

## **Prevalence of *Staphylococcus aureus* among Female Patients attending Rivers State University Teaching Hospital (RSUTH) in Port Harcourt, Nigeria**

### **ABSTRACT**

**Objectives:** To isolate, identify and determine the prevalence of *Staphylococcus aureus* among Female Patients attending Rivers State University Teaching Hospital in Port Harcourt using High Vaginal Swab samples.

**Methods:** A cross-sectional study was carried out on total of 103 female patients attending the outpatients department and Antenatal clinic of Rivers State University Teaching Hospital. High Vaginal Swab samples were aseptically collected from 55 non-pregnant and 48 six weeks postpartum women. These were then analysed in the Microbiology Laboratory of the Hospital, following standard microbiological procedures. Questions on age, number of sexual partners, knowledge of vaginal infection, symptomatic case, History of previous infection and treatments was responded to by each participant through the completing of questionnaires. Mannitol Salt Agar (MSA) was used for the isolation of the organism and their phenotypic traits were determined based on their cultural and biochemical characteristics.

**Results:** The study revealed that 25 (24.3%) consisting of 20 (36.4%) non-pregnant women and 5 (10.4%) Postpartum women were positive for *Staphylococcus aureus* infection. The prevalence of *S. aureus* among different groups was statistically significant, ( $P= .002$ ). The highest percentage of *S. aureus* isolation (36.4%) was found in non-pregnant population. Prevalence of *S. aureus* was found highest 10 (18.2%) in 21-25 age group among non-pregnant women and none in 26-30 age group among postpartum women. Data obtained from the questionnaires returned showed that 10 (40%) that tested positive for the organism were asymptomatic as at the time of sample collection, had history of previous reproductive tract infection and had previously undergone treatment.

**Conclusion:** The high rate of vaginal *Staphylococcal* colonisation observed and the positive correlation between *Staphylococcus aureus* prevalence and age, Child delivery status as well as treatment of previous reproductive tract infection seen in the study suggests the need for awareness on the importance of personal hygiene, proper antibiotic usage and regular screening of females within reproductive age.

**KEYWORDS:** Prevalence, *Staphylococcus aureus*, Female Patients, Port Harcourt.

## 1.0 INTRODUCTION

*Staphylococcus aureus* is a major contributor to most reproductive and obstetric disorders (Sulagna *et al.*, 2020). It is the most pathogenic *Staphylococci* species that is responsible for divers' disease conditions such as food poisoning, boils, septicemia, pustules, soft tissue infections, urinary tract infections (UTIs), impetigo, osteomyelitis, mastitis, meningitis, bronchopneumonia and wound infections, in both immunocompromised hospitalized persons and healthy immuno-competent people (Tong *et al.*, 2015). *Staphylococcus aureus* has been shown to frequently colonize the vagina of females of reproductive age, specifically 11-60 years (Mumtaz *et al.*, 2008). A major cause of aerobic vaginitis, a type of bacterial vaginosis, is *S. aureus*, along with *Ureaplasma urealyticum*, *Mycoplasma hominis*, *E. coli*, and *Pseudomonas* species (Wondamagegn, *et al.*, 2015; Abdelaziz *et al.*, 2014). Worldwide, between 5 and 10 million women seek gynecologic assistance for vaginitis each year (Donder *et al.*, 2002). Since, bacterial vaginosis is seen as a moderate, non-life-threatening condition, it has been handled lightly over the years. However, it is a morbid condition that makes it easier to contract and spread a variety of STIs, including gonorrhoea, trichomoniasis, herpes simplex virus type 2 (HSV-2) and Human Immunodeficiency Virus (HIV) (Myer *et al.*, 2005). Other complications has also resulted from bacterial vaginosis, these include; miscarriage, preterm labour, preterm delivery, and postpartum endometritis (Hay *et al.*, 1994; CDC, 2006). As an opportunist organism, *S. aureus* can enter the tissue by breaking through the skin and mucous membrane barriers via traumatic inoculation causing a local abscess lesion, and then spread to the blood stream resulting in septicaemia (Thomer *et al.*, 2016). *Staphylococcus aureus* is also capable of producing extracellular toxins such as exfoliative toxins A and B, toxic shock syndrome toxin-1 (TSST-1), and enterotoxins A to E (Mehrotra *et al.*, 2000). By producing toxins, it can cause life-threatening complications like toxic shock syndrome in menstruating women especially in those who use tampons. Studies conducted in 1980–1981 found that 25–40% of *S. aureus* strains produce Toxic Shock Syndrome Toxin 1 (TSST-1) and that 10-15% of women has vagina *S. aureus* colonization (Schlievert *et al.*, 2007). This study therefore, is intended to evaluate the spread of *Staphylococcus aureus* among women of reproductive age in Port Harcourt, Nigeria.

## 2.0 METHODS

### 2.1 Description of Study Area

The study was conducted at the Rivers State University Teaching Hospital (RSUTH) in Port Harcourt Local Government Area of Rivers State, Nigeria. RSUTH formerly known as Braithwaite Memorial Specialist Hospital (BMSH) is situated at Port Harcourt, the capital of Rivers State which is the largest Local Government Area of the State in terms of population (National Bureau of Statistics, 2010). It is one of the major Hospitals in Port Harcourt city that is frequently patronised by the Rivers people.

### 2.2 Study Population

The group of interest in the study were female patients above fourteen years of age attending Outpatients department and Antenatal Clinic of the Hospital.

**2.3 Inclusion Criteria:** Only Female patients within the required age group, not on any antibiotics and accept by signing the informed consent form to participate in the study are included.

Comment [A2]: ?

Comment [A3]: were

**2.4 Exclusion Criteria:** Women below Fourteen years of age that are on any antibiotics and decline to participate in the study are not included.

Comment [A4]: ?

Comment [A5]: were

### 2.5 Sample Size Determination

Using the Cochran formula ( $n = Z^2 * p(1-p) / d^2$ ), the sample size of 103 was determined (Chanuan *et al.*, 2021).

Where,

n= Sample size

Z=Z-score (1.96)

P=Estimated proportion of the population

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d=Margin of error (5%)

### 2.6 Specimen Collection

From the hospital's appropriate board, ethical permission was obtained. Consent of participant was sorted for through the signing of consent form. Collection procedure was explained and

Comment [A7]: by signing in consent form

self-administrable vaginal swab sticks along with questionnaires having an assigned unique reference code were given to each participant for the collection of high vaginal swab sample and vital information. Samples were properly labelled with same code on each participant questionnaire and then transported to the Microbiology laboratory of the Hospital.

## 2.7 Isolation of Organism

High vaginal Swab samples were inoculated onto Mannitol salt agar medium using streak plate method, inverted and incubated at 37°C for 24 hours (Cheesbough, 2000).

**Comment [A8]:** and incubated in inverted position

## 2.8 Characterisation of *Staphylococcus aureus* Isolates

Isolates were characterised based on their cultural morphology, Gram stain and biochemical properties. Automated Biometric Identification System (ABIS) online software for bacterial identification was referenced as a standard for bacteria morphological identification. Morphological examination was carried out on Mannitol salt agar media used for isolation of the organism. Isolates were sub-cultured based on colony size, elevation, colour, shape and texture to obtain pure isolates. Gram stain and Biochemical test such as Coagulase, Catalase, Haemolysis and Sugar Fermentation tests were carried out to characterised and identify organism as described by Cheesbough, (2000).

**Comment [A9]:** morphological identification of bacteria

## 2.9 Haemolysis Test

Isolates from pure cultures were inoculated onto blood agar plates, inverted and incubated at 37°C for 24 hours. Plates were then observed for any colouration around colonies. Yellow colouration around colonies indicates partial haemolysis ( $\beta$ -haemolysis), green colouration indicates complete haemolysis ( $\alpha$ -haemolysis) and no colouration around colonies indicates no haemolysis ( $\gamma$ -haemolysis) (Cheesbrough, 2000).

**Comment [A10]:** and incubated in inverted position

**Comment [A11]:** Yellow colouration around colonies indicates complete haemolysis ( $\beta$ -haemolysis), green colouration indicates partial haemolysis ( $\alpha$ -haemolysis)

## 2.10 Data Analysis

Data was analyzed using the Statistical Package for the Social Sciences (SPSS) software. Descriptive statistics for tabulation and graphical display were used to summarize the data. The measure of association was determined using chi-square test. Analysis of variance (ANOVA) was used to determine whether there was a significant relationship ( $p \leq 0.05$ ) between variables and *Staphylococcus aureus* prevalence.

### 3.0 RESULTS

#### 3.1 Distribution of Participants

The study included 103 women in total. 55 (53.4%) were non-pregnant women while 48 (46.6%) were six weeks postpartum women as shown in Figure 1. The highest numbers of participant were within 21-25 age group while the lowest was within 26-30 age group and above 36 years age group. Non-pregnant women participated more in the study than postpartum women (Table 1).

**Comment [A12]:** A total of 103 women which include 55 (53.4%) non-pregnant women and 48 (46.6%) six weeks postpartum women as shown in Figure 1 were included in the present study.

**Comment [A13]:** lowest in 15-20 age group

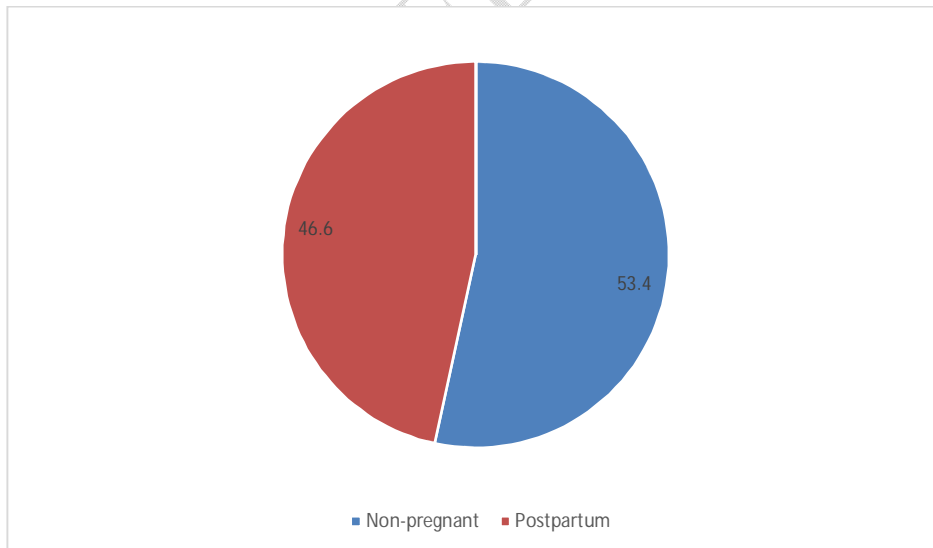
#### 3.2 Prevalence of *Staphylococcus aureus* among Study Population

Of the 25 (24.3%) that tested positive for *S. aureus*, 20 (36.4%) were non-pregnant women while 5 (10.4%) were Postpartum women as shown in figure 2.

**Comment [A14]:** Out of a total 103 women sample tested, 25 (24.3%) were found positive for *S. aureus* which included 20 (36.4%) non-pregnant women while 5 (10.4%) postpartum women samples as shown in figure 2.

*S. aureus* prevalence was found to be highest 10 (18.2%) in women within 21-25 age group and lowest in women of 36 years and above among non-pregnant population while among postpartum population the prevalent rate was found highest 2 (4.2%) within 31-35 age group and none in 26-30 age group (Figure 3). The analysis of the questionnaires returned is presented in Table 1-4.

**Comment [A15]:** Among non-pregnant women population, the highest prevalence of 18.2 per cent was recorded within 21-25 age group whereas lowest prevalence rate of 1.8 per cent was observed in each 31-35 age group and >35 age group. Among postpartum population, the highest prevalence rate of 4.2 per cent was found in each 31-35 age and > 35 age group while none of the sample tested found positive in 15-20 and 26-30 age group. The details are depicted in Figure 3.



**Figure 1: Number of non-pregnant and postpartum women involved in the study (%)**

**Table 1: Age group of Non-pregnant and postpartum women studied**

Age Group (In Years)	Non-pregnant n (%)	Postpartum n (%)	Overall n (%)
15-20	13 (23.4)	0 (0)	13 (12.6)
21-25	31 (56.4)	4 (8.3)	35 (34.0)
26-30	8 (14.5)	10 (20.8)	18 (17.5)
31-35	2 (3.6)	17 (35.4)	19 (18.4)
≥ 36	1 (1.8)	17 (35.4)	18 (17.5)

**Table 2: Marital status of Non-pregnant and postpartum women studied**

Marital status	Non-pregnant	Postpartum
Single	52 (94.5)	3 (6.25)
Married	3 (12)	45 (93.8)
Separated	-	-

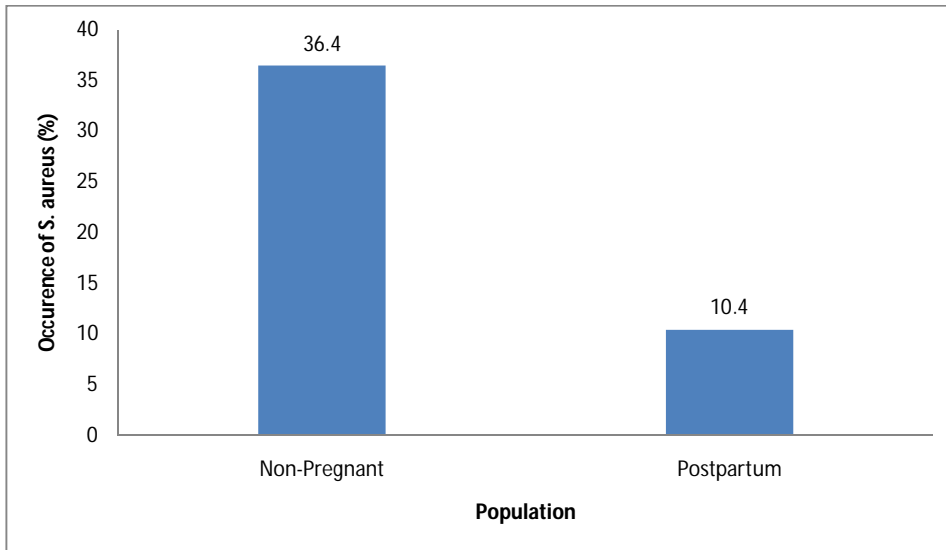
**Table 3: Number of sexual partners of Non-pregnant and postpartum women studied**

Number of Sexual partners	Non-pregnant	Postpartum
None	8 (14.5)	-
1	39 (70.9)	48 (100)
2	4 (7.3)	-
Multiple	1 (1.8)	-
Not applicable	3 (5.5)	-

**Table 4: Other data of Non-pregnant and postpartum women studied**

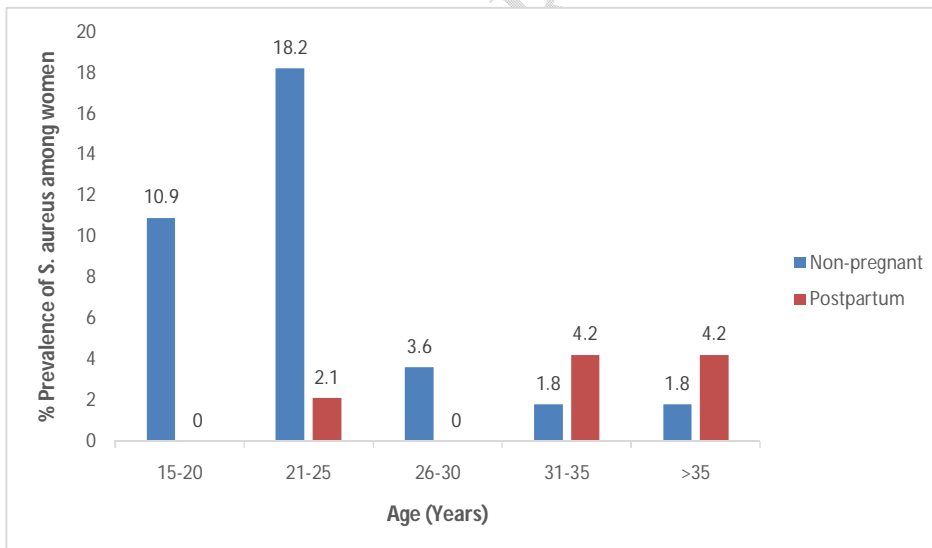
Variables	Non- pregnant			Postpartum			P- value
	Yes n (%)	No n (%)	Not applicable n (%)	Yes n (%)	No n (%)	Not applicable n (%)	
<b>Knowledge</b>	44 (80)	11 (20)	-	38 (79.2)	10 (20.8)	-	.236
<b>Symptomatic Cases</b>	33 (60)	15 (27.2)	7 (12.7)	11 (22.9)	32 (66.7)	5 (10.4)	.883
<b>History of Previous Infection</b>	19 (34.5)	35 (63.6)	1 (1.8)	10 (20.8)	37 (77)	1 (2.8)	.133
<b>Treatment</b>	18 (32.7)	1 (1.8)	36 (65.5)	8 (16.7)	-	40 (83.3)	.052*
<b>Regular Screening</b>	3 (5.5)	52 (94.5)	-	2 (4.2)	46 (95.8)	-	

\*Correlation is significant at the .05 level



*P*- Value = .002 ( $P \leq .05$ )

**Figure 2: Frequency of *S. aureus* in Non-pregnant and Postpartum women (%) studied**



*P*- Value = .040 ( $P \leq .05$ )

**Figure 3: Prevalence of *S. aureus* in Non-pregnant and Postpartum women according to age group**

#### 4.0 DISCUSSION

Reproductive tract infection in women is a major cause of concern to public health as cases of infertility, pregnancy complications, newborn abnormalities and increased spread of sexually transmitted diseases (STD's) has often been associated with it (Robert *et al.*, 2005; Donati *et al.*, 2010). The analyses identify the prevalence of *Staphylococcus aureus* in women of the study area as 24.3%. This observation is similar to 20% reported by Maidawa *et al.*, (2021) from some hospitals within Kaduna metropolis, Northwest of Nigeria but much lower than that (57.3%) recorded by Mahdieh *et al.*, (2014) from Qom City in Iran and 58.7% reported in female from Yenagoa, Bayelsa in Nigeria (Adebola and Godwin, 2012). This demonstrates that results from various nations and cities exhibit significant geographical diversity which can be attributed to factors such as level of knowledge of the infection, cultural practices (Marriage type), sexual behaviour and hygienic standard of the people amongst others (Kurewa *et al.*, 2010). The high level of knowledge of the infection (77.6%) seen in the research area can also be a contributing factor to the low prevalence of *Staphylococcus aureus* observed when compared to other previous findings (Mahdieh *et al.*, 2014; Adebola and Godwin, 2012).

Non-pregnant women show a higher rate of *Staphylococcus aureus* colonisation than postpartum women as revealed by the study. Similar findings also have reported a high isolation rate of *Staphylococcus aureus* in Non-pregnant women than in pregnant women attending a tertiary Hospital in Port Harcourt (Stanley *et al.*, 2013). There was significant difference in the prevalence of *Staphylococcus aureus* between Non-pregnant women and postpartum women ( $P= .002$ ). This difference might be as a result of routine prophylactic antibiotics administered after delivery which reduces maternal infectious morbidity (Bonet *et al.*, 2017).

The observed variations in isolation rates across the different age groups were statistically significant ( $P= .040$ ). A high occurrence of *S. aureus* was seen in women within 21-25 age group. This is in agreement with the findings Adebola and Godwin, (2012) who recorded high prevalence of *S. aureus* in women within 21-30 years of age. One might infer that these are the age ranges for both sexual activity and child bearing.

Data collated from the study also revealed that majority of women in this region rarely go for reproductive tract screening. This might have contributed to the high prevalence of the infection. The correlation of *Staphylococcus aureus* presence and treatment of previous

**Comment [A16]:** Similarly a high isolation rate of *Staphylococcus aureus* in Non-pregnant women than in pregnant women attending a tertiary Hospital in Port Harcourt have also been reported

reproductive tract infections disclosed by the study shows an indiscriminate use of antibiotics in this region arising from self medication which is frequently linked to insufficient dosage and noncompliance with therapy, as well as the accessibility of antibiotics to consumers over the counter with or without a prescription (James *et al.*, 2017). Sexual involvement with more than one individual has long been established as a predisposing factor for reproductive tract infections (Oliveira *et al.*, 2007). The study shows that 9.2% of the women precisely non-pregnant women had more than one sexual partners and majority of the singles are actively involved in sexual activity with partner(s) whose sexual faithfulness is questionable.

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The present study shows no significant correlation between symptomatic cases and prevalence of *Staphylococcus aureus*. However, a high percentage of women that tested positive for the infection were asymptomatic as at the time of sample collection. This suggests that healthy individual can serve as a carrier and disseminator of this infection (Ehinmidu, 2003). Therefore, the need for regular *Staphylococcal* infection screening is of necessity.

## CONCLUSION

In view of the outcome of the study, it can be concluded that females within reproductive ages are most vulnerable to *Staphylococcal* infection. The correlation of *Staphylococcus aureus* prevalence and treatment of previous reproductive tract infection seen in the study suggest that regular *Staphylococcal* screening of women should be greatly encouraged and *Staphylococcal* antibiotic resistance Surveillance should be reviewed.

Comment [A18]: small

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