Uluslararası Fen Araştırmalarında Yenilikçi Yaklaşımlar Dergisi
International Journal of Innovative Approaches in Science Research 2024, Vol. 8 (1), 21-37
https://doi.org/10.29329/ijiasr.2024.666.2

Original article

Detection of *Staphylococcus Epidermidis* from Patients Admitted to the Orthopedic Ward of Sir Yahaya Memorial Hospital (Symh) Birnin Kebbi, Nigeria

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Abstract

Although *Staphylococcus epidermidis* was once thought to be a non-pathogenic bacterium, it is now understood to be an opportunistic organism that causes a variety of nosocomial illnesses. *S. epidermidis*-colonized people are possible reservoirs for nosocomial infection transmission, which could be harmful to public health, particularly if there are antibiotic-resistant strains present. The aim of this research is the molecular detection of S. epidermidis, isolated from patients admitted to the orthopaedic ward of SYMH, Birnin Kebbi. A total number of 117 wound swab samples were collected from orthopaedic patients. Only 13 *S. epidermidis* were identified using phenotypic methods. The prevalence of S. epidermidis in orthopaedic patients was 13 (11.11%) the isolates were examined with antibiotics using the disc diffusion method. Clinical Laboratory Standard Institute Modified Kirby Bour techniques were used to determine the resistant status of recovered bacterial isolates. The results show that the isolates were 69.23%, resistant to Amoxicillin/clavulanic acid, 92.30% resistant to Meropenem, 100% resistant to Cefpodoxime, Cefepime, Cefotaxime and 30.76% resistant to Imipenem. PCR and Sanger sequence typing techniques were used to further identify the isolates, and only one *S. epidermidis* isolate was confirmed. *S. epidermidis* is among the major agents of wound infection at the Sir Yahaya Memorial Hospital in Birnin Kebbi, Nigeria. S. epidermidis isolates exhibited resistance to most of the antibiotics tested in this study. The high incidence of *S.epidermidis* isolates resistant to antibiotics tested in the hospital calls for urgent need to put in place measures to curtail the spread of nosocomial pathogens, especially *S. epidermidis* which has a high proportion of resistance in the hospital.

Keywords: *S. epidermidis*, orthopedic ward, Yahaya Memorial Hospital, Birnin Kebbi, Nigeria.

Received: 13 November 2023 * **Accepted:** 30 March 2024 * **DOI:** https://doi.org/10.29329/ijiasr.2024.666.2

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INTRODUCTION

A coagulase-negative and Gram-positive bacteria is *S. epidermidis*. *S. epidermidis* is a facultative anaerobe that is non-motile and can grow in both anaerobic and aerobic environments. The cocci of *S. epidermidis* are arranged in tetrads and clusters, and the cells are spherical (0.5-1.5 µl in diameter). *S. epidermidis* grows poorly in medium with 10% NaCl, although the culture conditions are comparable to those for *S. aureus*. According to Allegranzi *et al*. (2011), *S. epidermidis* colonies are roughly 2.5 mm in diameter, spherical, elevated, shiny, and gray.

The skin and mucous membranes typically harbor *S. epidermidis*, which is a consistent part of the human microbiota. The newborns babies will be invaded by *S. epidermidis* within a few days (Dominguez-Bello *et al*., 2010). Then, *S. epidermidis* contributes to the microbiota of human skin, predominating in moist places like the nares or nose but also appearing in sebaceous areas like the facial skin (Grice *et al*., 2009) and mucosal tissues like the lower reproductive tracts (Sharon *et al*., 2013). According to Majchrzak *et al*. (2016), *S. epidermidis* can develop a lifetime commensal connection with humans by sticking to their tissue surface via certain adhesions. This interaction can start as early as infancy.

Even though commensal *S. epidermidis* isolates have high rates of resistance to clinically significant antibiotics (Morgenstern *et al*., 2016), the healthy human host is largely unaffected by such circumstances because of the bacterium's natural role as commensal bacteria. *S. epidermidis* has, however, become a major opportunistic pathogen with the development of implanted medical equipment, such as prosthetic joints and fracture fixation devices (Otto, 2009; Widerstrom 2016).

Given that *S. epidermidis* can quickly attach to the device's surface and accumulate there, the implanted medical device may contribute to infection since it can unintentionally introduce the bacteria into the surgical site. According to Hogan *et al*. (2015) This surface-associated bacterial growth, also known as biofilm development, seems to be the fundamental feature enabling an invasive, device-related infection for a mostly non-pathogenic microorganism. Because *S. epidermidis* is so common on human skin, it has become apparent that employing medical devices might lead to serious complications when *S. epidermidis* is present (Rogers *et al*., 2009). Due to the rising prevalence of these devices and the high rates of antibiotic resistance, *S. epidermidis* device-related infection may continue to be a clinical issue for future generations (Montanaro *et al*., 2011).

The lack of the blood-clotting enzyme coagulase distinguishes the clinically diverse group of staphylococcal species known as coagulase-negative staphylococci (CoNS). As a result, they can be distinguished from *S. aureus* and a few other clinically insignificant coagulase-positive species. These days, CoNS have become one of the main nosocomial infections and are the most often identified bacteria in clinical cultures. The presence of indwelling medical devices, such as intravascular catheters,

or immunosuppression brought on by cancer treatment or HIV/AIDS are risk factors for CoNS infection. The increase of strains that are resistant to antibiotics, particularly methicillin-resistant *S. epidermidis*, makes treating CoNS infections more difficult (Rogers *et al*., 2009). According to Uckay *et al*. (2009), the pathophysiological mechanism for *S. epidermidis* orthopedic device infection involves direct injection of skin colonization strains during surgery.The disparity between the high prevalence of *S. epidermidis* carriage and the low incidence of *S. epidermidis* infections on orthopedic devices leads one to assume that *S. epidermidis* infections of the bones and joints may either be unintended consequences of colonizing strains or may be caused by a particular, more virulent sub-population of commensal isolates. The occurrence of such specificity may be essential as it may affect the management and prevention of these serious illnesses. According to Schierholz and Beuth (2001; Otto, 2009), the ability of a commensal pathogen to produce chronic diseases that are challenging to treat shows that these infections are caused by the organism's capacity to evade the immune system and antibiotic therapy.

MATERIAL AND METHODS

Study area

Between 12.43180 N latitude and 4.19560 E longitude is Birnin Kebbi, a city in northwestern Nigeria. It serves as both the administrative center for the Gwandu Emirate and the capital of Kebbi State. The City is connected by road to Argungu (45 km northeast), Jega (35 km southeast), and Bunza (45 km southwest). According to the 2006 census, the city has a population of 268 620 people (men 135,426 and women 133,194), the majority of them are Hausa and Fulani and practice Islam as their primary religion (Kaoje *et al*., 2016). The study area is the Sir Yahaya Memorial Hospital in Birnin Kebbi. The hospital serves as a referral hub for the state and as a secondary healthcare facility in the city. It has a facility with a capacity of over 290 beds and an annual average of 200 to 220 patient admissions. Its protocols and services are readily available, inexpensive, and afordeble (Nuhu *et al*., 2020).

Study design

This investigation, which comprised the molecular detection of *S. epidermidis*, was cross-sectional descriptive and hospital-based. Wound samples were collected from patient admitted in orthopedic ward of Sir Yahaya memorial Hospital (SYMH). *S. epidermidis* was isolated using standard Microbiological method. The isolates were identified using phenotypic method and confirm using molecular method as well. The identified *S. epidermidis* was subjected to antibiotics sensitivity testing using Kirby-Bauer disk diffusion method.

Sample size determination

The standard formula was used to determine the minimum sample size using the p-value from prior studies, resulting in a total of 117 samples.

$$N = \frac{Z^2 p - q}{d^2}$$

Where N = Number of sample (sample size), Z = Standard normal deviate at 95% confidence interval=1.96, P = Prevalence from previous studies (8.3%) According to a study conducted at the Ahmadu Bello University Teaching Hospital (ABUTH), Zaria (Atolagbe *et al*., 2021), D = allowable margin of error = 0.05

Ethical approval

Ethical approval for this study was obtained from Kebbi State Ministry of Health and research ethics review committee of Sir Yahaya Memorial Hospital with numbers; MOH/KSREC/VOL.1/57, SMHBK/SUB/011/VOL.

Inclusion criteria and Exclusion criteria

All categories of patients with wound in orthopedic wards irrespective of their age, and gender who/ are or relatives consented was included in this study. Non consented patients, patient with no wound and out of orthopedic ward was excluded from this study.

Sample collection

A sterile cotton swab stick was used to aseptically collect 117 wound swab samples, which were then moistened with sterile normal saline 5%. a rotating swab stick was used to remove the pus from the patient's wound in the orthopedic ward of Sir Yahaya Memorial Hospital Birnin Kebbi, the sample was then taken to the microbiology lab at Kebbi State University of Science and Technology, Aliero, in an ice-cold box for examination.

Isolation of *S. epidermidis* from swab samples

Sample enrichment and inoculation

The collected swab samples were inoculated into nutrient broth for 6 hours. The resulting medium were serially diluted, then 100µl of the diluted sample (tube 10^{-6}) was inoculated onto mannitol salt agar (MSA) plates using spread method then the plates were incubated at 37°C for 24hrs (Anam *et al*., 2015).

Identification of *S. epidermidis*

The spherical, raised shiny, gray, complete-edged, and morphologically distinct *S. epidermidis* colonies were recognized by this method. About 2.5 mm is the diameter. In most cases, they don't create a hemolytic zone. Mucus-producing strain with translucent, gooey colonies (Agnieszka *et al*., 2014). *S. epidermidis* was further identified unging Grams stainig (Thairu *et al.,* 2014) and biochemical tests such as Coagulase, Catalase, Indole, Desferrioxamine and Fosfomycine tests (Tille, 2014; Thiago *et al*., 2013).

Molecular identification of *S. epidermidis*

DNA lysate preparation

Boiling techniques were used to create the DNA lysate. From 24-hour-old mannitol salt agar culture plates, three (3) colonies of either *S. epidermidis* (equivalent to 0.5 McFarland) were transferred to a 1.5 ml sterile micro centrifuge tube containing 100 µl of DNA-free water. The tube was then sealed with parafilm, vortexed, and boiled for 10 minutes in a water bath. Followed by five minutes of centrifugation at 10,000 x g. In order to amplify DNA for PCR, the supernatant was carefully collected and used (Dashti *et al.*, 2009).

Determination of DNA lysate concentration

The success of the PCR experiment is significantly influenced by the target DNA concentration. DNA concentrations were measured using a biophotometer and a 2:50 dilution of the DNA absorbance at 260 nm (A260). A260/A280 ratios between 1.8 and 2.0, which suggest protein or RNA contamination, were regarded to be indicative of pure DNA (Bashir *et al.*, 2019).

Polymerase Chain Reaction

The extracted DNA was used to produce a PCR template. For the purpose of identifying the bacterium, two primer sequences were used: 27 Fw (5'- AGAGTTTGATCCTGGCTCAG-3') and 1429 Rev (5'-GGTTACCTTGTTACGACTT-3'). The components of the PCR cocktail mix are 2.5 ul of 10x PCR buffer, 1 ul of 25 mM MgCl2, 1 ul of each forward and reverse primer, 1 ul of DMSO, 2 ul of 2.5 mM DNTPs, 0.1 um of 5 u/l Taq DNA polymerase, and 3 ul of 10 ng/l DNA. 13.4 µl of nuclease-free water were used to create a 25 µl total reaction volume. The PCR procedure includes an initial denaturation step at 94 °C for 5 minutes, followed by 36 cycles of denaturation at 94 °C for 30 seconds, annealing at 56 °C for 30 seconds, and elongation at 72 °C for 45 seconds. Afterwards, the temperature is maintained at 10 °C indefinitely after a last elongation step that lasts 7 minutes at 72 °C. On 1.5% agarose electrophoresis gels stained with ethidium bromide, amplified fragments were visible. The amplicon is around 1500 bp in size, and the DNA ladder utilized was a 1 kbp ladder from NEB.

Agarose gel electrophoresis of *rpoB* PCR amplification

The PCR products were analyzed on 1% agarose gel in 1x TBE buffer, run at 100V for 45 minutes. A stock solution of 50x of TEA buffer in 1000ml of distilled water and a sufficient electrophoresis was prepared to cast gel and preparation of agarose was made. After cooling the melted gel, 0.5 ug/ml of ethidium bromide was added and allowed to completely set for 30 to 45 minutes at room temperature. A little amount of electrophoresis buffer was then added, and the gel was mounted on the electrophoresis tank. enough electrophoresis buffer to completely cover the gel, to a depth of 1 mm. Using a disposable micropipette, the sample DNA was progressively fed into 0.20 volumes of the appropriate 6x gel. Using

a gel documentation machine, the gel was photographed at wavelengths in the range of 470 nm to 520 nm while being stained with ethidium bromide at a concentration of 1 µg/mL (Pace, 1997).

Sanger sequencing

The BigDye terminator v3.1 cycle sequencing kit (Applied Biosystems, USA) was used for the cycle sequencing process, and 25ng of the purified PCR product was used as the input. The sequencing primer (MP13Forward/Reverseprimer) (1 µl), the PCR product (3 µl), and the BigDye Direct Sequencing Master Mix (2 µl) were produced as a 6 µl reaction mix, and 3 µl of the reaction mix was loaded to the appropriate well in the corresponding forward or reverse reaction plate. The following sequencing parameters were used in a thermocycler: 96°C for 1 min, then 25 cycles of 96°C for 10 s, 50°C for 5 s, and 60°C for 75 s. The tubes were briefly centrifuged at the conclusion of the experiment, and samples were then placed onto the ABI 3500 gene sequencer. Blastn (NCBI) and MEGA software (version 6.0) were used to examine the results.

Determination of antibiotics susceptibility patterns of *S. epidermidis*

The antibiotic susceptibility testing was performed using disc diffusion method (Anjana *et al.*, 2009). Colonies of 24h pure culture of *S. epidermidis* was picked up from nutrient agar plates, and transferred into tubes containing peptone water media, and turbidity was adjusted to 0.5 McFarland standards. Freshly prepared Sterile Mueller Hinton agar plates were inoculated with the standardized suspension (0.5 McFarland standard) of the isolates using sterile cotton swabs. Antibiotic that was used on this study were: Amoxicillin/Clavulanic acid (AX 30 µg), Cefpodoxime (CPD 10 µg), Cefepime (FEP 30 µg), Cefotaxime (CTX 30 µg), Meropenem (MEM 10 µg), and Imipenem (TPM 10 µg). These antibiotics discs were placed on the surfaces of inoculated agar plates using sterile forceps and incubate at 37ºC for 24hr. The diameters of the zone of inhibitions were measured in millimeters and results was interpreted according to the guidelines of Clinical and Laboratory Standard Institute (CLSI, 2020).

RESULTS

Socio-Demographic characteristics of study subjects.

Table 1 shows the demographic breakdown of the study participants. A total of one hundred and seventeen (117) patients were enrolled in this study. Thus the study participants were categorized on the bases of their gender, age, marital status, and educational level, tribal and residential status. However, Male has the higher frequency of occurrence 64.96% compared with that of females 35.04%, consequently, among the age group of study participants, 40 to 50 age group has the higher frequency of occurrence with 39.06% while 29 to 39 age group has less frequency. On the bases of their marital status, married participants had the higher percentage 54.70% while unmarried had the least 45.30%. Moreover, the non-educated study subject has the higher percentage 38.46% followed by primary education which account for 25.64%. Hausawa had higher frequency 69.52% as compared with

Fakkawa which had the least 2.56%. The rural dwellers had higher frequency of 58.12% while urban had lower frequency 41.88%.

Prevalence of *S. epidermidis* in orthopedic patients according to gender and age of the study subjects

A total of 117 samples were collected from Sir Yahayaya Memorial Hospital Birnin-Kebbi (SYMH), out of 117 samples collected, 31 (26.49%) were culture positive. However, males that turn positive for *S. epidermidis* were 8 (6.8%) and the number of positive for female were 5 (4.2%). The prevalence of *S. epidermidis* base on their age distribution, 18 to 28 and 51 to 61 has the highest prevalence 4(3.42%) each, while 40 to 50 show the less prevalence with 2(1.71%) Table 2.

Prevalence of *S. epidermidis* in orthopedic patients according to marital status and educational level of the study subjects

The prevalence of *S. epidermidis* among orthopedic patients according to marital status showed that married participants account for higher prevalence 7(5.98%) while unmarried participants had the least 6(5.13%). The result according to the educational level of orthopedic patients in this study showed that higher prevalence was observed among patients without formal education 6(5.13%) while 1(0.85%) was observed in graduates participants Table 3.

Prevalence of *S. epidermidis* in orthopedic patients according to tribe and residential status of the study subjects

The prevalence of *S. epidermidis* base on tribe of the studied participants showed that Hausa tribe has the higher prevalence 9(7.69%) as compared with Celela and Fakkawa tribes which account for 0(0.00%) each. On the bases of residential status, the rural dwellers had higher prevalence 8(6.84%) as compared with that of urban 5(4.27%) which had the least Table 4.

Distribution of *S. epidermidis* and *S. aureus* isolated from orthopedic patients of SYMH Birnin Kebbi

The overall prevalence for *S. epidermidis* in this study was 13 (11.11%) as compared with *S. aureus* which account for 18 (15.38%) among orthopedic patients of Sir Yahayaya Memorial Hospital Birnin-kebbi (SYMH) Fig 1.

Antibiotic resistant patterns of *S. epidermidis*

The antibiotic resistant profile for *S. epidermidis* isolates was determined using six different antibiotics. *S. epidermidis* were resistant to Cepodoxime 13(100%), Cefepime 13(100%), Cepotaxime 13(100%) Table 5 and Fig. 2.

Table 1. Socio-demographic information of the study participants

Categories	**Frequency of occurrence (n)**	**Percentage (%)**
Male	76	64.96
Female	41	35.04
Total	117	100
Age		
18-28	30	25.64
29-39	23	19.66
40-50	34	29.06
51-61	30	25.64
Total	117	100
Marital status		
Married	64	54.70
Unmarried	53	45.30
Total	117	100
Educational status		
No-formal	45	38.46
Primary	30	25.64
Secondary	27	23.08
Graduates	15	12.82
Total	117	100
Tribe		
Hausa	79	67.52
Zabarmawa	17	14.53
Fulani	14	11.97
Fakkawa	3	2.56
Celela	4	3.42
Total	117	100
Residence		
Rural	68	58.12
Urban	49	41.88
Total	117	100

Table 2. Prevalence of *S. epidermidis* in orthopedic patients according to gender and age of the study subjects

Parameters	**No. of Positive Samples (n)**	**Percentage (%)**
Gender		
Male	8	6.84
Female	5	4.27
Total	13	11.11
Age		
18-28	4	3.42
29-39	3	2.56
40-50	2	1.71
51-61	4	3.42
Total	13	11.11

Table 3. Prevalence of *S. epidermidis* in orthopedic patients according to marital and educational status of the study subjects

Parameters	**No. of positive sample (n)**	**Percentage (%)**
Marital status		
Married	6	5.13
Single	7	5.98
Total	13	11.11
Educational status		
Non-formal education	6	5.13
Primary	4	3.42
Secondary	2	1.71
Graduates	1	0.85
Total	13	11.11

Table 4. Prevalence of *S. epidermidis* in orthopedic patients according to tribe and residential status of the study subjects

Parameters	No. of positive sample (n)	Percentage (%)
Tribe		
Hausa	9	7.69
Zabarmawa	2	1.71
Fulani	2	1.71
Fakkawa	0	0.00
Celela	0	0.00
Total	13	11.11
Residence		
Rural	8	6.84
Urban	5	4.27
Total	13	11.11

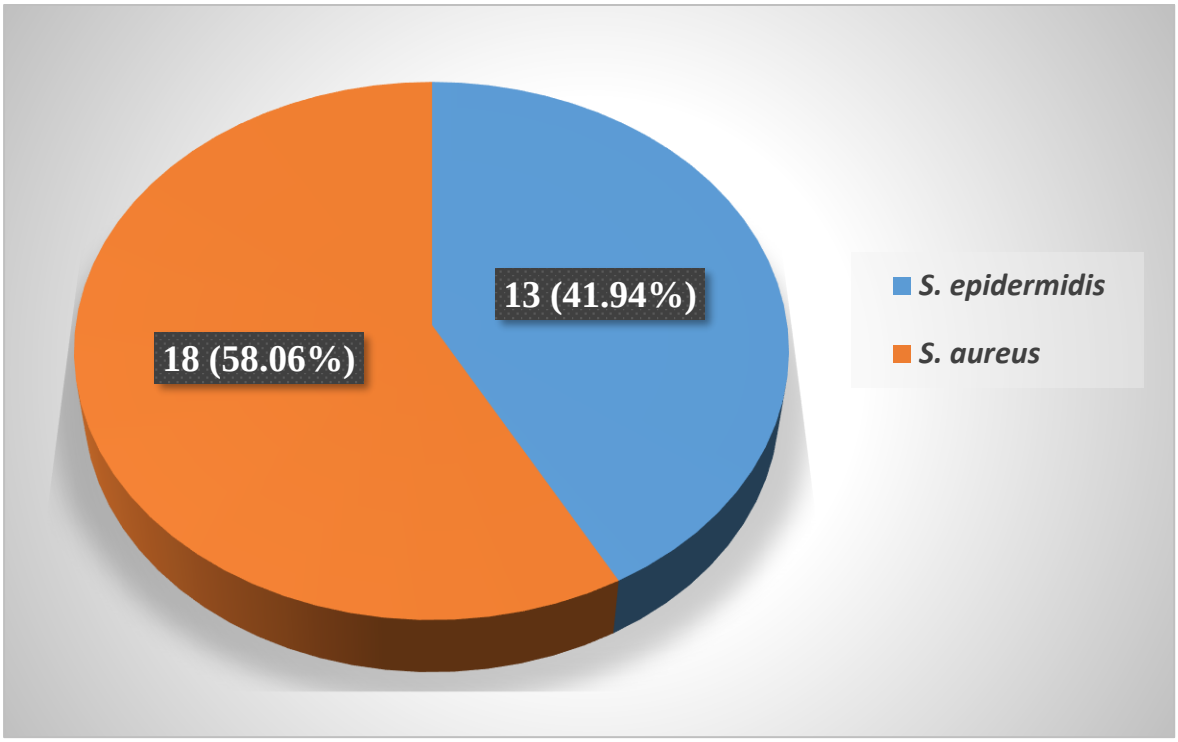

Figure 1. Distribution of *S. epidermidis* and *S. aureus* isolated from orthopedic patients of SYMH Birnin Kebbi

Table 5. Antibiotic resistance profile for *S. epidermidis* (n=13)

	Result interpretation		
Antibiotics	**Resistance %**	**Intermediate**	**Sensitive**
Amoxicillin/clavulanic acid (30 µg)	9 (69.23)	2 (15.38)	2 (15.38)
Cefpodoxime (10 µg)	13 (100)	0.00 (0.00)	0.00 (0.00)
Cefepime (30 µg)	13 (100)	0.00 (0.00)	0.00 (0.00)
Cefotaxime (30 µg)	13 (100)	0.00 (0.00)	0.00 (0.00)
Meropenem (10 µg)	12 (92.3)	1(7.69)	0.00 (0.00)
Imipenem (10 µg)	4 (30.76)	0.00 (0.00)	9 (69.23)

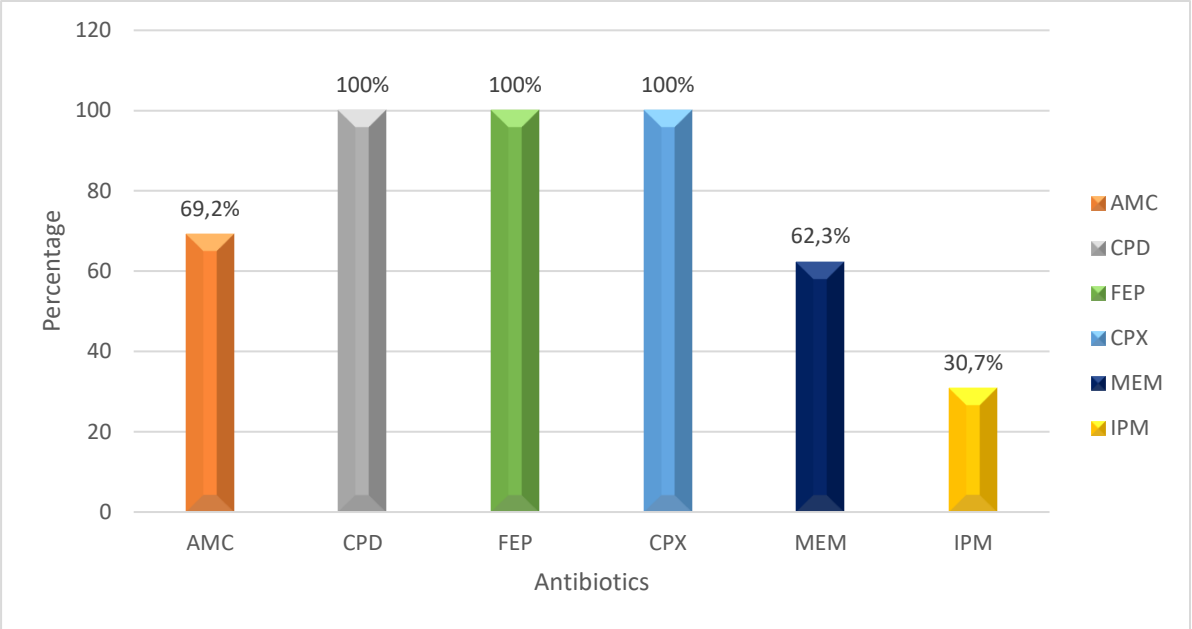

Figure 2. Antibiotic resistant profile of *S. epidermidis*

Key: AMC- Amoxicillin/clavulanic acid, CPD- Cefpodoxime, FEP- Cefepime, CTX- Cefotaxime, MEM- Meropenem, IPM- Imipenem

Molecular identification of *S. epidermidis* isolated in Sir Yahayya Memorial Hospital Birnin Kebbi, Nigeria.

Out of 13 *S. epidermidis* isolates identified using colony morphology, Gram staining, and biochemical test. Sanger sequencing and standard PCR techniques were used to identify one *S. epidermidis*.

The ribosomal RNA gene sequence was successfully retrieved from one *S. epidermidis* sample out of thirteen isolates, according to the PCR results, which showed a band of about 1500 base pairs (bp). As a result, the isolates were submitted to partial genome sequencing making use of the chain termination method of Sanger sequencing. To compare the newly discovered sequences with known *S. epidermidis* sequences kept in the bank, they were entered into the National Center for Biotechnology Information (NCBI) database using the Basic local alignment search tool (BLAST). In order to ascertain the evolutionary link between a sequence of this isolate and a known *S. epidermidis* isolate from NCBI, sequences of *S. epidermidis* from NCBI that shown similarities with the isolate were retrieved. The phylogenetic tree has been generated using the neighbour-joining and Clustal-Muscle methods, and bootstrapping was carried out using 1000 trials (Fig. 3).

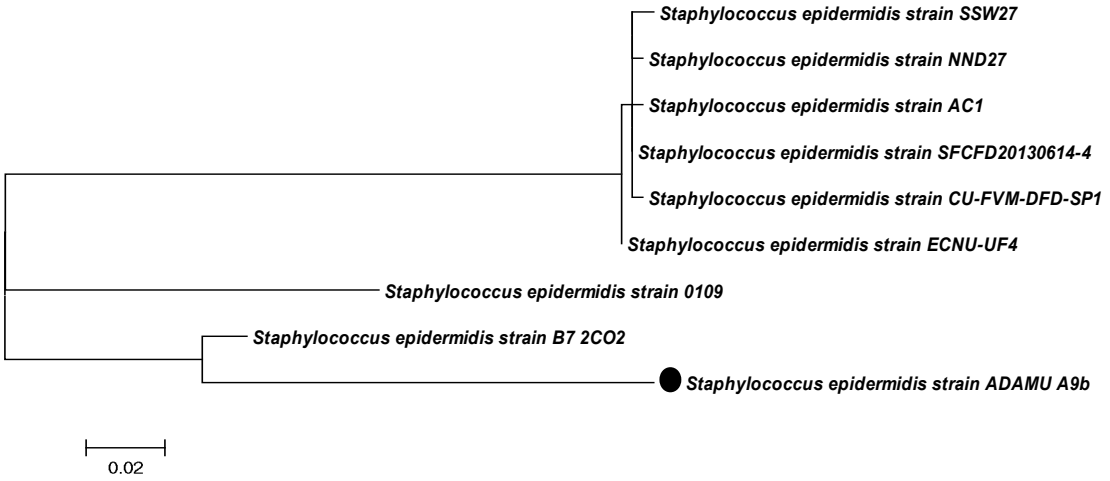

Figure 3. Molecular Phylogenetic analysis of isolated *S. epidermidis* . The evolutionary history was inferred using the Maximum Likelihood method based on the Tamura-Nei model**.**

DISCUSSION

Although *S. epidermidis* used to be thought of as a non-pathogenic bacterium, it is now understood to be an opportunistic organism that causes a number of nosocomial infections (Ehlers *et al*., 2018). According to Kateete *et al.* (2020), people who have *S. epidermidis* colonization are potential carriers for the spread of nosocomial infections, which could be dangerous to the public's health, particularly if antibiotic-resistant strains are present. In this study, 13 *S. epidermidis* were isolated which account for 11.11% prevalence of *S. epidermidis*. This report varies with different authors. However, the percentages reported 8.3% in a study in kaduna (Atolagbe *et al*., 2021), 9.9% in Kano (Muhammad and Muhammad, 2019), 2.2% in Borno (Pius *et al.,* 2016), 5.6% in Ogun (Seyi *et al.,* 2020), 33.3% in Lagos (Moro, 2021), 3.4% in Osun (Olawale *et al*., 2011), 33.3%, 55.6% in Edo (Eke *et al*., 2012), 36.76% in Bayelsa (Abdulrasheed *et al*., 2016), 29.28% in Revers (Chikere *et al*., 2008) and 11.4% in Kwara (Ayandele and Adeniyi, 2011). The differences in the prevalence might have been due to sample size variation, Hospitals environmental conditions and demographic characteristics of the studied participants. However, this finding is in line with studies carried out by Ayandele and Adeniyi (2011) in kwara state which recorded 11.4% prevalence of *S. epidermidis.*

The prevalence of *S. epidermidis* according to gender of study participants showed that Male had the higher prevalence compared to Females, this is a little bit higher than a report by Alaka *et al*., 2019 where he reported (5.23%) in Males and (1.96%) in Females. However, this could be as a result of personal hygiene. The prevalence of *S. epidermidis* in orthopedic patients according to age group showed that 18 to 28 and 40 to 50 has the highest prevalence **Table 4.2:** this might be because the patient was hospitalized for a long time and underwent invasive processes, which raise the possibility of

nosocomial infection by opportunistic bacteria. like *S. epidermidis, S. aureus*, however, this is in accordance with Thimmappa *et al*. (2021) Odewale *et al.* (2016) who reported that prolong hospital stay and invasive procedure can increase the risk of nosocomial infections.

Among the married and unmarried study subjects the prevalence of *S. epidermidis* was higher in married participant compared to unmarried **Table 4.3**. The contamination could be as a result of use of unsterilized water to wet the gauze before dressing the wound as observed during sample collection which may be the source of introducing opportunistic pathogens like *S. epidermidis* in the wound.

The educational level of study subjects showed higher prevalence among subjects without formal education according to this study, higher prevalence is seen in none educational subjects followed by subject with primary education. Thus the least among these group were graduate **Table 4.3**. The higher prevalence of *S. epidermidis* in none educated subject could be as a result of ignorance on how to maintain personal hygiene, and their socio-economic status of which most of them were unemployed and is associated with low standard of living.

In **Table 4.4** The tribal status according to this finding, Hausawa show the highest prevalence of *S. epidermidis* in orthopedic patients followed by Zabarmawa and Fulani. Celela and Fakkawa carry the least prevalence respectively. However, Hausawa has the highest number of patients in orthopedic ward which make their prevalence to be higher among other tribes.

On the bases of their residential status, the rural dwellers had the highest prevalence compared to the urban dwellers **Table 4.4**. The lack of personal cleanliness practiced by the majority of rural residents may increase their risk of contracting *S. epidermidis* nosocomial infections. This is in line with the finding of Nworie and Eze, (2010), who reported personal hygiene among the factors causing high prevalence of nosocomial infections among rural dwellers.

Most of the isolates that were used in this study were resistant to the following drugs. Cefpodoxime, Cefepime, Cepotaxime and Meropenem the sensitivity were only discovered in Imepenem and Amoxicillin/clavolanic acid **Table 4.5.** The resistance rate for *S. epidermidis* to amoxicillin/clavolanic acid found in this study did not coincide with the work of Pius *et al.* (2016), which reported 100% resistance to amoxicillin. Another study reported 55% resistant in Zaria by Atalobe *et al.* (2021) which is contrary to this study as well. Furthermore, this study recorded 92.3% resistant to meropeneme against *S. epidermidis*, a similar study in orthopedic patients in Ile-ife reported 37.50% resistant to meropeneme against *S. epidermidis* Alaka *et al.* (2019) which is contrary to this study. Consequently *S. epidermidis* showed 100% resistant to Cefotaxime, Cefepime and Cefpodoxime respectively. This indicate that *S. epidermidis* is a Multi-drug resistant (MDR) organisms, most likely as a result of the widespread use of antibiotics in hospitals and rampart use of antibiotic by individuals. However, this study recorded 30.76% resistant to Imepeneme which did not correlate with the finding

by Alaka *et al.* (2019) who reported a higher resistant rate 75%. Carbapenems use to be the drug of choice when treating multi-drug resistant organisms, but unfortunately, some *S. epidermidis* in this study resisted the action of carbapenems which confirmed the report by Towner, 2009 that carbapenems resistance organisms becoming common worldwide (Towner, 2009).

One of the 13 *S. epidermidis* isolates that were phenotypically isolated as part of this investigation is confirmed by PCR to be *S. epidermidis*, accounting for 1/13 (7.69%) of the isolates, even thouhg selective and differential media were used during isolation processes. However, the results were significantly different when compared to molecular techniques like PCR and sequencing. The remaining organisms that appear negative in molecular method (PCR) could be insufficient number of DNA during PCR application or the organisms might have been contaminated. These findings show us that we cannot entirely rely on the phenotypic technique for the identification of *S. epidermidis*, nevertheless. in order to accurately diagnose clinically significant diseases, molecular techniques must be implemented at Sir Yahayya Memorial Hospital and other secondary Hospitals throughout Kebbi State and Nigeria as a whole. Because of its distinctive ability to withstand the majority of antibiotics, *S. epidermidis* is a highly significant organism, particularly in the context of hospitals where it is a nosocomial pathogen among patients with weakened immune systems and those who have lengthy hospital stays.

CONCLUSION

S. epidermidis is among the main agents of wound infection at Sir Yahayya Memorial Hospital in Birnin Kebbi, Nigeria, according to this study, The majority of the antibiotics used in this study were resistant to the *S. epidermidis* isolates. However, the high number of *S. epidermidis* isolates that were found to be resistant to antibiotics during testing in the hospital highlights the urgent need for measures to be implemented to stop the spread of nosocomial diseases, particularly *S. epidermidis*, which has a high proportion of resistant isolates in the hospital. It is however, recomended that further studies should be carried out in the hospital to detect the gene responsible for resistance.

REFERENCES

Abdulrasheed, Kemebradikumo Pondei & Lamikanra Adebayo (2016). Linezolid and Methicillin-Resistant Coagulase Negative Staphylococci from Anterior Nares of Nigerian Tertiary School Students. Global Journal of Medical Research: C Volume 16 Issue 3 Version 1.0

Agnieszka Bogut, Justyna Niedzwiadek, Maria Koziot-Montewka, Dagmara Strzelec-Nowak, Jan Blacha, Tomasz Mazurkiewicz, Wojciech Marczynski and Dorata Plewik (2014). Characterization of *Staphylococcus epidermidis* and *Staphylococcus warneri* small-colony variants associated with prosthetic-joint infections. *Journal of Medical Microbiology*, Doi 10.1099/jmm.0.066068-0

Alaka O.O., (2019) "The Phenotypic Detection of Carbapenem Resistant Organisms in Orthopaedic Wound Infections in Ile-Ife, Nigeria". Acta Scientific Microbiology 2.2: 35-42.

Allegranzi B, Bagheri Nejad S, Combescure C, Graafmans W, Attar H, Donaldson L, *et al*. (2011) Burden of endemic healthcareassociated infection in developing countries: systematic review and meta-analysis. Lancet;377:228-41.

Anam FN, Asma A, Aamir A, Asad-ur-Rehman, Yasra S and Abdul H (2015). Molecular detection of antimicrobial resistance in local isolates of Staphylococcus epidermidis from urinary tract infections in faisalabad region of Pakistan. *Excli Journal*,;14:697-705.

Anjana RV and Padmini R (2015). Antibacterial Activity of Some Medicinal Plants Used by Tribals Against Uti Causing Pathogens. *World App Sci J*.;7(1):332-339.

Atolagbe, C.T., Tytler, B.A., Jimoh, O., Olayinka, A.T., and Olayinka, B.O. (2021). Prevalence and antimicrobial susceptibility pattern of coagulase-negative staphylococci obtained from nares of adult patients admitted to Ahmadu Bello University Teaching Hospital (ABUTH), Zaria. AROC in Pharmaceutical and Biotechnology, 1(1):34-43

Ayandele A.A and Adeniyi SA (2011). Prevalence and antimicrobial resistance pattern of microorganisms isolated from Naira notes in Ogbomoso North, Nigeria. *Journal of research in Biology* 8: 587-593

Bashir A., Garba I., Aliero A. A., Kibiya A., Abubakar M. H., Ntulume I., Faruk S., Ezera A. (2019). Superbugs-related prolonged admissions in three tertiary hospitals, Kano State, Nigeria. Pan African Medical *Journal.* 32(166).

Dashti A. A., Jadaon M. M., Abdulsamad A. M., Dashti HM. (2009) Heat treatment of bacteria: a simple method of DNA extraction for molecular techniques. *Kuwait Med J.;41(2):*117–122. [Google Scholar]

Dominguez-Bello, M. G., Costello, E. K., Contreras, M., Magris, M., Hidalgo, G., Fierer, N., et al. (2010). Delivery mode shapes the acquisition and structure of the initial microbiota across multiple body habitats in newborns. Proc. Natl. *Acad. Sci. U.S.A.* 107, 11971– 11975.

Ehlers M. M., Strasheim W, Lowe M, Ueckermann V, Kock MM (2018). Molecular epidemiology of Staphylococcus epidermidis implicated in catheter-related bloodstream infections at an Academic Hospital in Pretoria, South Africa. Frontiers in microbiology. Mar 7;9:417.

Eke, S., Abdulkadiri, S., Okoro, C.J., Ekoh, S. N., and Mbachi, N.G, (2012). The prevalence and resistivity pattern of staphylococcus aureus isolates from apparently healthy university students in ekpoma, edo, Nigeria. *International Journal of Basic, Applied and Innovative Research IJBAIR*, 2012, 1(4): 183 - 187

Grice E. A., Kong HH, Conlan S (2009) Topographical and temporal diversity of the human skin microbiome. Science 324: 1190–1192

Hogan, S., Stevens, N. T., Humphreys, H., O'Gara, J. P., and O'Neill, E. (2015). Current and future approaches to the prevention and treatment of staphylococcal medical device- related infections. Curr. Pharm. Des. 21, 100–113.

Chikere C. B., B. O Chikere and V. T. Omoni (2008). Antibiogram of clinical isolates from a hospital in Nigeria, 2008 *African Journal of Biotechnology* Vol. 7 (24), pp. 4359-4363, 17 December, 2008 Available online at http://www.academicjournals.org/AJB

Kaoje I. U., Dankani I and Ishiaku I (2016). Site Suitability Analysis for Municipal Solid Waste Disposal in Birnin Kebbi, Nigeria. *IOSR Journal of Humanities and Social Science* (IOSR-JHSS). 21(7):01-10.

Kateete, D. P., Asiimwe, B.B., Mayanja, R., Najjuka, C.F., and Rutebemberwa, E. (2020). Species and drug susceptibility profiles of staphylococci isolated from healthy children in Eastern Uganda. PLoS ONE, 15(2): e0229026.

Majchrzak, K., Mierzwinska-Nastalska, E., Chmura, A., Kwiatkowski, A., Paczek, L., Mlynarczyk, G., (2016). Comparison of staphylococcal flora in denture plaque and the surface of the pharyngeal mucous membrane in kidney transplant recipients. Transplant. Proc. 48, 1590–1597.

Montanaro, L., Speziale, P., Campoccia, D., Ravaioli, S., Cangini, I., Pietrocola, G (2011). Scenery of Staphylococcus implant infections in orthopedics. *Future Microbiol*. 6, 1329– 1349.

Morgenstern, M., Erichsen, C., Hackl, S., Mily, J., Militz, M., Friederichs, J (2016). Antibiotic resistance of commensal staphylococcus aureus and coagulase-negative staphylococci in an international cohort of surgeons: a prospective point-prevalence study. PLoS ONE 11:e0148437.

Moro Dauphin D (2021). Antibiotic susceptibility pattern and plasmid profiles of nasal staphylococci from apparently healthy Nigerians. DOI: https://doi.org/10.30574/wjbphs.2021.6.1.0035

Muhammad Ali1, Muhammad S. Abdallah (2019). Prevalence of Urinary Tract Infection among Pregnant Women in Kano, Northern Nigeria. Archives of Reproductive Medicine and Sexual Health ISSN: 2639-1791 Volume 2, Issue 1, PP: 23-29

Nuhu Hussaini Shehu , Abdullahi Alhaji Magaji , Abdulkadir Usman Junaidu , Abubakar Abubakar Panti , Makun Babazhitsu (2020). Seroprevalence of Toxoplasmosis in Pregnant Women Attending Antenatal Care at Sir Yahaya Memorial Hospital, Birnin Kebbi, Northwestern Nigeria, Published January - June *Annals of Clinical and Experimental Medicine* 2020 (Vol. 1, Is 1): 76

Odewale G., Adefioye OJ, Ojo J, Adewumi, FA, Olowe OA (2016). Multidrug resistance of Acinetobacter baumannii in ladeke akintola university Teaching hospital, Osogbo,Nigeria 6(3): 238-243.

Olawale, Kafayat Olayinka; Fadiora, Solomon Olufemi and Taiwo, Samuel Sunday (2011). Prevalence of hospital-acquired enterococci infections in two primarycare hospitals in osogbo, southwestern Nigeria *Afr. J. Infect. Dis*. 5(2): 40 - 46

Otto M. (2009) Staphylococcus epidermidis the 'accidental' pathogen. Nat Rev Microbiol 7:555–567

Pace, N. R. (1997) A Molecular View of Microbial Diversity and the Biosphere. Science, 272, 734-740.

Pius S., Bello M, Galadima GB, Ibrahim HA, Yerima ST, Ambe JP (2016). Neonatal Septicaemia, Bacterial Isolates and Antibiogram Sensitivity in Maiduguri North-Eastern Nigeria. *Nigerian Postgraduate Medical Journal.* 23(3):146.

Rogers K. L., Fey PD and Rupp ME (2009) Epidemiology of infections due to coagulase negative staphylococci. In: Crossley KB, Jefferson KK, Archer G, Fowler VG Jr (eds) The Staphylococci in human disease, 2nd edn. Blackwell Publishing, Oxford, pp 310–332

Seyi Samson Enitan1, Adeolu Sunday Oluremi, John Okeleke Ochei, Richard Yomi Akele, Stanley Osahon Usiobeigbe, Ileoma Emmanuel, Comfort Bosede Enitan, Rukayah Oluwapelumi Tajudeen (2020). Assessment of Oral Bacterial Profile and Antibiogram of Patients Attending Dental Clinic of a Private Tertiary Hospital in Ogun State, Nigeria 2020. *Saudi J Oral Dent Res* ISSN 2518-1300 (Print) |ISSN 2518-1297

Sharon, I., Morowitz, M. J., Thomas, B. C., Costello, E. K., Relman, D. A., and Banfield, J. F. (2013). Time series community genomics analysis reveals rapid shifts in bacterial species,

strains, and phage during infant gut colonization. Genome Res. 23, 111–120. doi: 10.1101/gr.142315.112

Schierholz JM, Beuth J (2001) Implant infections: a haven for opportunistic bacteria. *J Hosp Infect* 49: 87–93.

Thairu Y., Nasir AI, Usman Y. (2014) laboratory perspective of gram staining and its significance in investigation of infectious diseases. *Sub-saharan Afr J Med* 1:168-74

Thiago G. S., Keli C. R., Caio FdO, Pedro AA (2013). MALDI-TOF MS performance to identify gram-positive cocci clinical isolates in Porto Alegre/RS. Brazil. *J Infect Control*. 2(3):112-116.

Tille P.M. (2014) Bailey and Scott's diagnostic microbiology, Thirteen edition, Mostby,Inc., an affiliate of Eleservier Inc., 3251 Reverport Lane, St. Louis, Missouri 63043

Towner K. J. (2009) Acinetobacter: An old friend, but a new enemy. *Journal of Hospital Infection* 73:355-363

Uckay I., Pittet D, Vaudaux P, Sax H, Lew D. (2009) Foreign body infections due to Staphylococcus epidermidis (2009) Ann Med 41: 109–119.

Widerstrom, M., Wistrom, J., Edebro, H., Marklund, E., Backman, M., Lindqvist, P. (2016). Colonization of patients, healthcare workers, and the environment with healthcare-associated *Staphylococcus epidermidis* genotypes in an intensive care unit: a prospective observational cohort study. *BMC Infect*. Dis. 16:743.