

# Prevalence of *Staphylococcus aureus* in Clinical Specimens and its Antibiotic Susceptibility Profile

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## Abstract

Of the 200 clinical specimens comprising of blood (86), urine (101) and wound swabs (13) screened, *Staphylococcus aureus* was found to be present in 15 blood specimens, 63 urine specimens and 10 wound swabs specimens representing a prevalence value of 17.4%, 62.4% and 79.6%, respectively. Based on gender of the study subjects, *Staphylococcus aureus* was found to be more prevalent in female study subjects (60.2%) than in male subjects (26.8%) whereas based on age range, it was found that the *Staphylococcus aureus* was most prevalent in specimens obtained from subject aged between 21 – 30 years, this was followed by subjects aged between 31 – 40 years while subjects aged 51 and above had the least prevalence. The result of the antibiotics susceptibility profile revealed that the isolates from the urine, blood and wound swabs were susceptible to Ciprofloxacin (82.5%, 86.7% and 90%), Trimethoprim (80.9%, 80% and 70%), Penicillin (98.4%, 100%, 90%) and Augmetrin (96.8%, 86.7% and 80%) respectively.

**Keywords:** *Staphylococcus aureus*, prevalence, Wound swabs, Urine, Blood specimens, Susceptibility profile

## 1.1 Introduction

*Staphylococcus aureus* is a facultative anaerobic, Gram-positive coccus, which appears as grape-like clusters when viewed through a microscope and has large, round, golden-yellow colonies, often with hemolysis, when grown on blood agar plates (Ryan and Ray, 2004). They are endogenous microflora colonizing the nasal cavities, skin, gastrointestinal, anuses and vaginal vaults of healthy individuals. Its ability to convert hydrogen peroxide to water and oxygen distinguishes it from enterococci and streptococci. Generally, *S. aureus* produces coagulase, an enzyme that causes clot formation and enhances its pathogenicity. Other *Staphylococcus* species are coagulase-negative (Ryan and Ray, 2004). *S. aureus* is recognized as one of the most important bacteria pathogen seriously contributing to the problems of hospital and community-acquired infections all over the world (Emmerson, 1994; Lowy, 2003). The pathogen have been associated with various types of diseases and infection ranging from minor skin to soft tissue infections including immune-compromised patients due to its ability to survive in different growth conditions (Lowy, 1998; Lowy, 2003).

Other infections and clinical conditions such as burns, wound sepsis, pustules, carbuncles, furuncles and impetigo, septicemia, bacteremia, osteomyelitis and otitis have also been attributed to be caused by the pathogen (Emmerson, 1994; Prescott, John and Donald, 2008; Ryan and Ray, 2004). This study was designed to investigate the prevalence of *S. aureus* in various clinical specimens handled in University of Uyo Health center and its antibiotic susceptibility profile.

## 2.0 Materials and Method

### 2.1 Sample collection

Following informed consent and standard procedures, a total of two hundred (200) clinical specimens comprising of hundred and one (101) urine samples, thirteen (13) wound swabs and eighty six (86) blood specimens were obtained from patients at the University of Uyo Health center. Wound specimens were collected prior to dressing. The specimens collected were labeled with the age range and gender of the study subjects before transported to Microbiology Laboratory for analysis.

### 2.2 Preparation of media

The media used for the work were (NA) Nutrient Agar, MacConkey Agar (M/A) and Mannitol Salt Agar (MSA). The media were prepared according to manufacturer's instruction and sterilized by autoclaving at 121°C for 15mins

### 2.3 Isolation and identification of bacteria

The specimens were streaked on the surface of solidified NA, MA and MSA plates and incubated aerobically for 24 hours at 37° C. The culture plates were examined for significant growth and fermentation of monitors indicated by colour change of the medium around each colony from red to yellow. Isolates were also subcultured on sterile NA plates to obtain pure colonies. The pure colonies obtained were subjected to morphological and biochemical characterization to identify the isolates.

## 2.4 Characterization and Identification of the Bacteria Isolates

The bacterial isolates were characterized based on their morphological, biochemical and fermentative characteristics as described by Chessbrough, (2006). The obtained characteristics were compared with those given by Barrow and Feltham (2003a); Barrow and Feltham, (2003b) for identification.

## 2.5 Antibiotics Susceptibility Test

The antibiotics resistance pattern of the isolates was determined against seven commercial antibiotics. A sterile wire loop was used to touch three well isolated colonies of each isolates on agar plate and emulsified in 4ml of nutrient broth. The broth culture was incubated for few hours until it became slightly turbid and the turbidity of each suspension was then matched to standard turbidity (0.5 McFarland standards). A sterile cotton swab was dipped into the standardized bacterial test suspension and evenly inoculated on the entire surface of a sterile dry solidified agar plate. Excess fluid was removed by pressing and rotating the swab against the side of the tube above the

level of the suspension before inoculation. After inoculation, the surface of the agar was dried for 5minutes with the petri dish lid in place after which the appropriate antibiotic disks, which have been allowed to attain room temperature about 1hour before use were aseptically placed evenly on each inoculated plates with sterilized forceps. Each disk was firmly pressed to ensure its constant with the agar surface. The plates were allowed for 30 minutes after applying the disks after which it was inverted and incubated aerobically at 37° C for 24 hours. *S. aureus* plate with no antibiotic disc inoculated was used as control. This procedure was repeated for each of the isolates. After 24 hours incubation, zones of inhibition exhibited by each isolate against tested antibiotics were measured and recorded in millimeter. These were then interpreted as either susceptible or resistant depending on the diameter of the halo (Cheesbrough, 2006; CLSI, 2007).

## 3.0 Results and Discussion

The results of the morphological and biochemical characteristics of *Staphylococcus aureus* isolated from the various clinical specimens is as given in Table I below

**Table I:** Morphological and biochemical characteristics of *Staphylococcus aureus* isolated from clinical samples.

Test	Shape	GS	Cat	Coa	U	MR	VP	G	M	L	S
Observation	Spherical in Clusters	+	+	+	+	+	-	A	A	A	A

Key: GS, Grams Staining; Cat, Catalase; Coa, Coagulase; U, Urease; MR, Methyl Red; VP, Vogues Proskauer; G, Glucose; M, Mannitol; L, Lactose; S, Sucrose; “+”; Positive; “-”; Negative; A: Acid

Analysis of gender prevalence of *S. aureus* in the clinical specimens collected showed that of the two hundred (200) samples collected, *S. aureus* was associated with 88 (44%). *S. aureus* was associated with 8(14.8%) out of 54 and 7(21.9%) out of 32 blood samples collected from male and female subjects respectively. 15 (39.5%) out of 38 and 48

(76.2%) out of 63 urine samples collected from male and female subjects respectively also showed association with *S. aureus* whereas 3 (60%) out of 5 and 7 (87.5%) out of 8 wound swabs collected showed association with *S. aureus*. A summary of this resulted is given in Table 2 below.

**Table2:** Prevalence of *Staphylococcus aureus* in Clinical Specimens in relation to Gender

Clinical Specimens	Total No Obtained (n=200)		No (%) Positive 44 (88)		Total Positive (%)
	M	F	M	F	
Blood	54	32	8(14.8)	7(21.9)	15(17.4)
Urine	38	63	15(39.5)	48(76.2)	63(62.4)
Wound swabs	5	8	3(60)	7(87.5)	10(76.9)

The distribution of the clinical specimens collected based on the age range and gender of the study subjects shows that the study subjects comprised of 97 male and 103 female. The highest number of clinical specimens (99) was collected from study subjects aged between 21 – 30years,

this was followed by the subjects aged between 31 – 40 years (43) while the least number of specimens (11) was collected from subjects aged 51years and above. Of this, the study subjects comprised of 103 female and 97 male. A summary of this is given in Table 3 below

**Table3:** Age and Gender Distribution of Specimens Collected

Age Range (Yrs)	Blood		Urine		Wound swab	
	Male No (%)	Female No (%)	Male No (%)	Female No (%)	Male No (%)	Female No (%)
10-20	6(11.1)	2(6.25)	6(15.8)	10(15.9)	1(20)	2(25)
21-30	32(59.3)	16(50)	18(47.4)	29(46.0)	3(6.0)	1(12.5)
31-40	8(14.8)	10(31.3)	7(18.4)	16(25.4)	0(0)	2(25)
41-50	5(9.3)	1(3.1)	5(13.2)	5(7.9)	1(20)	3(37.5)
≥ 51	3(5.6)	3(9.4)	2(5.3)	3(4.8)	0(0)	0(0)
Total	54(62.8)	32(37.2)	38(37.6)	63(62.4)	5(38.5)	8(61.5)

The prevalence of *Staphylococcus aureus* based on age and gender of study subjects shows that persons aged between 41 – 50 years had the highest prevalence rate of 55% (11/20 x100), this was followed by persons aged between

31 – 40 years with prevalence rate of 51.2% (22/43 x 100) while persons aged 51 years and above had the least prevalence rate of 36.4% (4/11 x 100). A summary of this is given in Table 4 below

**Table 4:** Prevalence of *Staphylococcus aureus* based on Age and Gender of Subjects

Age Range (Yrs)	Blood		Urine		Wound	
	Male No(%)	Female No(%)	Male No(%)	Female No(%)	Male No(%)	Female No(%)
10-20	1(12.5)	1(14.3)	2(13.3)	6(12.5)	0(0)	1(14.3)
21-30	4(50)	3(42.8)	6(40)	24(50)	2(66.7)	1(14.3)
31-40	2(25)	1(14.3)	4(26.7)	13(27.1)	0(0)	2(28.6)
41-50	1(12.5)	1(14.3)	2(13.3)	3(6.25)	1(33.3)	3(42.8)
≥ 51	0(0)	1(14.3)	1(6.7)	2(4.2)	0(0)	0(0)
Total	8(100)	7(100)	15(100)	48(100)	3(100)	7(100)

The antibiotic susceptibility profile of the isolated showed that 61(96.8%), 12 (80%) and 6 (60%) of the *Staphylococcus aureus* isolated from the urine, blood and wound swab specimens were resistant to Ampicillin. 60 (95.2%), 10 (66.7%) and 6 (60%) of the isolates from urine, blood and wound swab respectively were also seen with Tetracycline antibiotics. Whereas, 62 (98.4%), 10 (100%)

and 9 (90%) of the isolates from urine, blood and wound swab respectively were sensitive to penicillin. Augmentin also had a high level of antibacterial effects on the isolates as 61 (96.8%), 13 (86.7%) and 8 (80%) of the isolates obtained from urine, blood and wound swabs respectively were sensitive to Augmentin. A summary of this result is given in the Table below

**Table 5:** Antibiotic Susceptibility Profile of *Staphylococcus aureus* isolated from the Clinical Specimens

Antibiotics	Urine (n=63)		Blood (n=15)		Wound Swab (n=10)	
	No(%) of <i>S. aureus</i>		No (%) of <i>S. aureus</i>		No (%) of <i>S. aureus</i>	
	R	S	R	S	R	S
Tetracycline	60(95.2)	3(4.8)	10(66.7)	5(33.3)	6(60)	4(40)
Gentamycin	23(36.5)	40(63.5)	13(86.7)	2(13.3)	3(30)	7(70)
Ciprofloxacin	11(17.5)	52(82.5)	2(13.3)	13(86.7)	1(10)	9(90)
Trimethoprim	12(19)	51(80.9)	3(20)	12(80)	3(30)	7(70)
Co-trimoxazole	55(87.3)	8(12.7)	12(80)	3(20)	9(90)	1(10)
Penicillin	1(1.6)	62(98.4)	0(0)	15(100)	1(10)	9(90)
Augmentin	2(3.2)	61(96.8)	2(13.3)	13(86.7)	2(20)	8(80)
Ampicillin	61(96.8)	2(3.2)	12(80)	3(20)	6(60)	4(40)

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The result of the antibiotic susceptibility profile of the *Staphylococcus aureus* isolated in this study showed that, the isolates were highly resistant to Ampicillin (96.8%, 80% and 60%) and Tetracycline (95.2%, 66.7% and 60%) for urine, blood and wound swab respectively. This tends to agree with the findings of Weems *et al* (2001) who reported that *Staphylococcus aureus* strains resistant to most beta-lactam antibiotics. The high resistance observed in ampicillin is also in agreement with the reports by Chigbu and Ezeronye (2003) who reported that a high number of Hospital acquired *S. aureus* were resistant to Ampicillin. Of the isolates screened, 62 (98.4%), 10 (100%) and 9 (90%) of the isolates from urine, blood and wound swab respectively were sensitive to penicillin. Augmentin also had a high level of antibacterial effects on the isolates as 61 (96.8%), 13 (86.7%) and 8 (80%) of the isolates obtained from urine, blood and wound swabs respectively were sensitive to Augmentin.

#### 4.0 Conclusion and Recommendation

The result of this study have provided information on the prevalence *Staphylococcus aureus* in clinical specimens obtained from University of Uyo Health center and its antibiotic susceptibility profile. Apart from this, it has also provided data on the age and gender prevalence of *Staphylococcus aureus* with respect to the clinical specimens obtained from the health center. Based on the result of this study, it is therefore important to adhere to and maintain hygienic and aseptic protocols while handling clinical specimen as much as overuse and abuse of antibiotics should be discouraged as this increases the chances of the pathogen acquiring resistant to such drugs.

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