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ORIGINAL ARTICLE

Asymptomatic Bacteriuria among Pregnant Women Attending Antenatal Clinic at the University Hospital, Kumasi, Ghana

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The apparent decline in immunity of pregnant women appears to promote the growth of both commensal and non-commensal microorganisms. The objective of the study was to determine the prevalence of asymptomatic bacteriuria in pregnant women visiting the University hospital, Kumasi. This prospective hospital-based study was carried out between April-June 2009. A total of 200 pregnant women were recruited for this study. The ages of the women ranged from 15 to 46 years. About 5-10mls of clean catch urine was cultured on Cysteine Lactose Electrolyte Deficient (CLED) agar aerobically at 37^{o}C . Isolates were identified to the species level using standard protocol. Antibiotic sensitivity test were carried out using the Kirby-Bauer disc diffusion method. Of the 200 women examined, 19 had significant bacteriuria representing a prevalence of 9.5% in the study population. Pregnant women in their second trimester from the study had the highest prevalence of significant bacteriuria (52.6%) with age ranges between 30-34 years having the highest prevalence (36.8%). Nulliparous women were 35 (17.5%) with 3 (8.6%) testing positive for bacteriuria and 165 (82.5%) were multiparous with 16 (9.7%) testing positive for bacteriuria. E. coli (36.8%) was the common bacteria isolate from this study. From this study, asymptomatic bacteriuria is common among antenatal women in the population studied. It is therefore recommended that periodic testing of pregnant women is advocated and those found to be infected need to be treated to avoid complications.
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Keywords*:* Asymptomatic bacteriuria, pregnancy, urine, Prevalence, Parity

INTRODUCTION

Urinary Tract Infections (UTIs) is an infection caused by the presence and growth of microorganisms anywhere in the urinary tract. It is perhaps the single most common bacterial infection of mankind (Morgan and McKenzie, 1993; Ebie *et al.*, 2001a). UTI is evident when there are 10^5 or more of microorganisms or of a single strain of bacterium per millilitre in midstream urine samples (Davidson *et al.*, 1989; Bloomberg *et al.*, 2005). The presence of bacteria without symptoms is termed asymptomatic bacteriuria. Common pathogens associated with UTI include *E. coli* and *Klebsiella* species although the distribution of pathogens that cause UTI is changing (Ojiegbe and Nworie, 2000).

Pregnant women are at increased risk for UTIs with incidence rates being as high as 8% in the United States (Delzell and Lefevre, 2000). Asymptomatic bacteriuria.in pregnancy has been attributed to increase urinary stasis, ureteric relaxation and other anatomical changes. These pathological conditions begin in week 6 and peak during weeks 22 to 24 and this prevent easy passage of urine

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(Delzell and Lefevre, 2000). Women with asymptomatic bacteriuria during pregnancy are more likely to deliver premature or low-birth-weight infants (Ronald, 1987; McGregor *et al*., 1990; Schults *et al*., 1991). These pregnant women also have a 20 to 30-fold increased risk of developing pyelonephritis (Zhanel *et al*., 1990; Mittendorf *et al*., 1992; Gratacos *et al*., 1994) compared with women without bacteriuria. Other conditions including transient renal failure, acute respiratory distress syndrome, sepsis, shock and haematological abnormalities occur in cases where asymptomatic bacteriuria is untreated or inadequately treated. However, variations have been noted to exist in the incidence of bacteriuria and subsequent UTI in different countries and this has been attributed to differences in definition, methods of screening and associated risk factors such as age, parity and pregnancy.

There are several ways to diagnose UTI, but urine culture still remains the most reliable tool for its diagnosis. Urine culture has shown *Escherichia coli* to be the most common bacterial isolate of UTI during pregnancy (Stein and Funfstuck, 2000; Ebie *et al*., 2001b; Bloomberg *et al*., 2005; Obiogbolu *et al*., 2009). Other studies have also reported *Klebsiella spp* (Omonigho *et al*., 2001) and *Staphylococcus aureus* (Ugbogu *et al*., 2010) as the commonest isolates.

This hospital-based prospective study was carried out to determine the prevalence of asymptomatic bacteriuria in pregnant women visiting the University hospital, Kwame Nkrumah University of Science and Technology (KNUST), Kumasi. The aim of the study was to evaluate the possible effects of maternal age, gestational age and parity on the prevalence of asymptomatic bacteriuria and to find the predominant causative agents associated with bacteriuria and subsequent UTI.

MATERIALS AND METHODS

Study site
This prospective hospital-based study was conducted in the antenatal clinic at the Kwame Nkrumah University of Science and Technology hospital, Kumasi during the periods of April 2009 to July 2009.

Study population
In all, a total of 200 asymptomatic pregnant women with ages ranging from 15 to 46 years were randomly selected on an every other day basis within the periods of 8:00am to 12:00 noon. Pregnant women who were on antibiotic treatment two weeks prior to their initial visit, those who exhibited clinical signs and symptoms of urinary tract infection (UTI) and those at 38 weeks gestation or more were excluded from the study. Information on parity and stage of pregnancy was extracted from the antenatal folders of the pregnant women. Other information was obtained using a well structured questionnaire. All the pregnant women recruited into the study over the period agreed to a written informed consent.

Sampling and bacteriological analysis
Subjects were properly educated to collect clean catch midstream urine samples into wide-mouthed sterile capped containers after proper cleansing of the external genitalia. Urine samples were labelled and immediately sent to the laboratory in cold boxes and cultured on appropriate media.

Culture process
Urine samples were cultured using a standard loop calibrated to hold 0.01 ml of urine onto blood agar and Cysteine Lactose Electrolyte Deficient (CLED) agar. Inoculated plates were incubated at 37^{o}C aerobically overnight. After overnight incubation the plates were read and the growths were identified based on the growth characteristics on the inoculated media.

Colony counts
Colonies were counted on CLED and multiplied by the loop volume. A bacterial count of $1x10^5$ per ml was considered significant for UTI and counts of 10^2 – 10^4 per ml were considered as suspected/doubtful bacteriuria while counts less than 10^2 per ml were considered no significant bacterial growth.

Bacterial identification
Growths on the culture media were identified using their growth characteristics, Gram stain and biochemical and sugar fermentation tests. The biochemical tests used were: Indole test for lactose fermenting bacteria particularly Escherichia coli and Klebsiella and Coagulase test to differentiate *Staphylococcus aureus* from *Staphylococcus*.

Sensitivity tests
Antimicrobial susceptibility test were performed using Kirby-Bauer disc diffusion test. The isolates from this study were tested against the following antibiotics: Ampicillin (10µg), Cefuroxime (30µg), Cotrimoxazole (25µg), Gentamicin (10µg), Tetracycline (30µg), Nalidixic acid (30µg), Nitroforantoin (300µg) and pipemidic acid (20µg). Zone diameter was measured by Clinical Laboratory Standard Institute (CSLI).

RESULTS

Out of the 200 asymptomatic pregnant women sampled, 19 (9.5%) had colony counts of 10^5 colonies/mL or more (positive) with the highest prevalence of bacteriuria being observed in pregnant women within the 30 – 34 years age group (36.8%). This was followed by women within the 25 – 29 years (26.3%), then the 35 – 39 years age group (15.8%), 20 – 24 years age group (10.5%), 15 – 19 and 40 – 44 years age group respectively (5.3%) and the 45 – 49 years age group which recorded no case of bacteriuria. The prevalence of asymptomatic bacteriuria amongst the study participants stratified by age group and colony count from urine culture samples is shown in Table 1. Forty-eight (48) representing 24.0% of pregnant women had bacterial colony counts between 10^2 - 10^4 colonies/mL with the highest prevalence of 25.0% being observed in women within the 25 – 29 and 30 – 34 years age groups respectively. This was followed by the 35 – 39 years age group (20.8%), 20 – 24 years age group (12.5%), 15 – 19 years age group (10.4%) and 40 – 44 years age group. A total of 133 (51.5%) pregnant women had no bacteria growth in their urine samples.

Out of the 200 asymptomatic pregnant women sampled, 73 (36.5%) were within the first trimester of pregnancy with 4 (5.5%) testing positive for significant bacteriuria; 65 (32.5%) were in their second trimester of pregnancy and 10 (15.4%) tested positive for significant bacteriuria and 62 (31.0%) in their third trimester of pregnancy with 5 (8.1%) testing positive for significant bacteriuria. A total of 181 (90.5%) pregnant women comprising 69 (94.5%) in their first trimester, 55 (84.6%) in their second trimester and 57 (91.9%) in their third trimester showed no bacterial growth in their urine samples. A comparison of the occurrences of number of women with significant bacteria showed pregnant women in the second trimester having marginally significant likelihood of testing positive for significant ($\chi^2 = 3.70$; $p = 0.054$) bacteriuria when compared to pregnant women in the first trimester. A comparison of first trimester pregnant women with significant bacteriuria to third trimester pregnant women and then second trimester to third trimester showed significant differences (Table 2).

Table 3 shows the prevalence of asymptomatic bacteriuria in pregnant women sampled for the study based on parity. The pregnant women were classified as nulliparous and multiparous. Out of the 200, 35 (17.5%) were nulliparous with 3 (8.6%) testing positive for bacteriuria and 165 (82.5%) were multiparous and 16 (9.7%) of them tested positive for bacteriuria. A comparison of the frequencies of occurrences of pregnant women with significant bacteriuria when classified as nulliparous and multiparous showed no significant difference ($\chi^2 = 0.043$; $p = 0.8366$).

The prevalence of bacteria isolated from the 19 positive cases is shown in Figure 1. The prevalence of *Escherichia coli* was 36.8% (7/19) which ranked as the most prevalent isolated organism followed by *Klebsiella* spp. (26.3%), Staphylococcus aureus (21.1%) and other coliforms (15.8%).

DISCUSSION

The prevalence of asymptomatic bacteriuria among the pregnant women in this study was 9.5%. Varying prevalence rates of asymptomatic bacteriuria in pregnant women have been reported with Hazhir (2007) reporting

Table 1: Prevalence of asymptomatic bacteriuria in the study population based on age distribution

	CFU (colonies/mL)			
	10^5	10^2-10^4	$<10^2$	
Age group	Positive (%)	Suspected (%)	Negative (%)	Total
15 – 19	1 (5.3)	5 (10.4)	12 (9.0)	18 (9.0)
20 – 24	2 (10.5)	6 (12.5)	25 (18.8)	33 (16.5)
25 – 29	5 (26.3)	12 (25.0)	29(21.8)	46 (23.0)
30 – 34	7(36.8)	12 (25.0)	41 (30.7)	60 (30.0)
35 – 39	3 (15.8)	10 (20.8)	24(18.1)	37 (18.5)
40 – 44	1 (5.3)	3 (6.3)	1 (0.8)	5 (2.5)
45 – 49	0 (0.0)	0 (0.0)	1 (0.8)	1 (0.5)
Total	**19(9.5)**	**48 (24.0)**	**133 (51.5)**	**200**

Data are presented as proportions; CFU = Colony forming unit

Table 2: Prevalence of asymptomatic bacteriuria in the study population based on trimester

Trimester	No. of pregnant women	No. with significant bacteriuria	No. without significant bacteriuria
1	73 (36.5)	4 (5.5)	69 (94.5)
2	65 (32.5)	10 (15.4)[a]	55 (84.6)
3	62 (31.0)	5 (8.1)	57 (91.9)
Total	**200**	**19(9.5)**	**181 (90.5)**

Data are presented as proportions; [a](P = 0.054, χ^2 = 3.70) indicates the level of significance when Trimester one was compared to Trimester 2 (Chi-square test)

Table 3: Prevalence of asymptomatic bacteriuria in the study population based on parity

Parity	No. of pregnant women	No. with significant bacteriuria	No. without significant bacteriuria
Nulliparous	35 (17.5)	3 (8.6)	32 (91.4)
Multiparous*	165 (82.5)	16 (9.7)	149 (90.3)
Total	**200**	**19(9.5)**	**181(90.5)**

Multiparous = as used here was defined as a pregnant woman with at least an existing child; χ^2 = 0.043; P value = 0.8366

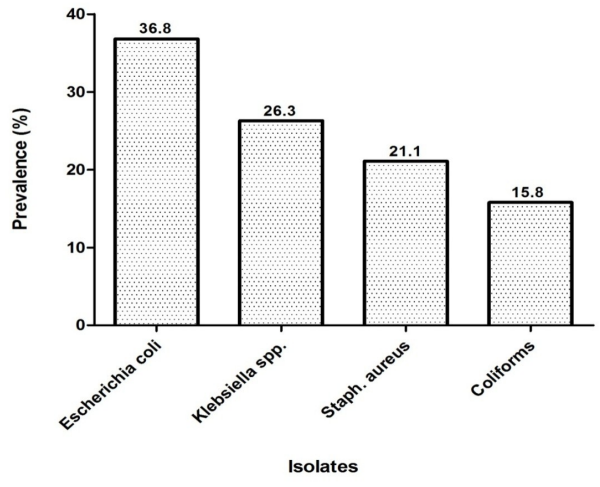

Figure 1: Prevalence of bacterial species isolated from cases of significant bacteriuria in pregnant women

a prevalence rate of 6.1%, Turpin *et al* (2007) reported a prevalence of 7.3%, Hernandez *et al* (2007) reported a prevalence of 8.4% and Tadesse (2007) reported a prevalence of 9.8%. Prevalence rates as low as 3.3% (Moghadas and Irajian, 2009) and 3.7% (Mobasheri *et al*., 2002) have been reported and rates as high as 22.2% (Famurewa, 1992) and 23.9% (Olusanya *et al*., 1993) have also been reported in separate studies. Bint and Hill (1994) in a study on bacteriuria in pregnancy reported that the prevalence of asymptomatic bacteriuria in pregnancy ranges from 4% to 7% depending on the population being studied.

The results of this study compares well with that of Tadesse (2007) but in relation to other determined rates affirms the findings which ascribed variations in prevalence to population characteristics such as age, parity, socio-economic status, sexual activity (multiple sexual partners) and health care during pregnancy (Wong and Stamm, 1983; Strom *et al*., 1987; Andriole and Patterson, 1991; Olusanya *et al*., 1993). There is therefore an impli-

cation that about 9.5% of pregnant women from this study are at risk of developing acute episodes and complications of UTI during pregnancy if they are not properly treated.

In analyzing the study respondents by age, the highest prevalence of asymptomatic bacteriuria was observed in pregnant women within 30 – 34 years age group followed by the 25 – 29 years age group and then the 35 – 39 years age group. Turpin *et al.,* (2007) reported a high prevalence of asymptomatic bacteriuria in pregnant women aged 35 – 39 years. Alghalibi *et al.,* (2007) reported a higher prevalence of UTI in pregnant women aged 21 – 25 years in their study. The observed trend of bacteriuria in this study and reports from other studies shows the age range of 25 – 39 years serving as a risk group for developing UTI in pregnant women.

By parity, pregnant women with at least an existing child (multiparous) had high prevalence of asymptomatic bacteriuria when compared to nulliparous women although the differences between the percentage occurrences were not statistically significant (p=0.251). These findings are however contrary to that of El Sheikh *et al.,* (1999) who in their study on characteristics of bacteriuria in pregnant women attending a teaching hospital in Sudan reported a decreased incidence of bacteriuria with age of patients and a significantly high bacteriuria in primigravidae than multigravidae. This finding, they suggested, to be attributable to the trauma caused by the movement of the penis in the vagina hence the increased prevalence of bacteriuria in young women and primigravidae as related in the study of Olusanya *et al.* (1993). The reason/s for the observed increase in bacteriuria among older pregnant women in this study can however not be readily explained from this study in the light of the absence of clinical data on signs and symptoms of UTI, history of sexual frequency and time of marriage.

This study further observed that pregnant women in the second trimester of pregnancy had the highest prevalence of asymptomatic bacteriuria followed by pregnant women in the third trimester of pregnancy which is in consonance with the findings of Alghalibi *et al.,*(2007) who in a study on bacterial urinary tract infection among pregnant women in Yemen reported the second and third trimesters of pregnancy as being associated with the highest prevalence of UTI. It is however contrary to the findings of Turpin *et al.,* (2007) who reported a high percentage of asymptomatic bacteriuria in the first and early second trimesters of pregnancy and attributed it to pregnant women reporting at the antenatal clinic for booking during these periods. This impression can however not be said to be same from the findings of this study in that it is evident that pregnant women report for booking within the first and second trimesters of pregnancy and continue with their scheduled antenatal visits until delivery thereby making it possible for this study to enrol most pregnant women within the third trimester of pregnancy.

The most common bacterial isolates from midstream urine samples of asymptomatic pregnant women enrolled in this study were *Escherichia coli* (36.8%) followed by *Klebsiella species* (26.3%). Rahman *et al.,* (1990) and Ahmed and Rashid, (1996) in separate studies also reported *E. coli* as being the commonest pathogen responsible for bacteriuria which is consistent with the findings of this study. Delzell and Lefevre, (2000), Colgan *et al.,* (2006), Turpin *et al.,* (2007), Hernandez *et al.,* (2007) and Hazhir (2007) have all reported *E. coli* as the dominant bacterial agent causing asymptomatic UTI. Mohammad *et al.,* (2002) suggested that the high risk of acquiring *E. coli* UTI is because of the anatomical and the functional changes that occur during pregnancy and the fact that *E. coli* is the most common micro-organism in the vaginal and rectal area. Shanson, (1989) and Delzell and Lefevre, (2000) reported that this significant finding could be due to the fact urinary stasis is common in pregnancy and since most *E. coli* strains and other bacteria prefer that environment, they are able to persist and cause UTI. Akram *et al.,* (2007) reported that the anatomical proximity of the anal and urogenital opening in females makes it possible for faecal contamination of the urinary tract from commensals of the bowel of which *E. coli* is a typical example.

The antibiotic sensitivity patterns from this study showed that most of the *E. coli* isolated were sensitive to nitrofurantoin and gentamicin. The choice of antibiotic should however be based on urine culture, stage of gestation, clinical data and the characteristics of the antibiotic. Although aggressive antibiotic treatment may be necessary to reduce the risk of pyelonephritis and other complications of asymptomatic bacteriuria in pregnancy, this should be done with caution as it known that urinary pathogens are becoming resistant to commonly used antibiotics which could be attributed to wide spread and indiscriminate use of the drugs (Okonko *et al.*, 2009).

CONCLUSION

This study showed that approximately 10% of the pregnant women recruited had asymptomatic bacteriuria. It is therefore imperative that pregnant women are

screened for bacteriuria periodically in every trimester of the gestational period. Talks on personal hygiene and cleanliness around the urogenital and anal area to prevent faecal contamination of the urinary tract should be emphasized during antenatal visits.

COMPETING INTERESTS

We declare that we have no competing interests.

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