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Gender and Age Variation on the Prevalence of Staphylococcus Species from Clinical Isolates in Esan Land, Nigeria

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Abstract

This study examines the effect of gender and age differences on the distribution of *Staphylococcus species* (*S.* spp) among in and out patients of 3 health facilities in Esan, Nigeria. In a bid to achieve this objective, 863mid-stream urine of patients attending the Irrua Specialist Teaching Hospital, Irrua, Gilead Hospital Center, Ekpoma and Calvary Medical Centre, Ekpoma, were assessed for staphylococcus infection. The samples were retrospective specimens from male and female (15 to 60+years) during January and December, 2013. The results showed 406 samples (47.05%) were positive for *Staphylococcus* species isolates made up of 59.11% males and 40.89% females. *S. aureus* counted for 81.53% while *S. saprophyticus* and *S. epidermidis* accounted for 16.50% and 1.97% respectively. All the age groups were positive for S. aureus while ages ranging from 25 to 44 years were only positive for S. epidermidis in both gender. However, male within ages 55 and above and female between ages 50 and 54 were negative for S. saprophyticus. This study showed that there are age and gender variations in the distribution of *Staphylococcus spp* and that these factors could be considerable risk factors *Staphylococcus* infection treatments.

Keywords

Age, Gender, Staphylococcus Species, Esan

1. Introduction

Urinary tract infections (UTIs) are among the most frequent bacterial infections worldwide [1-3]. In 2000, according to the Urologic Diseases in America Project, UTIs accounted for more than 8 million office and 1.7 million emergency room visits, leading to around 350000 hospitalizations [4]. Although women, particularly those aged 16–64 years, are significantly more likely to experience UTIs than men [5], urinary infections frequently occur in both genders and across all age groups [4, 5].

Microbial etiology of UTIs has been regarded as well established, with E. coli being the causative pathogen in 50–80% of cases [6, 7]; other Enterobacteriaceae (Klebsiella, Proteus, Enterobacter) together with Enterococci, Streptococci, Staphylococci, and Pseudomonas spp. account for most of the remaining positive urine cultures [6]. Today other bacteria, such as *Staphylococcus* spp. can cause UTI infections, which are gradually increasing [8]. Species, such as *Staphylococcus aureus*, *Staphylococcus saprophyticus* and *Staphylococcus epidermidis* cause urinary tract infection mostly in young women and old men and rarely in children [8-11]. *Staphylococcus aureus* is the main cause of UTIs

among inpatients and also is the second cause of common infection among outpatients [12]. These bacteria are also cause of nosocomial pneumonia and are the second reason for septicemia throughout the world [13].

The importance of *Staphylococcus* spp. is not only because of its pathogenicity but these species show high resistance in the treatment of UTIs [14, 15]. Hence, considering the situation of this pathogenic agents and evaluating its risk factors in the different age and gender are of great importance. Both in community and hospital settings, UTIsare among the most common bacterial infections which occur in all age groups and in both genders [16, 17]. Seasonal variations and gender are known to affect the prevalence of a number of infections [17-19]. This study aimed to examine gender and age differences on the distribution of *Staphylococcus species* among adults in Esan, Nigeria.

2. Materials and Methods

This study was a simple random sampling carried out on both in-patients and out-patients of Irrua Specialist Teaching Hospital (I. S. T. H), Irrua, Esan Central Local Government Area, Gilead Hospital, Ekpoma and Calvary Medical Centre, Ekpoma, both in Esan West Local Government Area, in Edo State, Nigeria. Samples were obtained between January and December 2013. Verbal informed consent was obtained from subjects and permission and approval to carry out the study was obtained from Health Research Ethics Committee of the Ambrose Alli University, Ekpoma

A total of 863subjects gave consent and were included. The specimens obtained from these subjects included urine and high vaginal swab, semen in some cohorts and urine specimens which were mid-stream urine (MSU); catheter specimens (from ambulatory patients). Specimens were sent to the medical microbiology laboratory for analysis immediately after collection.

The method for the urine samples processing is as documented by a previously published article by Momoh et al. [20].

The organisms from various specimens were isolated using nutrient agar and *Staphylococcus* species identification was as reported by Momoh et al. [20].

Derived data were analysed via simple descriptive statistics of frequencies and percentages using SPSS (version 17) and the results presented in tables.

3. Results and Discussion

The criteria for identifying the various *Staphylococcus* species is shown in table 1. All the isolated staphy species were positive for catalase, clumping factor, and fibrinogen. *S. aureus* was additional positive to coagulase, staphyloslide, novobiocin mannitol reaction and DNASE but beta in blood agar hemolysis and a golden yellow in colour on nutrient agar. On the other hand, *S. epidermidis* was white on nutrient agar sensitive with novobiocin mannitol reaction and negative to both coagulase and staphyloslide. *S. saprophyticus* was negative to both coagulase and staphyloslide and white-yellow to nutrient agar but resistant to both novobiocin mannitol and desferrioxamine reactions.

Table 1. *Criteria for staphylococcus species differentiation.*

IdentificationCriteria	ISOLATES		
	***Staphylococcus aureus* (n=331)**	***Staphylococcus epidermidis* (n=8)**	***Staphylococcus saprophyticus* (n=67)**
Catalase	+	+	+
Coagulase	+	-	-
Staphyloslide	+	-	-
Colour differences (Nutrient agar)	Gold-yellow	White	White-yellow
Hemolysis on Blood agar	Beta	None	None
Reaction to Novobiocin Mannitol	SensitiveYellow (+)	SensitiveRed (-)	ResistantPinkish Red (+/-)
Reaction to Desferrioxamine	Resistant	Sensitive	Resistant
DNASE	Positive (Clear Halo Region)	Negative (Heavy Growth)	Weakly Positive (Halo not distinct)
Clumping factor/Protein A	+	+/- (weakly positive)	+
Fibrinogen	+	+/- (weakly positive)	+

Key: + = Positive, - = Negative

Table 2 shows the S*taphylococcus* species isolates distribution based on gender. Overall, a total of 406 of the 862 samples studied were positive for S*taphylococcus*species infestation. The total prevalence of *Staphylococcus* infestation was 47.05% (table 2). The observed prevalence of *Staphylococcus* infestation in this study area is high compared to the 35.5% and 38.6% reported for Jos; North-central part of Nigeria [21] and Lagos; South-western Nigeria [22] respectively. Comparatively, a very lower prevalent has been documented for Ibadan in western Nigeria where Okesola and Oni [23] reported a prevalence of 22%. However, the observed prevalence of staphylococcus in this study is low compared to the 77.9% documented in Enugu; eastern Nigeria [24] and the 60% and 67.2% reported for Lafia [25] and Yola-Adamawa State [26] respectively; both in northern part of Nigeria. These differences in staphylococcus prevalence indicate variation in staphylococcus infection with the country and this assertion agrees the report by Snydman [27] and Savas et al. [28] that microorganisms and their resistance patterns vary from hospital to hospital and even from clinic to clinic in the same hospital.

Based on gender, the males to female prevalence was 55.68%vs. 38.43% (table 2). Odd ratio revealed that male population was 2.01 times more likely to present with S*taphylococcus* species infestation than female population

(table 2). In support of the observed higher prevalence of staphy infestation in male than in female in the present study, several other researchers have documented similar findings [27, 28]. In fact, Kolawale et al. [25] documented similar findings in a study among patients attending Dalhatu-Araf Specialist Hospital, in Lafia, Nasarawa State of Nigeria and Otajevwo et al. [29] reported same among out patients visiting a tertiary hospital based in Midwestern Nigeria.

Table 3 shows the S*taphylococcus* species isolates distribution based on age. The prevalence of S*taphylococcus*species infestation in the young was 60.31% as against 32.19% in the old adult. In fact, the odd ratio revealed that the young is 3.2 times more likely to present with S*taphylococcus* species infestation than the old (table 3). Not a lot of study has reported the distribution of S*taphylococcus* infestation according to age without gender grouping. In this study we discovered the younger adultshad higher prevalence of S*taphylococcus* infestation compared to the older adults.

Table 2. *Staphylococcus species distribution based on gender.*

	Positive	Negative	Total	Odd ratio
Male	240 (55.68%)	191 (44.32%)	431 (49.94%)	
Female	166 (38.43%)	266 (61.57%)	432 (50.06%)	2.01
Total	406 (47.05%)	457 (52.95%)	863	

Table 3. *Staphylococcus species distribution based on age.*

	Positive	Negative	Total	Odd ratio
Young adult (15-39 years)	275 (60.31%)	181 (39.69%)	456 (52.84%)	
Old adult (40-60 years+)	131 (32.19%)	276 (67.81%)	407 (47.16%)	3.20
Total	406 (47.05%)	457 (52.95%)	406 (47.05%)	

Table 4 is a distribution of different isolated *staphylococcus* species according to gender and age. Of the isolated *Staphylococcus* species, *Staphylococcus aureus* accounted for 81.53% (n=331) while *Staphylococcus saprophyticus* and *Staphylococcus epidermidis* accounted for 16.50% (n=67) and 1.97% (n=8) respectively. Based on gender, of the 331 *Staphylococcus aureus* positive samples, male accounted for 59.52% (n=197) and female 40.48% (n=134). Similarly, male accounted for 61.19% (n=41) of the total 67 positive *Staphylococcus saprophyticus* samples while female accounted for 38.81% (n=26). On the other hand, of the total 8 positive *Staphylococcus epidermidis* samples, female accounted for 75.0% (n=6) while male accounted for 25.0% (n=2). Male represented higher in *Staphylococcus aureus* and *Staphylococcus saprophyticus* infections while female presented higher in *Staphylococcus epidermidis* infection. The observed differences in male and female indicates variation in gender differences with staphylococcus infection. In agreement with this observation, sex differences in infections have been documented by several studies [25, 27, 28]. The observation that male presented higher staphy infection than female is in agreement with the finding by Otajevwo [29] who reported *Staphylococcus aureus* occurred more in male outpatients (19.1%) than in female outpatients (6.7%). The reason for this, is not clear but lack of circumcision, receptive anal intercourse (as in homosexuals) and HIV infection may predispose males to UTI [16].

Table 4. *Distribution of isolated staphylococcus species according to gender and age.*

Age (in years)	Prevalence						Total
	Staphylococcus epidermidis		*Staphylococcus aureus*		*Staphylococcus saprophyticus*		
	Male	Female	Male	Female	Male	Female	
15 – 19	0	0	6	2	1	7	16
20-29	0	1	24	43	8	8	84
30 - 39	1	5	87	56	20	6	175
40 - 49	1	0	69	21	8	3	102
50 - 59	0	0	9	5	4	1	19
60 +	0	0	2	7	0	1	10
	8 (1.97%)		331 (81.53%)		67 (16.50%)		
Total	2 (25.0%)	6 (75.0%)	197 (59.52%)	134 (40.48%)	41 (61.19%)	26 (38.81%)	406

On the bases of age, *Staphylococcus aureus* was isolated in both male and female cohorts and in all the age ranges with higher frequency within the age range of 30 – 39and 40 – 49 years among the male cohorts and ages 20 – 29 years among the female cohorts. *Staphylococcus saprophyticus* was not isolated in the age ranges 55 and above among the male cohort and 50 – 54 years among the female cohorts. However, ages 30 – 39 and 15 – 19 presented higher frequency of *Staphylococcus saprophyticus* in the male and female cohort respectively. On *Staphylococcus epidermidis*, female within the ages of 25 - 39 and male within 30 - 34 and 40 – 44 presented positive isolates. Based on these findings, females presented wider age spread for staphylococcus infection and this may be due to the reproductive tract difference in anatomy and presentation. This assertion agrees with the report that documented the reason for higher female prevalence in

infection; especially UTI was due to shorter urethra in females [30], certain behavorial factors, including delays in micturition, sexual activity, the use of diaphragms and spermicides [26].

Staphylococcus aureus was the most common organism from both gender and age groups. This finding disagrees with the study by Mohammad et al. [31] where *S. saprophyticus* was the most prevalent species among all age groups and genders. But the finding on *Staphylococcus epidermidis* in this study agrees with the by Mohammad et al. [31] and Farajnia*et al*. [32] who documented *S. epidermidis* was not observed in the age group lower than 10 years.

4. Conclusion

Conclusively, this study showed that there are variations in the distribution of *Staphylococcus spp* based on age and sex. These variationsbased on age and genders are important factors affecting the difference in prevalence between location and season. Also, age and gender differences in staphylococcus distribution could be risk factors to consider in the management and treatment of *Staphylococcus* infection and may be important in the emerging difference in drug (antibiotic) resistant pattern. Overall, this study showed that the young are over 3 times more likely to be infected with staphylococcus and this may also affect antibiotic response between different age group. Also in this study, male gender was over 2 times more likely to be infected with staphy infestation and again suggesting the different in antibiotic response between gender.

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