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# Prevalence of Urinary Tract Infection in Women Attending Murtala Muhammad Specialist Hospital, Kano State, Nigeria

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***Authors' contributions***

*This work was carried out in collaboration among all authors. Author MBI designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors MSA and AAS managed the analyses of the study. Author AAS managed the literature searches. All authors read and approved the final manuscript.*

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## ABSTRACT

**Background:** Urinary Tract Infections (UTIs) happened to be caused by the presence and growth of microorganisms anywhere in the urinary tract. Women were more vulnerable to as well as many factors contributed towards the development of UTIs.
**Methods:** Early morning midstream urine samples were collected from Murtala Muhammad Hospital. Freshly prepared cysteine-lactose electrolyte deficient (CLED) agar and MacConkey Agar were used and plates were incubated at 37°C for 24 hours for isolation. The resulting pure colonies obtained were used for biochemical tests aimed at identifying the bacterial isolates as well as subjected to Gram staining.
**Results:** Out of 120 samples screened from both pregnant (60) and non-pregnant (60) women suspected of urinary tract infection, 21(35%) pregnant women were positive, 39(65%) were negative and 16(26.7%) non-pregnant women were positive, 44(73.3%) were negative. The study

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showed the prevalence of urinary tract infection of 21 (35%) and 16 (26.7%) among pregnant and non-pregnant women respectively, indicated that about 35% of pregnant women were at risk of development for acute episode of urinary tract infection during pregnancy that lack of proper treatment. In the present study the infection rate was higher between age group 23-27 years in both pregnant and non-pregnant women. According to this study, highest incidence of UTI was seen in third trimester 10 (47.6%), followed by second trimester 7 (33.3%) and least was seen in first 4 (19.0%). In the present research, the most frequent isolates were *Staphylococcus aureus* (45.9%), *Escherichia coli* (35.1%), *Klebsiella pneumoniae* (10.8%), *Proteus mirabilis* (5.4%) and *Pseudomonas aeruginosa* (2.7%).

**Conclusion:** Urinary tract infection appeared to be multifactorial. A screening for UTI in women especially pregnant women must be done to discover the infected cases, which could allow early treatment to avoid the complications. As such, strong personal hygiene is recommended since most of the causative organisms were of faecal origin as well as sound health education on preventive measures of the diseases should be provided by government so as to curve the menace of this deadly infection.

*Keywords: Urinary tract infection; biochemical; isolation; pregnant; non-pregnant women.*

## 1. INTRODUCTION

Urinary Tract Infections (UTIs) were mainly caused by microorganisms anywhere in the urinary tract [1]. UTIs was evident when there are $10^5$ or more of microorganisms of a single strain of bacterium per milliliter in midstream urine samples [2]. UTIs affects all age groups, but women were more vulnerable than men, due to; small urethra, absence of prostatic secretion, pregnancy and easy contamination of the urinary tract with fecal flora [3]). Moreover, the physiological increase in plasma volume pattern during pregnancy decreases urine concentration up to 70% in pregnant women which developed glucosurea and also encouraged bacterial growth in the urine [4]. Subsequently, Women identified with asymptomatic bacteriuria in early pregnancy have a 2030-fold increased risk of developing pyelonephritis during pregnancy, compared with women without Bacteriuria [5]. Nevertheless, mostly women experienced premature delivery that led to having infants of low birth weight. Prospective, comparative clinical trials have consistently reported that antimicrobial treatment of asymptomatic bacteriuria during pregnancy decreased the risk of subsequent pyelonephritis from 20% - 35% to 1% - 4% [6]. Also there are links between maternal complications of pregnancy and pyelonephritis including anaemia, amnionitis, hypertension, endometritis and preeclampsia [7]. The most common pathogen involved in bacteriuria was *Escherichia coli* accounting in a range of 60 to 90% of infections in women. Other bacteria involved include *Klebsiella pneumoniae*, *Proteus mirabilis* and *Pseudomonas aeruginosa* [8]. Gram-positive organisms like *Staphylococcus saprophyticus* also cause bacteriuria [9]. There are several ways to diagnose UTIs, but urine culture still remains the most reliable tool for its diagnosis [2]. Urinary tract infections (UTIs) are common bacterial infections in women, with half of all women experiencing at least one in their lifetime [10]. Moreover, certain number of women affected around 25-30% develop recurrent infections unrelated to any functional or anatomical abnormality of the urinary tract [11]. Most UTIs in women are episodes of acute uncomplicated cystitis which occur in women of childbearing age [10]. Although acute uncomplicated cystitis may not be thought of as a serious condition, it affects the patient's quality of life by causing an estimated six days of discomfort [10]. Acute cystitis refers to symptomatic infection of the bladder in the lower urinary tract [12]. Most episodes of cystitis and pyelonephritis are considered to be uncomplicated infections when occurring in otherwise healthy non-pregnant women. A complicated UTIs can occur in either the upper or lower urinary tract, but is accompanied by an underlying condition which increases the risk of therapy failing, such as obstruction, an anatomical abnormality, urological dysfunction, pregnancy or resistant pathogen [12]. The research aimed to: isolate and identify bacteria responsible for UTIs among pregnant and non-pregnant women attending Murtala Muhammad specialist Hospital, Kano as well as determined the most affected category.

## 2. MATERIALS AND METHODS

### 2.1 Study Area

The study was conducted at Medical Microbiology Laboratory of Murtala Muhammad Specialist Hospital Kano State.

### 2.2 Determination of Sample Size

In a previous study [13] in Nigeria found that the prevalence of urinary tract infection in women to be 8.5%.

Thus for this research, prevalence values were used to calculate sample size using the formula stated by Naing et al. [14].

$$N = \frac{(z^2 \times pq)}{D^2}$$

Where:

N=Number of samples
z= statistic for level of confidence at 95% = 1.96
p= Prevalence (8.5%) = 0.085
q= 1-p
D = allowable error of 5% = 0.05

$$N = \frac{(1.96)^2 \times 0.085 \times 0.915}{(0.05)^2}$$

$$= \frac{3.8416 \times 0.07775}{0.29878044}$$

$$= \frac{0.29878044}{0.0025}$$

N= 120

### 2.3 Samples Collection

Early morning midstream urine samples were collected from patients attending the study area. Samples were also processed immediately after collection (16).

### 2.4 Sample Processing

Each urine sample was streaked using a sterilized platinum wire loop onto the surface of freshly prepared cysteine-lactose electrolyte deficient (CLED) agar. The plates were incubated at 37°C for 24 hours to isolate the organisms. Colonies were picked with a sterilized wire loop and re-inoculated onto the surface of MacConkey Agar, for only gram negative bacterial isolation and also the gram positive bacteria were maintain using the (CLED Agar medium). The resulting pure colonies obtained were tested using biochemical tests aimed at identifying the bacterial isolates as well as Gram stained [9].

### 2.5 Gram Staining

A gram staining procedure was employed for the isolates [9].

### 2.6 Biochemical Tests

Biochemical tests were carried out on all the suspected Organisms as follows:

#### 2.6.1 Indole test

Indole reagents were utilized for the identification of isolates based on the procedures outline by Cheesbrough [9] and Abdallah et al. [15].

#### 2.6.2 Citrate utilization test

Simmon citrate agar was used to confirm both the positive and negative isolates [9].

#### 2.6.3 Methyl red and Voges Proskauer test

A pure culture of the organism was inoculated in the MR/VP solutions for the actual identification of the isolates [15].

#### 2.6.4 Oxidase test

A filter paper with tetra methyl-p-phenylenediamine dihydrochloride (TMPD) were used to test the actual isolates for the confirmation of oxidase positive or negative [9].

#### 2.6.5 Catalase test

Catalase test was conducted to identify the actual isolates that were positive and negative [9].

#### 2.6.6 Coagulase test

It was employed to confirm the actual isolates that were true and untrue coagulase clumping [9].

## 3. RESULTS

### 3.1 Prevalence of Urinary Tract Infections between Age Groups among Pregnant and Non-pregnant Women

Showed that the highest prevalence rate of urinary tract infection was among the age group

**Table 1. Prevalence of urinary tract infections between age groups among pregnant and non-pregnant women**

| Age group years | Pregnant | | | Non- pregnant | | |
|---|---|---|---|---|---|---|
| | Positive (%) | Negative (%) | Total (%) | Positive | Negative | Total |
| 18-22 | 6(28.6) | 6(15.4) | 12(20) | 3(18.8) | 10(22.7) | 13(21.7) |
| 23-27 | 7(33.3) | 7(17.9) | 14(23.3) | 5(31.3) | 6(13.6) | 11(18.3) |
| 28-32 | 2(9.5) | 10(25.6) | 12(20) | 4(25) | 7(15.9) | 11(18.3) |
| 33-37 | 2(9.5) | 5(12.8) | 7(11.7) | 3(18.8) | 8(18.2) | 11(18.3) |
| 38-42 | 3(14.3) | 6(15.4) | 9(15) | 0(0) | 5(11.4) | 5(8.3) |
| 43-47 | 1(4.8) | 5(12.4) | 6(10) | 1(6.3) | 8(18.2) | 9(15) |
| Total | 21(35) | 39(65) | 60 (100) | 16 (26.7) | 44 (73.3) | 60 (100) |

*The data was analyzed using turkey's tests and there was significance difference between age group at (P≥0.05)*

between 23-27 years in both pregnant and nonpregnant women, while the lowest prevalence occurred between the age 43-47 years in pregnant women and 38-42 years in non-pregnant women.

## 3.2 Prevalence of Urinary Tract Infection of Women Based on Trimesters

The bacterial isolates found in pregnant women as well as observed the highest in the third trimester than in second trimester and First trimester respectively.

**Table 2. Prevalence of urinary tract infection of women based on trimesters**

| Pregnancy trimester | Positive (%) | Negative (%) | Total (%) |
|---|---|---|---|
| First Trimester | 4 (19.0) | 11 (28.2) | 15 (25) |
| Second Trimester | 7 (33.3) | 21 (53.8) | 28 (46.7) |
| Third Trimester | 10 (47.6) | 7 (17.9) | 17 (28.3) |
| Total | 21 (35) | 39 (65) | 60 (100) |

*Data was analyzed using turkey's tests and there was significance difference (P≥0.05)*

## 3.3 Frequency of Occurrence of Bacterial Isolates among Pregnant and Non-pregnant Women

The frequency of bacterial isolates among pregnant and nonpregnant women attending Murtala Muhammad Specialist Hospital showed that *Staphylococcus aureus*, 17(45.9%) had the highest frequency, followed by *Escherichia coli* 13(35.1%), *Klebsiella pneumoniae* 4(10.8%), *Proteus mirabilis* 2(5.4%), *Pseudomonas aeruginosa* being the least among 1(2.7%). Yielded growth of bacteria in pregnant women having the highest frequency 22(58%) than non-pregnant women with 16(42%).

## 3.4 Biochemical Characterization of the Bacterial Isolates

The results showed that the some of the isolates were positive while some were negative based on the reactions of the individual biochemical test as shown in the Table 4. The results conform to that of Cheesbrough [9] and Abdallah et al. [15].

**Table 3. Frequency of occurrence of bacterial isolates among pregnant and non-pregnant women**

| Organisms | Pregnant (%) | Non-pregnant (%) | Total (%) |
|---|---|---|---|
| *Staphylococcus aureus* | 11(57.1) | 6(37.5) | 17(45.9) |
| *Escherichia coli* | 7(33.3) | 6(37.5) | 13(35.1) |
| *Klebsiella pneumoniae* | 2(9.5) | 2(12.5) | 4(10.8) |
| *Proteus mirabilis* | 1(4.8) | 1(6.3) | 2(5.4) |
| *Pseudomonas aeruginosa* | 0(0) | 1(6.3) | 1(2.7) |
| Total | 21 (35) | 16 (26.7) | 37 (100) |

*The data was analyzed using turkey's tests and there was significant difference between the organisms at (P≥0.05) level of freedom*

## 4. DISCUSSION

Urinary tract infection remained one of the most common medical complications in women more especially during pregnancy. It leads to anatomic and physiological changes that occur during pregnancy [16]. The physiological changes increased the vulnerability to the development of asymptomatic to pyelonephritis which may results in maternal morbidity and poor fetal outcome [17]. The study showed that the prevalence of urinary tract infection of 21 (35%) and 16 (26.7%) were significantly different among pregnant and non-pregnant women as shown in Table 1, consequently, indicated that about 35% of pregnant women were at risk of development for acute episode of urinary tract infection during pregnancy that lacked proper treatment. Moreover, the prevalence in the present study was lower than that of [17], who found that the prevalence in pregnant women was at 43%, but higher than that

**Table 4. Biochemical characterization of the bacterial isolates**

| Colonial appearance | Gram reaction | Catalase | Coagulase | Citrate | Oxidase | Indole | VP | MR | Organisms |
|---|---|---|---|---|---|---|---|---|---|
| deep yellow colonies on CLED agar | + Cocci | + | + | + | - | - | + | + | *S. aureus* |
| Opaque yellow colonies on CLED agar and dry, dark pink colour on MacConkey agar | - Rod | + | - | - | - | + | - | + | *E. coli* |
| Yellow to whitish blue colonies on CLED agar and dark pink, mucoid on MacConkey agar | - Rod | + | - | + | - | - | + | - | *K. pneumoniae* |
| Translucent blue colonies on CLED agar and form smooth, colourless colonies on MacConkey | - Rod | + | - | + | - | - | - | + | *P. mirabilis* |
| Greenish colonies on CLED agar | - Rod | + | - | + | + | - | - | - | *P. aeruginosa* |

*Key= + = positive, - = negative, VP= Voges Proskauer, MR= Methyl red, shows the result of biochemical tests of bacterial isolates which include; catalase, coagulase, citrates, Methyl Red-Voges-Proskauer, Indole and oxidase respectively*

obtained by Muhammad [18], who found that the prevalence was at 15.5%. The differences in prevalence may be explained due to differences in socio-economic status, environmental condition, social habit, personal hygiene and educational level and also due to physiological, functional and structural changes that pregnant women undergo which made them more susceptible to various germs [19].

In the present research, the infection rate was higher between age group 23-27 years in both pregnant and non-pregnant women as depicted in Table 1, agreed with that of Al-Haddad [20], but contrary to Buzayan Muna Mohamed [21] in Libya that observed the bacteriuria were more at the age group between 25-30 years. Higher incidences among women in this category may be as a result of higher sexual activity which in turn increased the risk of UTIs.

According to the present study, highest incidence of UTIs was seen in third trimester 10 (47.6%), followed by second trimester 7 (33.3%) and least is seen in first 4 (19.0%) as shown in Table 2, also supported that of Ranjan [22] who found higher incidence among subjects in third trimester. In contrary to that of Buzayan Muna Mohamed [21]. However, the result was not significant. According to them, the increased incidences during third trimester may relate to increased mechanical obstruction due to gravid uterus. Secondly, most of the pregnant women in the study area came for ante-natal care during second or third trimester. In the present research, the most frequent isolates were *Staphylococcus aureus* (45.9%), *Escherichia coli* (35.1%), *Klebsiella pneumoniae* (10.8%), *Proteus mirabilis* (5.4%) and *Pseudomonas aeruginosa* (2.7%) as shown in Table 3, was in contrast to that of Nworie and Eze [23] who found that *Escherichia coli* was the most prevalent. Presence of members of Enterobacteriacea family such as *E. coli, Klebsiella* and *Proteus* means that infection was as result of poor personal hygiene because the organisms were of fecal origin. It may also be connected with the proximity of anus to female vagina. The domination of gram negative UTIs bacteria resulted to so many disorders which also accounted UTIs in pregnancy and also encouraged *E. coli* growth and Faecal contamination due to poor hygiene [24]. Nworie and Eze [23] attributed the high prevalence of *Staphylococcal* infection to poor personal hygiene. All the identified organisms in the present study were in conformity with that of Cheesbrough [9] and Abdallah et al. [15], as shown in Table 4.

## 5. CONCLUSION

Urinary tract infection appeared to be multifactorial. A screening for UTIs in women especially pregnant women must be done to discover the infected cases, which could allow early treatment to avoid the complications. As such, strong personal and menstrual hygiene are recommended since most of the causative organisms were of faecal origin as well as sound health education on preventive measures of the diseases should be provided by government so as to curve the menace of this deadly infections.

## CONSENT AND ETHICAL APPROVAL

An approval for the study was obtained from Research and Ethics Committee Kano State Ministry of Health through Health Science Management Board. It was explained clearly to the clients and informed consent obtained before proceeding to the study.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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