND SEX

AGE GROUP (YEARS)	NUMBER OF INFECTED MALE	% OF INFECTION IN MALE	NUMBER OF INFECTED FEMALE	% OF INFECTION IN FEMALE	TOTAL % WITHIN THE GROUP
16-20	4	3.0	37	15.0	18.0
21-30	23	17.0	71	28.0	45.9
31-40	33	24.4	78	31.7	56.1
41-50	53	39.3	39	15.9	53.2
51-60	17	12.6	17	6.9	19.5
61-70	5	3.7	4	1.6	5.2
TOTAL	135	100	246	100	

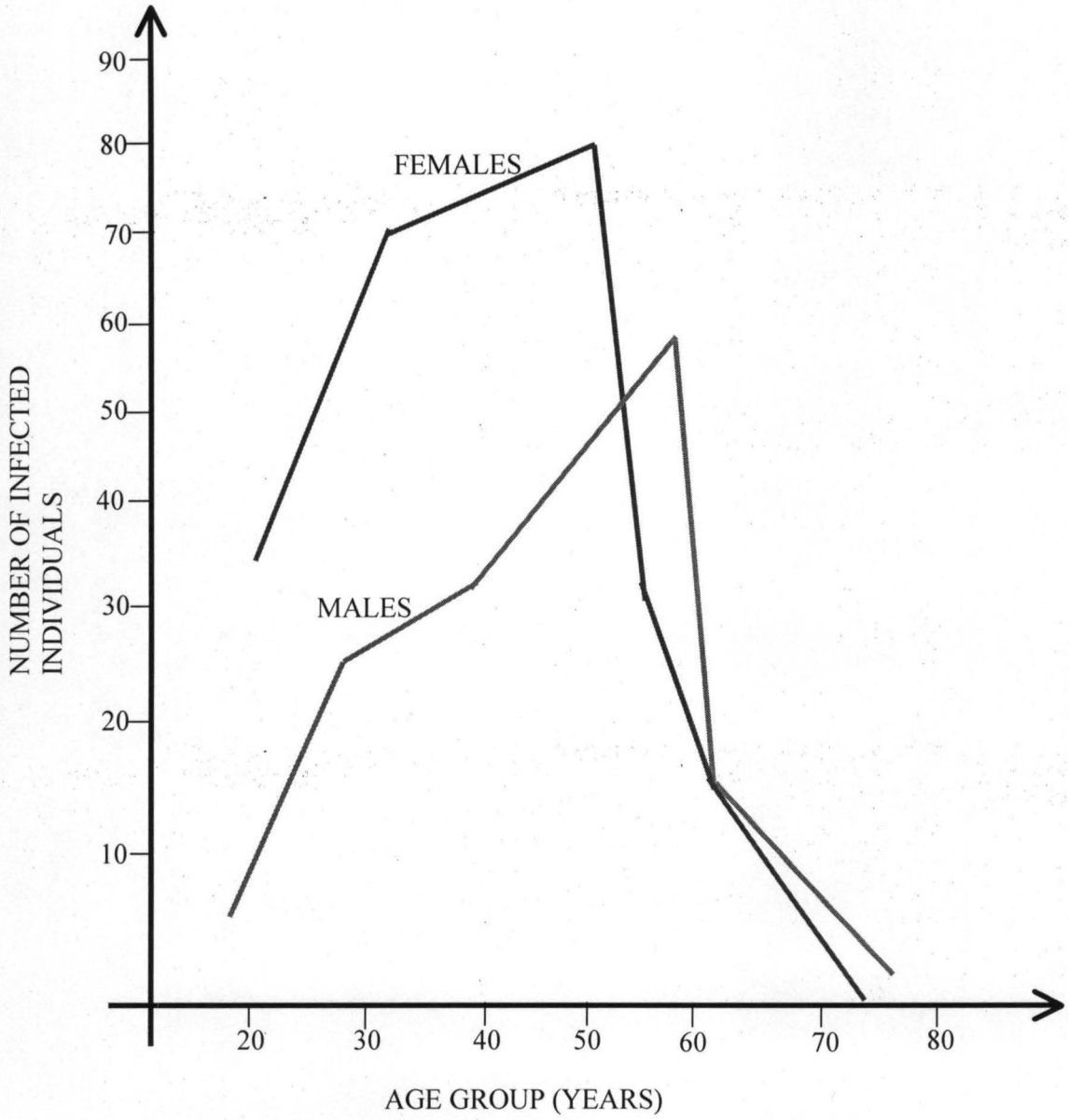


FIGURE 4.2. UTIs IN RELATION TO SEX AND AGE OF PATIENTS IN THE SIX L.G.As.

4.2. AGENTS OF URINARY TRACT INFECTIONS ISOLATED.

Agents of urinary tract infections isolated in this investigation are *Staphylococcus aureus, Streptococcus faecalis, Klebsiella species, Proteus vulgaris, Pseudomonas aeruginosa, Neisseria gonorrhea* and *Candida albicans*, were isolated in this investigation, in varying degree of occurrence (Table 4.3). *Escherichia coli* had the highest frequency (22.2%) of occurrence, followed by *Staphylococcus aureus* (17.9%), *Klebsiella species* (14.1%), *Candida albicans* (10.9%), *Streptococcus faecalis* (5.6%), *Pseudomonas aeruginosa* (5.3%) and *Neisseria gonorrhea* had the least frequency (3.8%) of occurrence (Table 4.3).

4.3 STATISTICAL INTERPRETATION OF THE RESULTS OBTAINED

4.3.1 Hypothesis one

The first hypothesis stated that:

There is no significant difference between the incidence of Urinary tract infections in male as compared with the incidence of tract infections in female.

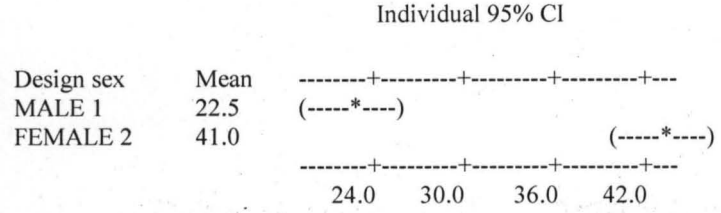
In this case an attempt was made to test the extent of urinary tract infections in male and female patients recorded in the six local government areas. In the analysis, Design 1 and Design 2 were recorded for male and female patients respectively (Appendix B).

It could be seen from the table that the analysis yielded a mean of 225 and 41.0 for Design 1 and Design 2 respectively; this indicated a great difference between the incidences of urinary tract infections in both the sexes. To determine whether the difference obtained is statistically significant an attempt was made to compare the two results in a Design chart (Design chart 1)

TABLE 4.3. DISTRIBUTION OF ISOLATES FROM THE POSITIVE CASES OF UTIS IN THE SIX L. G.As.

ISOLATES	RAF.	MAS.	MAR.	MAG.	KON.	RIJ.	TOTAL	%TOTAL
S. aureus	11	11	19	16	9	18	84	17.9
E. coli	18	24	23	14	14	11	104	22.2
S. faecalis	2	3	6	6	3	6	26	5.6
Kleb.species	10	18	13	11	5	9	66	14.1
P. vulgaris	5	5	6	13	7	7	43	9.2
Ps.aeruginosa	3	7	2	5	4	4	23	5.3
N. gonorrhea	2	3	5	5	1	2	18	3.8
C. albicans	5	12	6	13	9	6	51	10.9
Unidentified spp.	8	9	7	8	5	14	51	10.9
TOTAL	64	92	87	91	57	77	468	100

Design chart one



From the design chart presented above, it could be seen that the incidence of Urinary tract infections is significantly higher in female than in male. However, the null hypothesis, which stated that there is no significant difference between the incidences of urinary tract infections in male as compared with the incidence of urinary tract infections in female, is therefore rejected.

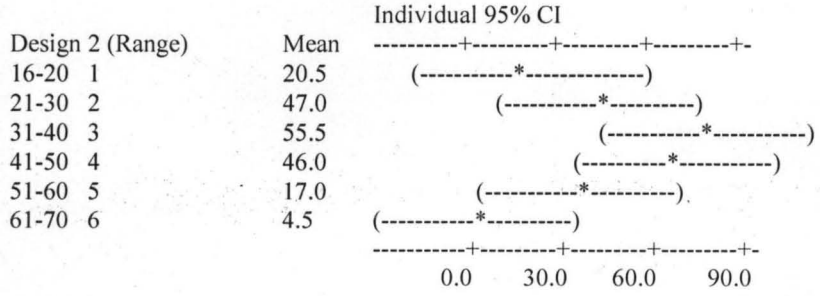
4.3.2.Hypothesis two

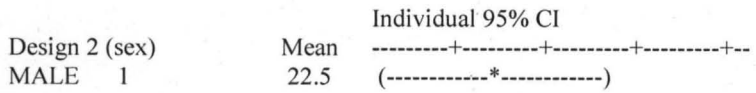
Hypothesis two tested state that:

There is no significant difference between the results obtained from the patients on the incidence of urinary tract infections and their age group.

The statistical analysis obtained from Appendix C yielded two designs (i.e. design1 and design 2). The design 1 indicated in this table refers to the age group of the patients, while Design 2 is considered as the sexes of the patients.

Design chart two





FEMALE 2 41.0 (----------*----------)

---------+---------+---------+---------+--

15.0 30.0 45.0 60.0

From design chart 2, an average of 20.5, 47.0, 55.5, 17.0 and 4.5 was obtained within the age group 16-20 years, 21-30, 31-40, 41-50, 51-60 and 61-70 years respectively. It could be seen that the age range 31-40 years had the highest mean of 55.5, this figure correspond to the highest number of infected individuals recorded in all the six Local government areas. How ever, the results obtained in the design chart 3 shows interweaving on the incidence of UTIs in male and female with regards to ages of the patients. Therefore, hypothesis two can equally be rejected.

4.3.3.Hypothesis three

The third hypothesis tested in this study is on the significant difference between the results obtained on the incidence of UTIs in all the six local government areas investigated. The null hypothesis is stated as follows.

There is no significant difference between the results obtained on the incidence of UTIs in all the six local government area investigated.

When this hypothesis was tested similar table was obtained as in Appendix B. However when the table was subjected to design chart in 3, the following results were observed.

Design chart three

Design L.G.A		Mean	Individual 95% CI
RAFI	1	28.0	(-------*-------)
MASHEGU	2	38.0	(------*-------)
MARIGA	3	39.5	(------*-------)
MAGAMA	4	35.0	(-------*-------)
KONTAGORA	5	26.0	(------*-------)
RIJAU	6	24.0	(------*-------)

----+---------+---------+---------+------

21.0 28.5 35.0 42.0

From the above design chart the average number of infected individuals in each local government area was taken. Mariga local government area had an average of 39.5 and

this figure was found to be the highest number of infected individuals, followed by Mashegu (38.0), Magama (35.0), Rafi (28.0), Kontogora (26.0), and Rijau (24.0) local government area. This indicated a great difference between the results obtained in the six local government areas investigated. Therefore the null hypothesis, which stated that, there is no significant difference between the results obtained on the incidence of UTIs in all the six local government areas investigated can be rejected.

4.4.0. OCCURRENCE OF UTIs IN EACH OF THE SIX (6) LOCAL GOVERNMENT AREAS INVESTIGATED

The results obtained on the incidence of urinary tract infections in each of the six local government areas investigated are given below.

4.4.1 RAFI LOCAL GOVERNMENT AREA

Fifty-six (56) positive cases were recorded, representing 56% of the total samples screened. 19 positive cases were recorded in male and 37 positive cases were recorded in female, this represents 34% and 66% of infection rate in male and female respectively. The table also revealed high incidence rate within age group 41-50 years in male with 47.4% infection rate, while age range 31-40years in female was found to have 35.1% infection rate, this figure recorded, present the highest infection rate in female

(Table 4.4).

However, the total number of infected individual within their age rage in both sexes are 16-20 years (3), 21-30 years (12), 31-40 years (16), 41-50 years (16), 51 –60 years (8) and 61-70 (1) person.

The results revealed that, sixty-four (64) bacterial and yeast isolates were obtained (Table 4.5), these organisms were found to be responsible for urinary tract infections in Rafi L.G.A. *E.coli* (28.10%) had the highest frequency of occurrence, followed by *S.aureus* (17.2%) *Klebsiella species* (15.6%), *Proteus vulgaris* (7.8%), *Candida albicans* (7.8%) and *Pseu.aeruginosa* (4.7%), while *Strep.faecalis* and *Neisseria gonorrhea,* had 3.10% frequency of occurrence each (Table 4.5).

TABLE 4.4. UTIs IN RELATION TO AGE AND SEX OF THE PATIENTS IN RAFI L.G.A.

AGE GROUP (Years)	*NO. OF INFECTED MALE*	*% OF INFECTED MALE*	*NO. OF INFECTED FEMALE*	*% OF INFECTED FEMALE*	*TOTAL % OF INFECTION WITHIN AGE GROUP*
16-20	0	0.0	3	8.1	8.1
21-30	2	10.5	10	27.0	37.5
31-40	3	15.8	13	35.0	50.9
41-50	9	47.4	7	18.9	66.3
51-60	5	26.3	3	8.1	34.4
61-70	0	0.0	1	2.7	2.7
TOTAL	19	100	37	100	

Sample size n = 100

TABLE 4.5. DISTRIBUTION OF ISOLATES FROM THE POSITIVE CASES OF URINARY TRACT INFECTIONS IN RAFI L.G.A.

ISOLATE	*No. OF ISOLATES IN MALE*	*No. OF ISOLATES IN FEMALE*	*TOTAL No. OF ISOLATES*	*% TOTAL OF ISOLATES*
S.aureus	2	8	11	17.2
E.coli	6	12	18	28.1
Strep. faecalis	1	1	2	3.1
Klebsiella species	4	6	10	15.6
Proteus vulgaris	3	2	5	7.8
Pseu.aeruginosa	2	2	4	6.2
Neisseria gonorrhea	1	1	2	3.1
Candida albicans	0	5	5	7.8
Unidentified species	3	5	8	12.5
TOTAL	22	42	64	100

4.4.2 MARIGA LOCAL GOVERNMENT AREA:

The results obtained on the incidence of urinary tract infections in Mariga local government area, are presented in table 4.6, seventy-nine (79) positive cases were recorded in this local government area, this figure represents 79% of the total samples screened. Thirty 30(38%) cases and 49(62.0%) cases were established in the males and females respectively. There was a high incidence rate (53.3%) within the age range 41-50 years in male, while in female 28.8% was recorded as the highest incidence rate (Table 4.6). Total numbers of infected individuals within their age range are 16-20 years (8), 21-30 years (14), 31-40 years (25), 41-50 years (23), 51-60 years (8) and 61-70 years (1) person.

The results (Table 4.7) revealed that Eighty-seven (87) bacterial and yeast isolates were obtained in this local government area. Out of this number *E.coli* constituted 23 (26.4%) frequency of occurrence, *S.aureus* 19 (21.8%), *Klebsiella species* 13 (14.9%), *Strep.faecalis, Proteus vulgaris* and *Candida albicans* each had 6.9% frequency of occurrence. *Neisseria gonorrhea* constituted 5 (5.7%) while 2(2.3.%) isolates were *Pseud. aeruginosa* (Table 4.7).

TABLE 4.6. UTIs IN RELATION TO AGE AND SEX OF THE PATIENTS IN MARIGA L.G.A.

AGE GROUP (years)	*NO OF INFECTED MALE*	*% OF INFECTION IN MALE*	*NO OF INFECTED FEMALE*	*% OF INFECTION IN FEMALE*	*TOTAL % OF AGE GROUP*
16-20	1	3.3	7	14.3	17.6
21-30	4	13.3	10	20.4	33.6
31-40	6	20.0	19	28.8	58.8
41-50	16	53.3	7	14.3	67.6
51-60	3	10.0	5	10.2	20.2
61-70	0	0.0	1	2.0	2.0
TOTAL	30	100	49	100	

TABLE 4.7. DISTRIBUTION OF ISOLATES FROM THE POSITIVE CASES OF URINARY TRACT INFECTIONS IN MARIGA L.G.A.

ISOLATES	*No OF ISOLATES IN MALE*	*No OF ISOLATES IN FEMALE*	*TOTAL No OF ISOLATES*	*% TOTAL OF ISOLATES*
S.aureus	8	11	19	21.8
E.coli	10	13	23	26.4
Strep.faecalis	2	4	6	6.9
Klebsiella Species	6	7	13	14.9
Proteus vulgaris	3	3	6	6.9
Candida albicans	0	6	6	6.9
Pseu.aeruginosa	1	1	2	2.3
Neisseria gonorrhea	1	4	5	5.7
Unidentified Species	1	6	7	8.0
TOTAL	32	35	87	100

4.4.3. MASHEGU LOCAL GOVERNMENT AREA.

The results (Table 4.8) revealed that seventy-six urine samples were recorded as positive cases in Mashegu Local Government Area. This represents 76% of the total samples collected and screened. 31 (41%) positive cases were recorded for male and 45 (59%) positive cases for female. The most infected age group in male is 41-50 years with 35.5% infection rate, while age group 31-40 years recorded the highest number of positive cases with 28.9% infection rate in female (Table 4.8). The total numbers of infected individual within their age groups are 16-20 years (11), 21-30 years (17), 31-40 years (21), 41-50 years (21), 51-60 years (5) and 61-70 years (1) person.

Ninety-two (92) isolates were obtained in this local government area. *E. coli* had the highest frequency of occurrence 24(26.1%) followed by, *Klebsiella* species 18 (19.6%), *Candida albicans,* 7(7.6%), *Neisseria gonorrhea* 12 (13.0%), *S. aureus* had 11 (12.0%), *Proteus vulgaris* 5(5.4%) and *Pseudomonas aeruginosa* 3 (3.3), while unidentified species constituted 9(9.8%) as indicated in table 4.9.

TABLE 4.8. UTIs IN RELATION TO AGE AND SEX OF THE PATIENTS IN MASHEGU L.G.A.

AGE GROUP (Years)	*No OF INFECTED MALE*	*% OF INFECTION IN MALE*	*No OF INFECTED FEMALE*	*% OF INFECTION IN FEMALE*	*% TOTAL WITHIN AGE GROUP*
16-20	3	9.7	8	17.8	27.5
21-30	5	16.1	12	16.7	42.8
31-40	8	25.8	13	28.9	54.4
41-50	11	35.5	10	22.2	57.7
51-60	3	9.7	2	4.4	14.1
61-70	1	3.2	0	0.0	3.2
TOTAL	31	100	45	100	

TABLE 4.9. DISTRIBUTION OF ISOLATES FROM THE POSITIVE CASES OF UTIs IN MASHEGU L.G.A.

ISOLATE	*No OF ISOLATES IN MALE*	*No OF ISOLATES IN FEMALE*	*TOTAL No OF ISOLATES*	*% TOTAL WITHIN AGE GROUP*
S.aureus	7	4	11	12.0
E. coli	11	13	24	26.1
Strep. faecalis	1	2	3	3.3
Kleb. Species	8	10	18	19.6
Proteus vulgaris	2	3	5	5.4
Candida albicans	3	4	7	7.6
Pseud. aeruginosa	0	3	3	3.3
Neisseria gonorrhea	0	12	12	13.0
Unknown	2	7	9	9.8
TOTAL	34	58	92	100

4.4.4 MAGAMA LOCAL GOVERNMENT AREA

The results obtained on the incidence of Urinary tract infections in this local gov't area are presented in table 4.10. Seventy (70) positive cases were recorded in this local government area, which represent 70% of the total samples collected and screened for a significant bacteriuria. 24 (34%) positive cases were recorded in male while 46(66%) positive cases were recorded in female. The highest infection rate was observed in the age range 21-30 years with 16 (34.8%) positive cases for female while in male the age range 41-50 years had the highest infection rate (29.2%) the total number of infected individual within their age range are 16-20 years (10), 21-30 years (22), 31-40 years (18), 41-50 years (12), 51-60 years (5) and 61-70 years (3) persons.

Ninety-one (91) bacterial and yeast isolates were recorded in this local government area. A total of 32 and 59 isolates were found in male and female patients respectively. *S. aureus* had the highest (17.6%) frequency of occurrence, while *E. coli* had 15.4%, *Candida albicans* and *Proteus vulgaris* had 14.3% each. *Neisseria gonorrhea* and *Pseudomonas aeruginosa* equally had the same frequency (5.5%) of occurrence (Table 4.11).

TABLE 4.10. UTIs IN RELATION TO AGE AND SEX OF THE PATIENTS IN MAGAMA L.G.A.

AGE GROUP (years)	*No OF INFECTED MALE*	*% OF INFECTION IN MALE*	*No OF INFECTED FEMALE*	*% OF INFECTION IN FEMALE*	*% TOTAL WITHIN AGE GROUP*
16-20	0	0.0	10	21.7	21.7
21-30	6	25.0	16	34.8	59.8
31-40	6	25.0	12	26.1	51.1
41-50	7	29.2	5	10.9	40.1
51-60	3	12.5	2	4.3	16.8
61-70	2	8.3	1	2.2	10.5
TOTAL	24	100	46	100	

TABLE 4.11. DISTRIBUTION OF ISOLATES FROM THE POSITIVE CASES OF UTIs IN MAGAMA L.G.A.

ISOLATE	*No OF ISOLATES IN MALE*	*No OF ISOLATES IN FEMALE*	*TOTAL No OF ISOLATES*	*% TOTAL WITHIN AGE GROUP*
S.aureus	8	8	16	17.6
E. coli	8	6	14	15.4
Strep. faecalis	2	4	6	6.6
Kleb. species	3	8	11	12.1
Proteus vulgaris	5	8	13	14.3
Pseud. aeruginosa	3	2	5	5.5
Neisseria gonorrhea	1	4	5	5.5
Candida albicans	0	13	13	14.3
Unidentified species	2	6	8	8.8
TOTAL	32	59	91	100

4.4.5. KONTAGORA LOCAL GOVERNMENT AREA.

The results obtained on the incidence of Urinary tract infections in this local government area are presented in table 4.12. Fifty –two (52) positive cases were recorded in this local government area, 19 positive cases in male and 33 positive cases in female, representing 37% and 63% infection rate respectively. The results revealed high incidence rate (36.8%) in the age range 31-40 years in male, while in female the age group 21-30 years had the highest infection rate (42.4%). The number of infected individual within their age range are 16-20 years (3), 21-30 years (18), 31-40 years (16), 41-50 years (8), 51-60 years (3) and 61-70 years (2) persons.

Fifty-seven (57) bacterial and yeast isolates were obtained in this local government area, as agents of urinary tract infections. *E. coli* had the highest frequency of occurrence (24.6%), *S. aureus*, and *Candida albicans* had 15.8%, *Proteus vulgaris* had 12.3%, *Streptococcus faecalis* had 5.3%, *Pseudomonas aeruginosa* 7.0%, *Klebsiella* species had 8.8%, and *Neisseria gonorrhea* had 1.8% frequency of occurrence. While unidentified species had 8.8% (Table 4.13).

TABLE 4.12. UTIs IN RELATION TO AGE AND SEX OF THE PATIENTS IN KONTAGORA L.G.A.

AGE GROUP (years)	*No OF INFECTED MALE*	*% OF INFECTION IN MALE*	*No OF INFECTED FEMALE*	*% OF INFECTION IN FEMALE*	*% TOTAL WITHIN AGE GROUP*
16-20	0	0.0	3	15.2	15.2
21-30	4	21.1	14	42.4	63.2
31-40	7	36.8	9	27.3	64.1
41-50	5	26.3	3	9.1	35.4
51-60	2	10.5	1	3.0	13.5
61-70	1	5.3	1	3.0	8.3
TOTAL	19	100	33	100	

TABLE 4. 13. THE DISTRIBUTION OF ISOLATES FROM THE POSITIVE CASES UTIS IN KONTAGORA L.G.A.

ISOLATE	*NO. OF ISOLATES IN MALE*	*NO. OF ISOLATES IN FEMALE*	*TOTAL NO. OF ISOLATES*	*%TOTAL OF ISOLATES*
S. aureus	5	4	9	15.8
E. coli	6	8	14	24.6
Strep. faecalis	1	2	3	5.3
Kleb. species	2	3	9	8.8
Proteus vulgaris	3	4	7	12.3
Pseud. Aeruginosa	2	2	4	7.0
Neisseria gonorrhea	0	1	1	1.8
Candida albicans	0	9	9	15.8
Unidentified species	0	5	5	8.8
TOTAL	19	38	57	100

4.4.6 RIJAU LOCAL GOVERNMENT AREA

The results obtained on the incidence of urinary tract infections in this local government area are recorded in table 4.14. Fourty-eight (48) positive cases were recorded from this local government area. This represents 48% of the total samples collected and screened. Out of this number, 12(25%) positive cases were recorded in male, and 36 (75%) positive cases were recorded in female. The results also revealed high number of infected individuals in the age group 41-50 years in male with 41.7% infection rate. 12 positive cases were recorded within the age range 31-40 years with 33.3% infection rate, as the highest infection rate in female (Table 4.14). The number of infected individual within their age range are 16-20 years (4), 21-30 years (11), 31-40 years (15), 41-50 years (13), 51-60 years (5) and 61 –70 years (1) person.

Seventy-seven (77) bacterial and yeast isolates were obtained and identified to be responsible for urinary tract infections in this local government area. *Staphylococcus aureus* had the highest frequency of occurrence 23.4%, *E. coli* had 14.4%, *Kleb. species* had 11.7%, *Proteus vulgaris* had 9.1%, *Streptococcus faecalis* and *Candida albicans* had 7.8% each while *Pseudomonas aeruginosa* had 5.2% frequency of occurrence (Table 4.15).

TABLE 4.14. URINARY TRACT INFECTIONS IN RELATION TO AGE AND SEX OF THE PATIENTS IN RIJAU LGA.

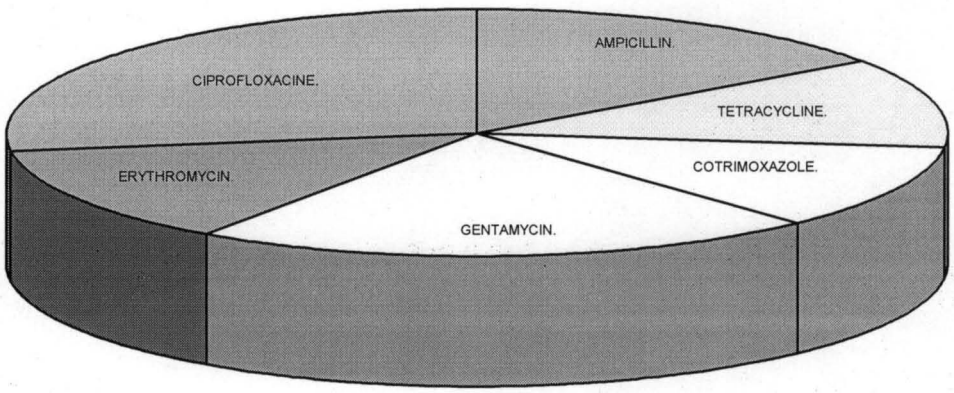
AGE (years)	*NO. OF INFECTED MALE*	*%NO. OF INFECTION IN MALE*	*NO. OF INFECTED FEMALE*	*%NO. OF INFECTION IN FEMALE*	*%TOTAL WITHIN AGE GROUP*
16-20	0	0.0	4	11.1	11.1
21-30	2	16.7	9	25.0	41.7
31-40	3	25.0	12	33.0	58.3
41-50	5	41.7	7	19.4	61.1
51-60	1	8.3	4	11.1	19.4
61-70	1	8.3	0	0.0	8.4
TOTAL	12	100	36	100	

TABLE 4.15. THE DISTRIBUTION OF ISOLATES FROM THE POSITIVE CASES OF UTIs IN RIJAU L.G.A

ISOLATE	*No OF ISOLATE IN MALE*	*No OF ISOLATE IN FEMALE*	*TOTAL No OF ISOLATES*	*% TOTAL OF ISOLATES*
S. aureus	5	13	18	23.4
E. coli	5	6	11	14.4
Strep. faecalis	2	4	6	7.8
Kleb. species	3	6	9	11.7
Proteus vulgaris	2	5	7	9.1
Pseud. aeruginosa	1	3	4	5.2
Neisseria gonorrhea	0	2	2	2.6
Candida albicans	0	6	6	7.8
Unidentified species	5	9	14	18.2
TOTAL	23	54	77	100

4.5.0. ANTIBIOTIC RESISTANCE PROFILES

The acceptable zone sizes (NCCL, 1990) considered being resistance in this investigation was ≥14mm in diameter. The results on the antibiotic resistance profiles revealed that *Staphylococcus aureus,* were highly resistance to Cotrimoxazole (100%), Tetracycline (67%) and Erythromycin (50%) but the organism were sensitive to Ciprofloxacin and Ampicillin (Table.4.16) *Escherichia coli*, were highly resistance to Tetracycline (100%) and Erythromycin (50%) but sensitive to Ciprofloxacin, Gentamycin, Cotrimoxazole and Ampicillin *Streptococcus faecalis* exhibited high resistance to Erythromycin (33 %) Cotrimoxazole (83%) and moderately resistance to Teracycline (17%) *Klebsiella* species exhibited high degree of resistance to Erythromycine (100%) Tetracycline (83%) and Cotrimoxazole (83%) (Table 4.16). *Proteus vulgaris* were highly resistance to Ampicillin (100%) and Cotrimoxazole (85%) but were found to be sensitive to Ciprofloxacin, Erythromycin, Gentamycin and Tetracycline. *Pseudomonas aeruginosa* isolates were highly resistance to Erythromycin (83%), Tetracycline (83%) and Ampicilline (50%). *Neisseria gonorrhea* isolates exhibited high to Cotrimoxazole (100%), Tetracycline (67%), Ampicillin (67%) moderately resistance it Erythromycin (17%). The overall results on the effectiveness of antibiotics tested on bacteria isolated from positive cases of UTIs are indicated in figure 4.3.



FUGURE 4.3. EFFECTIVENESS OF ANTIBIOTICS ON BACTERIA ISOLATED FROM POSITIVE CASES OF UTIs

CHAPTER FIVE

4.0 DISCUSSION, CONCLUSION AND RECOMMEDATIONS

5.1 DISCUSSION

The results of this study revealed high infection rates of individuals in all the six local government areas investigated, with a prevalence rate of 63.3%. This observation agrees with the report of Freedman *et al* (1982) who carried out an epidemiological survey on the studies of urinary tract infections in Hiroshima, and reported an increase in the number of positive cases of urinary tract infections, with an infection rate of 56.7% while Ijah and Sar (1996), observed one hundred and Three positive cases in Four hundred and Twenty urine samples collected from patients in Gboko, Nigeria. Their finding showed 24.4% infection rate. The increase in the incidence rate of urinary tract infections as observed in the present study could be attributed to the following factors: poor personal hygiene, sexual promiscuity, urinary tract catheterization, Environmental factors, and predisposing factors such as impaired host resistance (More, 1991; Princewill *et al*, 1991; Umeh, 1993).

The overall results on the data analysis revealed that urinary tract infections was found to be far more prevalent in female than in males. This observation agrees with the report of other investigators (Aneke, 1987; Pfeu, 1990; More, 1991; Ijah and Sar, 1996; Graemer, 2001) working independently at different periods. Cattel (1985) reported that urinary tract infections are mostly found in woman and girls, because of their relatively short urethra. The investigator further explained that about 20% of all women will experience urinary tract infections in their life time. Other workers such as Leigh (1994), Ijah and Sar (1996) and Ray (1999) had also reported this observation, while Ketchon (1988) explained that short urethra of about 4cm in length found in woman provides bacteria with a short distance to travel before entering the bladder. Lakhoo (1996) identified the presence of an anatomical abnormally of urinary tract as the only predisposing factor to

infections, while Hoffman (1990) reported that Professor Schaeffer of Northwestern University in the United States of America, observed that the epithelial cell lining to the urinary tract of all infected women has a sticky surface glycoprotein that attracted and allowed the colonization by microorganisms. On the other hand, Chisholum *et al,* (1990) reported that antibacterial prostatic secretion is always produced in males, which protect them from bacterial colonization of the urinary tract. All the above-mentioned factors and many more render women more vulnerable than men to urinary tract infections.

The results obtained from hypothesis two tested in this study revealed that the Age group with the highest incidence rate in female is between the age ranges of 31-40 years, while between the age ranges of 41-50 years was found to have the highest incidence rate in male. Other investigators (Anderson, 1982; Hoffman, 1990; Roy, 1999) had earlier reported this observation. Leigh (1984) reported that the prevalence of urinary tract infections were always higher in females of all age than the male of the corresponding age. The present study shows a slight deviation from the assertion. The high infection rate observed in the age range of 41-50years in male was equally report by other investigators, (Anderson, 1982; Hoffman, 1990; Roy, 1999). Roy (1999) detected only two positive cases of urinary tract infection in 7731 boys and young man examined. Freedman *et al,* (1982) investigated 1244 older males and could not find positive urine culture below the age of 45 years. The investigators later concluded that infection of older males could probably be due to the fact that males rather then females are the primary source of urinary tract infections. Similarly, Scott (1995) reported that urinary tract infections at the age 60 and beyond in males could be due to bladder neck obstruction, which leads to the inevitable vesical urine residues.

The results of the statistical analysis also show an interweaving in the incidence of urinary tract infections at the age ranges of 21-43 years in both sexes. This observation agrees with that of Stammey (1986) who reported a moderate prevalence rate of UTIs within the age group of 21-45 years in both sexes. How age affects the incidence of urinary tract infections is still a matter of debate and research. Hoffman (1990) suggested that in

very young children infection could be as a result of an undeveloped immune system, making such children prone to infections. He however, stressed that with the development of immune system in later years, other conditions and activities came in to play role to trigger attacks of urinary tract infections. These conditions may include sexual promiscuity and practices such as the use of diaphragm.

The results of hypothesis three tested in this study revealed that urinary tract infections are far more prevalent among patients in Mariga, Magama and Mashegu Local Government Areas, moderately prevalent among patients in Rafi and Kontagora Local Government Areas and less prevalent in Rijau Local Government Area. These variations could be attributed to their differences in geographical locations: Such differences could lead to the prevalent of certain aetiologic agents of urinary tract infections in one location but absent in the other location. In addition different social and human activities could account for the observed differences.

Agents of urinary tract infections that were identified are *Staphylococcus aureus, Escherichia coli, Streptococcus faecalis, Klebsiella species, Proteus vulgaris, Pseudomonas aeruginosa, Neisseria gonorrhea*, and *Candida albicans;* These organisms have been implicated in UTIs by other investigators (Duguid *et al,* 1987; Prescott *et al,* 1990; Princewill and Obetie, 1991; Umeh, 1993; Ijah and Sar, 1996; Roy, 1999) but with varied frequencies of occurrence. Princewill and Obiete (1991) suggested that the differences in results observed by different investigators with regards to the frequencies of occurrence of the isolates responsible for urinary tract infections could be attributed to factors such as geographical locations, social difference, and human activities.

E.coli had the highest frequency (22.2%) of occurrence. This agrees with the report of Herold *et al*, (1982) who observed that over 80% of urinary tract infections were due to *Escherichia coli.* Prescott e*t al,* (1990) also reported that urinary pathogens are usually enteric bacteria and the most dominant among them is *Escherichia coli,* which accounts for 90% initial urinary tract infections, and 50% of recurrent urinary tract infections. *Proteus*

species, *Klebsiella species,* and *Enterococcus faecalis* constituted the remaining percentage. The investigators further stressed that urinary tract infections caused by other organisms, such as *Mycobacterium*, *Mycoplasma*, *Neisseria, Staphylococcus aureus, Candida albicans*, and *Pseudomonas aeruginosa* are usually associated with underlying pathology or prolonged broad-spectrum antibiotic therapy. *Candida albicans* accounted for 10.9% infection rate in the present study and it was observed to cause the infection in females only. These observations have been reported by Owen (1982) and Gayle (2001). Graemer (2001) reported the organism to be the major cause of vaginitis in women.

The results an the sensitivity test revealed that *Staphylococcus aureus, Escherichia coli, Streptococcus faecalis, Klabsiella species, Proteus vulgaris, Pseudomonas aeruginosa, Neisseria gonorrhea*, were found to be highly sensitive to Ciprofloxcin and Gentanycin, Moderatly sensitive to Ampicillin and Enythromycin, but less sensitive to Tetracycline and Cotrimoxazole. However the finding suggests that Ciprofloxacin, or Gentamycin could be use as a drug of choice against infections of urinary tract causes by these organisms. Ampicillin could be useful in cases involving mostly species of *Staphylococcus aureus, Escherichia coli, Streptococcus faecalis, and Klebsiella species.* Also the drug (Erythromycin) could be used in the treatment of urinary tract infections in cases involving *Proteus species*.

The high levels of resistance to Tetracycline and Cotrimoxazole exhibited by some of these organisms in the present study, is not surprising because these drugs are usually recommended for treatment of urinary tract infections and they are readily available from diverse sources. This leads to gross abuse of the drugs by individuals resulting to diminished in effectiveness of the drugs. Another possible reason for the high levels of resistance to antibiotics exhibited by the organisms could be the high rate of resistance factor (R) transfer, which is common among the enterobacteriecae (Peclzar *et al* 1986; Duquid *et al* 1987).

5.2 CONCLUSION

The results of the study have led to the following conclusions:

1. The incidence of urinary tract infections in Mashegu, Mariga, Magama, Rafi, Kontagora and Rijau local government areas of Niger State have been investigated, and the results revealed 63.3% prevalence rate.
2. A significantly higher incidence rates of urinary tract infections occurred in females than in males.
3. The diseases mostly affected the age groups 16-40years in female and 41-60years in males.
4. Great variations in the incidence of urinary tract infections existed among the six local government areas.
5. Most of the agents of urinary tract infections isolated in this study are the opportunistic pathogens, predominantly members of the genus enterobacter and few Gram-positive organisms.
6. The results equally revealed that Ciprofloxacin and Gentamycin tested on the isolates were very effective and therefore, the two antibiotics could be the drugs of choice in the treatment of urinary tract infections caused by these organisms.

5.3 RECOMMENDATIONS

As part of efforts to reduce the incidence of urinary tract infections and to effectively control the spread of antibiotics resistant pathogens, the following recommendations are necessary:

1. Proper treatment of infected individuals should be encouraged as many deaths and other serious medical problems could be predisposed by urinary tract infections.

2. Routine screening of infected individuals is also necessary to rule out the possibilities of re-current urinary tract infections.
3. Health education is important to enlighten the public on the danger of indiscriminate use of antibiotics and home remedies. The public should also be advised on the need for proper personal hygiene.
4. Sexual promiscuity and the use of artificial lubricant among couples should be discouraged.
5. For Rural hospitals and General hospitals, Government should provide enough medical facilities, especially in the areas of diagnostic investigations.
6. Health workers should always use the history, examination and bacteriological finding to make a precision before treating a patient with urinary tract infections
7. The use of systemic anti-infective agents for prevention of urinary tract infections in chronically catheterized patients should be avoided, as this may results to development of resistant organisms.
8. Future studies on the incidence of urinary tract infections should be widened to cover the rest of the local government areas in Niger State. This will help in determining the incidence rate of infected individuals in these areas. Besides, such studies would provide ready tools for use by the institution and the government (at the Federal, State, or local government levels) in boosting rural and urban health care delivery system.

REFERENCES

Anderson, R.B. (1982). Health line, Health line Publishing Inc, Virginia, pp. 20-28.

Aneke, C; Mbakwen-anieb, C; Ibe, S.N; Blankos, C and Iniowurari, A. (1987). Urinary tract infections and drug resistance of *Escherichia coli* and other *Coliforms*. Nigerian Journal of Microbiology 7:19-30.

Asschar, A.W. (1980). The Challenge of Urinary Tract Infections. Academic Press, New York, Grune and Stratton.pp.13-58

Anthony, J. S. (1996), Role of Bacteria Adherence in Urinary Tract Infections. Scientific Foundation of Urology. 3rd edition, Churchill Living Stone, Edinburgh, pp. 124-126.

Baker, P.J. and Silvertor, R.E. (1985). An Introduction to Medical Laboratory Technology. Butterworths, London, pp. 293-302.

Barbara, H. M. (1997). Statistical Methods for Health Care Research. J.B. Lippincort Company, England. pp.117-108

Bauer, A.W. and Kabei A.U (1966). Antibiotic Susceptibility Testing a Standardized Single Disc Method. American Journal of Clinical Pathology 44:493-496

Briggs, A. (1990). The Longman Encyclopedia. Longman Group Limited. England, pp. 1101-1102.

Cattel, W.R (1985). Urinary infections in Adults. Postgraduate Journal of Medicine 6l:907-913.

Chisholum, D; Geoffrey, U. and Willhem, R. (1990). Scientific Foundation of Urology 3rd edition, Large Medical Publishing, London, pp. 113-140.

Duguid, J. P; Marimion, B.P. and Swin, R.H. (1987). Medical Microbiology Practical Manual Churchill Livingston, Edinburgh, pp. 54-201.

Edward, P.R. and Ewing, W.H. (1972). Identification of Enterobacteriaceae, 3rd edition Mincopons Burges Publishing Company, London pp. 5-22, 26-31

Fawcett, D.P; Emkyn, S. and Bultitride, M.J. (1985). Urinary tract infections following Trans rectal biopsy of prostate. Journal of Urology, 47: 679-680.

Fowler, J.E. and Stammey, T.A. (1987). Studies of introital colonization in women with recurrent urinary tract infections Vll. The role of bacterial adherence. Journal of Urology 117:49.

Freedman, L.R; Pair, J.R. and Sew, M. (1982). The epidemiology of urinary tract infections in Hiroshima. Tale Journal of Medicine 34:26

Gayle, F. (2001). Treatment of vaginitis and volvitis Australian Prescriber. 24 (3):59-61.

Gillies, R.R. and Dodds, M. (1984). Bacteriology illustrated 5th edition, Longman Group Ltd. Honkong, pp 80-82.

Graemer, D. (2001). Treatment of Candida vaginitis and vulvitis. Australian Prescriber. An independent review 24(3): 62-64.

Herold, P; Lamber, V; Fmp, W. and Edmind, F. (1982). Infections diseases illustrated. An intergrated text and colour Atlas. Dergamon Medical Publication, Oxford. pp. 8.1-9.24.

Hoffmann, B.A. (1990). Urinary Tract Infection in Human Sexuality. Dushkin Publishing Company, Grilford, pp. 57-60.

Hubley; J. and Frense, L. (1996). Health education and sexually transmitted Diseases. Tropical Doctor 26:121-125.

Ijah, U.J.J and Sar, T.T. (1996). Incidence of urinary tract infections in Gboko, Benue State, Nigeria. West African Journal of Biological and Applied Chemistry 41:34-37.

James, J. F. (2000). Relationship of bacterial vaginosis and *Mycoplasma* to the risk of spontaneous abortion. Nigerian Clinical Review (Nov/Dec.) 22:4-8

Jan, W. M. D. (1980). Urinary tract infections in children. Nigerian Medical Journal 6:3-7.

Kriangere, J. N. (1986). Complications and treatment of urinary tract infections during pregnancy, Urological Clinic North America 13:685.

Kunin, C.M (1980) Detection, Prevention and management of urinary tract infections 3rd edition Philadelphia, pp. 21-23.

Lakhoo, K; Thomas, D. and Fuenfer, M. (1996). Failure of prenatal Ultrasonography to prevent urinary tract infections associated with underlying Urological abnormalities. Department of pediatric Urology at James. Univ – Hospital and Germ infirmany Leeds. U.K Journal of Urology 77(6):56-58

Leigh, D.A. (1984). Single dose treatment of urinary tract infections. African Journal of Clinical Microbiology 1(1):1-3.

Mitchell, J.P. and Gillespie, W.A. (1984). Bacteriological complications from the use of urethral instruments; Principles of Prevention. Journal of Clinical Pathology 17 (49):16-19.

More, I. A. (1991). Kidneys and Urinary Tract Infections in Nulls Textbook of Pathology. Anderson J.R (edition) Edward Arnold, London, pp. 22-48.

Morse, S.I. (1987). In Davis. B.O. Dulbecco, R. Eizen, H.N and Ginsberg, H.S. Microbiology 3rd (edition) Herper and Row, Hergerstown, pp. 52-58

National Committee for Clinical Laboratory Standards (1988). Performance Standard for Antimicrobial Disc Susceptibility Tests. Tentative Standard 4th ed. Villanva, P.A. USA.

Nitzen, Y. M.M; Wagabman, C. and Drucker, M. (1983). Urinary tract infection and drug resistance bacteria in different patients population, First Journal of Medical Science 19: 103-1045

Obaseikie, E. and Salami, C. (1983) Susceptibility of Urethratis *Escherichia coli, Klebsiella spp* and *Proteus spp* isolates to antibiotics in Benin City. Nigeria Journal of Microbiology 3:4-120

Ogbulic J.N; Uwaezuoke J.C. and Ogichurs, I. (1998). Introductory Microbiology Practical Springfield, Owerri, Nigeria, pp. 127.

Owen, R.L (1982). Sexualy transmitted enteric disease in current clinical tropics, in Infections Diseases, Remington. J.S and M.M Swarthy (edition). Macgraw Hill, New York, pp.1-29.

Patterson, T.F. and Andniole, U.T. (1987). Bacteria Uria in Pregnancy, Infectious Disease Clinic, North America 1:807.

Pelczer, J.M; Chan, E.C. and Morel, R. K. (1986). More, 1991; John 1991). Microbiology Macgraw-Hill International, Singapore. pp. 160-263.

Prescott, L.M; Harley, J.P. and Wein, D.A (1990). Microbiology. WM C-Brown Publishers, Dubuque, pp. 436-439.

Princewill, J.T.J. and Obiete, C.I. (1991).Urinary tract infection in school children. In Book of Abstracts of the 19th Annual Conference of the Nigerian Society for Microbiology 1st – 4th Sep. 1991. P. 21 Ahmadu Bello University, Zaria, Nigeria.

Pfeu, A. T. (1986). The bacteria of vaginal vistibule, urethra and vagina in premenospausal women with recurrent urinary tract infection. Journal of Urology

Pfeu, A. (1990). An evaluation of midstream urine culture in the diagnosis of urinary tract infection in females. Urology Integrated 19:305.

Roy, P.C. (1999). Children urinary tract infection Australian Prescriber. 22(2):40-43.

Richard, G.F. and David, J.B. (1983). Sanitation and Disease, Health Aspects of Excreta and Wastewater Management. John Willey and Sons New York.

Reisenberger, E. and Cotton, I. (1983). Microbial Biology, Saunders College Publishers, Philadelphia, pp. 404-408.

Sexual Transmitted Diseases (STDS) Treatment Guidelines (1982). "Morbidity and Mortality" weekly report 31:35, Atlanta U.S. Department of Health and Human Services.

Scott, R. (1995). Urology Illustrated. 3rd (edition) Churchill Livingstone, pp. 94-98.

Smith, D.R. (1981). General Urology (10th edition) Large Medical Publication, London, pp. 153-215.

Stamm, W. and Turk, M. (1980). Urinary tract infections in Harrisons Principles of Internal Medicine 9th edition Kurt, J. and Raymond, A Granstill Book Company, New York, pp. 1296-1384.

Stammey, T.A (1986). Diagnosis, localization and classification of urinary infection in pathogenesis and treatment of urinary tract infection. Williams and Wilkins, Baltmore, pp 1-51.

Umeh, E.U. (1993). Bacterial agent of urinary tract infections in Enugu, Enugu State. In Book of Abstracts of the 34th Annual Conference of Science Teachers Association of Nigeria (STAN). December 12-16, Bayero University Kano, Nigeria.

Vandepitte, J; Engback, K; Piot, P. and Hark, C. (1991). Basic Laboratory Procedures in Clinical Bacteriology World Health Organisation, Geneva, pp.31-36.

POSITIVE CASES OF URINARY TRACT INFECTIONS:

ISOLATE	CULTURAL CHARACTERISTICS	GRAM STAIN REACTION	CATALASE	OXIDASE	INDOLE	MR	V/P	UREASE	COAGULASE	CITRATE	STARCH	HYDROLYSIS	LACTOSE	SUCROSE	FRUCTOSE	GLUCOSE	MANNITOL
S. aureus	Abudant opaque Golden yellow colunieson N.A.	Gram positive cocci	+	-	-	-	+	-	+	-	-		A	A	A	A	A
E. coli	White, moist and Glistening colonies on N.A.	Gram Negative Rod	+	-	+	+	-	-	-	-	-		AG	AG	AG	AG	-
Strep. faecalis	Thin white spreating viscous growth on N. A	Gran positive cocci	+	-	-	-	+	-	-	-	-		-	-	-	-	AG
Klebsiela species	Slimy white, translucentraised colonies Nutrient A.	Gram Negetive Rod	+	-	-	-	+	+	-	+	-		AG	AG	AG	AG	AG
Proteus vulgaris	Spreading growth over the surface of Nutrient Agar (N.A)	Gram Negetive Rod	+	-	+	+	-	+	-	+	-		-	AG	AG	AG	-
Pseu. aeruginosa	Abudant white colonies medium turn green as it age on N.A	Gram Negetive Rod	+	+	-	-	+	-	-	+	-		-	-	-	AG	AG
Neisseria Gonorrhea	Grey to white opaque raised and glistening colonies on B.A.	Gram Negetive Diplococci	+	+	-	-	+	-	-	-	-		-	-	AG	AG	-

APPENDIX B LABORATORY PREPARATION OF DIFFERENT CONCENTRATION OF ANTIBIOTICS USED FOR THE SCREENING OF THE TEST ISOLATES

Antibiotic	ORIGINAL CONCENTRATION	No. OF DISC PREPARED	REQUIRED CONCENTRATION	VOLUME REQUIRED	RV/0g/ ml
Ampicillin	250000µg	50	500µg	5ml	0.01
Tetracycline	250000µg	50	1500µg	5ml	0.03
Gentamycin	80000µg	50	500µg	5ml	0.031
Co-trimoxazole	48000µg	50	1250µg	5ml	0.013
Erythromycin	250000µg	50	750µg	5ml	0.015
Ciprofloxacin	250000µg	50	5000µg	5ml	0.01

APPENDIX C ANTIBIOTIC RESISTANCE PROFILES

ANTIBIOTIC	CONCENTRATION	*S. aureus*	*E. coli*	*Strep. faecalis*	*Klebsiella Spp.*	*Proteus vulgaris*	*Pseudo. aeruginosa*	*Neisseria gonorrhea*
AMPICILLIN	10µg	0(0.0)	0(0.0)	0(0.0)	0(0.0)	6(100.0)	3(50.0)	4(67.0)
TETRACYCINE	30µg	4(67.0)	6(100.0)	1(17.0)	5(83.0)	0(0.0)	5(83.0)	4(67.0)
COTRIMOXAZOLE	25µg	6(100.0)	0(0.0)	5(83.0)	5(83.0)	5(85.0)	0(0.0)	6(100.0)
GENTAMYCINE	10µg	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
ERYTHROMYCINE	15µg	3(50.0)	3(50.0)	2(33.0)	6(100.0)	0(0.0)	5(83.0)	1(17.0)
CIPROFLOXACIN	100µg	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)

APPENDIX D ANTIBIOTIC RESISTANCE AND SENSITIVITY PROFILES OF SCREENED *S. aureus.* ISOLATES.

(Zones of inhibition measured in millimetres)

Antibiotic	**SA01.**	**SA02**	**SA03.**	**SA04.**	**SA05.**	**SA06.**	**AVERAGE ZONE SIZE**
Ampicillin	25.0	28.0	22.5	18.5	26.5	28.5	24.0
Tetracycline	09.0	12.0	15.5	19.5	12.0	12.0	13.0
Co-trimoxazole	00.0	09.0	12.0	00.0	10.0	00.0	5.0
Gentamycin	23.0	27.0	32.5	38.5	25.0	22.4	28.0
Erythromycin	12.0	19.5	9.5	22.5	14.0	11.0	15.0
Ciprofloxacin	40.0	43.5	39.5	40.0	26.0	26.0	36.0

APPENDIX E ANTIBIOTIC RESISTANCE AND SENSITIVITY PROFILES OF SCREEN *E. coli* ISOLATES.

(Zones of inhibition measured in millimetres).

ANTIBIOTICS	EC01.	EC02.	EC03	EC 04.	EC05.	EC06	AVERAGE ZONES SIZE
Ampicillin	22.0	25.0	20.0	18.0	22.0	26.0	22.0
Tetracycline	00.0	10.5	12.5	09.0	00.0	14.5	8.0
Cotrimoxazole	26.0	22.5	28.0	21.0	22.5	19.5	23.0
Gentamycin	26.0	30.0	27.5	22.0	25.0	18.0	25.0
Erythromycin	10.0	12.5	18.0	095	22.0	20.0	15.0
Ciprofloxacin	33.0	29.0	35.5	30.5	30.0	25.0	31.0

APPENDIX F ANTIBIOTICS RESISTANCE AND SENSITIVITY PROFILES OF SCREENED *Strep. faecalis* ISOLATES.

(Zones of inhibition measured in millimetres)

ANTIBIOTICS	SF01.	SF02	SF03	SF04	SF05.	SF05	AVERAGE ZONE SIZE
Ampicillin	20.0	22.0	18.5	24.5	17.5	18.0	20.0
Tetracyclin	23.0	17.0	21.5	24.5	24.5	15.0	21.0
Co-trimoxazole	10.0	15.5	00.0	00.0	09.5	12.0	8.0
Gentamycin	28.0	26.0	22.5	17.0	19.5	20.0	22.0
Erythromycin	18.0	15.0	18.5	20.5	12.5	0.0	14.0
Ciprofloxacin	35.0	20.0	21.0	36.5	35.3	23.0	28.0

APPENDIX G

ANTIBIOTICS RESISTENCE AND SENSITIVITY PROFILES OF SCREENED *Klebsiella SPECIES* ISOLATES.

(Zones of inhibition measured in millimetres).

ANTIBIOTIC	KS01.	KS02.	KS03	KS04	KS05	KS06	AVERAGE ZONES SIZE
Ampicillin	25.0	22.0	18.5	16.0	18.0	19.0	20.0
Tetracycline	09.0	12.0	16.0	00.0	00.0	09.0	8.0
Co-trimoxazole	15.0	10.0	12.5	00.0	09.5	12.0	10.0
Gentamycin	20.0	18.5	20.0	17.5	20.5	20.0	19.0
Erythromycin	09.0	14.5	09.0	10.0	00.0	12.0	9.0
Ciprofloxacin	40.0	35.0	32.0	41.5	23.5	21.0	32.0

APPENDIX H

ANTIBIOTIC RESISTANCE AND SENSITIVITY PROFILES OF *Proteus vulgaris* ISOLATES.

(Zones of inhibition in millimetres).

ANTIBIOTICS	PV01.	PV02.	PV03.	PV04.	PV05	PV06.	AVERAGE ZONES SIZE
Ampicillin	00.0	00.0	00.0	00.0	00.0	00.0	0.0
Tetracycline	25.0	26.0	21.0	20.0	19.0	18.5	22.0
Co-trimoxazole	00.0	00.0	09.0	15.0	10.0	12.5	14.0
Gentamycin	26.0	22.0	19.0	25.5	20.0	19.0	12.0
Erythromycin	20.0	20.0	22.0	18.5	16.0	15.0	19.0
Ciprofloxacin	31.0	26.0	28.0	26.0	32.5	30.0	29.0

APPENDIX I

ANTIBIOTIC RESISTANCE AND SENSITIVITY PROFILES OF SCREENED *Pseudomonas aeruginosa* ISOLATES

(Zones inhibition measured in millimetres)

ANTIBIOTIC	PA01.	PA02.	PA03.	PA04.	PA05.	PA06	AVERAGE ZONES SIZE
Ampicillin	22.0	20.0	10.0	15.0	10.5	12.0	15.0
Tetracycline	00.0	00.0	15.0	09.0	12.0	0.00	6.0
Cotrimoxazole	26.0	22.0	28.0	21.0	19.0	21.0	23.0
Gentamycin	26.0	23.0	23.0	21.0	18.0	16.0	21.0
Erythromycin	10.0	10.0	09.0	12.0	15.0	00.0	9.0
Ciprofloxacin	38.0	32.0	25.0	22.0	20.0	31.0	28.0

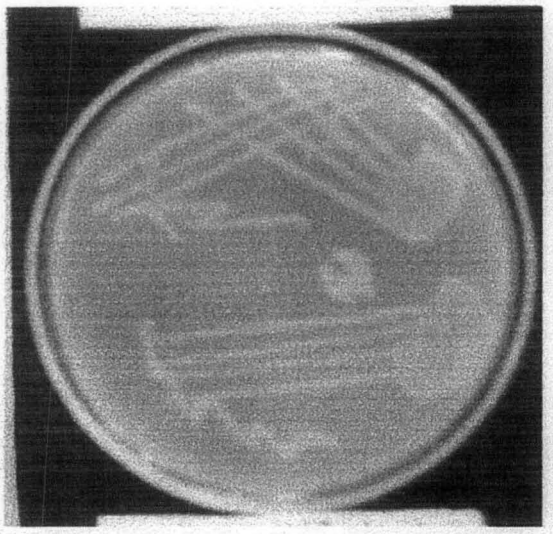
APPENDIX J

ANTIBIOTIC RESISTANCE AND SENSITIVITY PROFILES OF SCREENED *Neisseria gonorrhea* ISOLATED

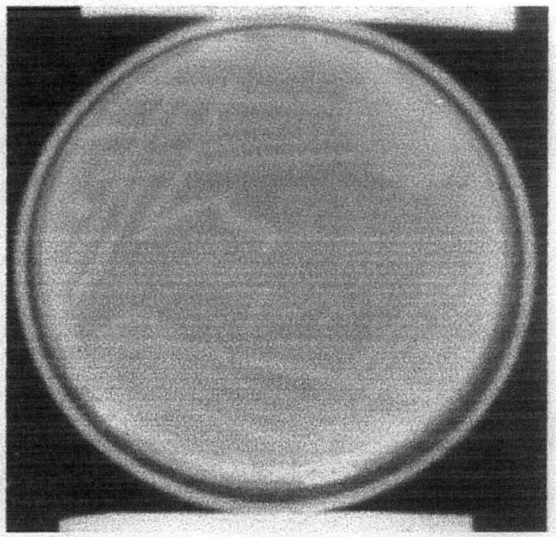
(Zones of inhibition measured in millimetres)

ANTIBIOTICS	NA01.	NA02.	NA03.	NA04.	NA05.	NA06.	AVERAGE ZONE SIZE
Ampicillin	12.0	14.0	0.90	18.0	20.0	09.0	14.0
Tetracycline	00.0	09.0	13.5	18.0	18.5	10.0	10.0
Cotrimoxazole	00.0	00.0	00.0	00.0	00.0	00.0	0.0
Gentamycin	30.0	25.0	23.0	16.0	18.0	22.0	24.0
Erythromycin	15.0	19.0	12.0	16.0	19.5	18.0	17.0
Ciprofloxacin	25.0	22.0	24.0	18.0	19.0	18.0	21.0

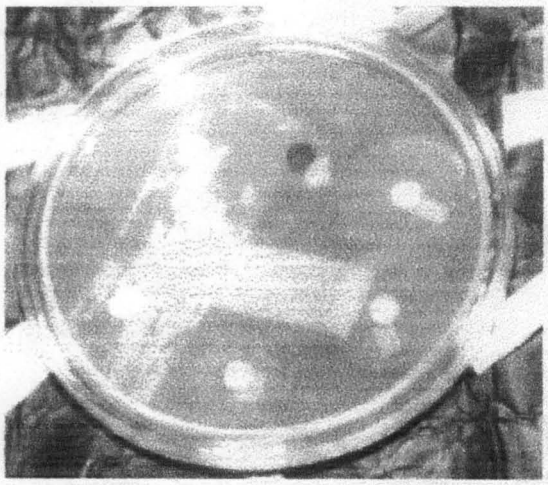
APPENDIX K



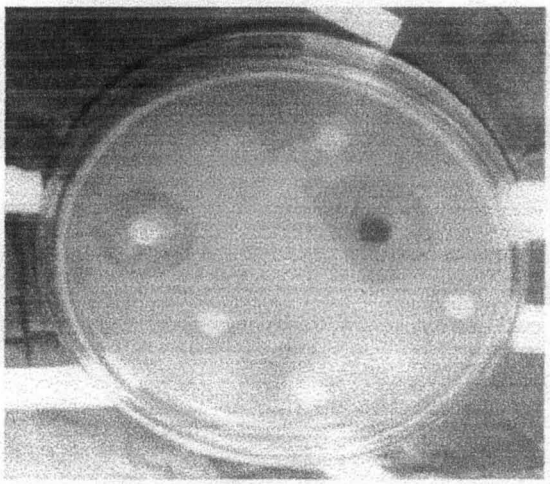
Shows *mixed cultures obtained from Raf. 015 and 028.*



Shows *mixed cultures obtained from Mas.006 and 016.*



Shows the antibiotic sensitivity test of a screened *Pseu. aeruginosa* Isolate.



Shows the antibiotic sensitivity test of a screened *S. aureus Isolate.*