Prevalence of *Staphylococcus aureus* on Noncritical Surfaces of the Laboratories of a Medical Laboratory Training Institution

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Abstract

Staphylococcus aureus is a Gram positive bacterium that is frequently encountered on surfaces such as benches and skin. This organism being a normal flora of the skin is usually nonpathogenic but becomes pathogenic when found outside its normal flora where it can cause varying number of infections such as nosocomial infections and sepsis which may even lead to death if left untreated. This research was therefore carried out to determine the prevalence of *Staphylococcus aureus* on noncritical surface areas including: Furniture, Doors and Windows of the laboratories of Federal College of Medical Laboratory Science & Technology Jos, Nigeria. Samples were processed, examined and analyzed accordingly. It was observed that out of the 120 samples examined, 8 were gram positive cocci in clusters under Gram staining examination Coagulase and catalase tests were positive indicating specific biochemical tests to identify the organisms in the 8 organisms as *Stapylococcus aureus* showing a prevalence rate of 6.67%. The 17 working Benches examined, 3(2.50%) were positive. Out of 75 Chairs examined, 5(4.17%) were positive. The 18 Windows examined, 10 Doors examined showed no growth for *Staphylococcus aureus*. Distribution according to laboratory sections showed that, out of the 95 samples in main laboratory, 6(5.00%) were positive. Out of the 14 samples examined in side laboratory one, 2(1.67%) were positive while none 0(0.0%) was positive out of 11 samples examined in side laboratory two. The isolation of *Staphylococcus aureus* from these locations stresses the urgent need for public enlightenment campaigns by the appropriate authorities to educate the laboratory workers as well as the masses on the etiological agents, the possible risk factors, routes of transmission and health implication of *Staphylococcus aureus* infection and ways of preventing these bacteria in the Laboratories especially in Federal College of Medical Laboratory Science and Technology Jos Nigeria.

Keywords: *Staphylococcus aureus*; Noncritical Surfaces of Laboratory; MRSA

Introduction

In healthcare certain, noncritical surfaces are the areas that come in contact with hands of patients or healthcare professionals who have been exposed to infected patients. Noncritical surfaces are at the center of continuous transmission and spread of nosocomial pathogens. The knowledge of such issues in healthcare environment

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J Inf Dis Trav Med

informs patients, patients' relatives and caregivers an ample opportunity to ensure disinfection, sterilization and maintenance of hygiene so as to prevent nosocomial infections [1]. Noncritical areas abound in various health environments ranging from clinics to laboratories. *Staphylococcus aureus* is a Gram positive cocci and aerobe that has been implicated in most nosocomial infection. Although a normal flora of the skin, *Staphylococcus aureus* when opportune causes many infections [2]. Microscopic morphology of *S. aureus* cells are Gram-positive and appear in spherical shape. They are often in clusters resembling bunch of grapes when observed under light microscope after Gram staining. It is versatile human pathogen responsible for nosocomial and community-associated infection and associated with high morbidity and mortality rates [3]. In the developing world, mortality associated with severe *Staphylococcus aureus* infections far exceeds that in developed countries [4]. Emerging reports revealed that *Staphylococcus aureus* infections have continued to rise in health care facilities increasing the rate of hospital acquired infections with increased emergence of strains resistant to Methicillin called Methicillin Resistant *Staphylococcus aureus* (MRSA). MRSA infection has resulted in prolonged hospital stay, increased medical expenses and difficulty in patient treatment and management [4].

The unique characteristic of MRSA strains is the multidrug resistance pattern to β-lactam and other classes, due to acquisition of mecA gene, key genetic determinant located on the *Staphylococcal cassette* chromosome (SCCmec). The mecA gene, encodes the PBP2a an inducible 75b PBP responsible for low-affinity to β-lactam and other drugs [5]. Recent reports from Nigeria have indicated that the prevalence of hospital-associated MRSA varies in health care institutions. Also, a number of investigations have reported that *Staphylococcus aureus* is among the most frequently encountered bacterial species in microbiology laboratories in Nigeria [6]. For effective treatment of *Staphylococcus aureus* infections, adequate information and data on susceptibility patterns and characterization of the organism are of great importance [6]. However, available data are relatively limited in this locality when compared to information from other parts of the world.

The statement of problem leading to this study is that *Staphylococcus aureus* is one of the leading causes of skin and soft tissue infections such as abscesses (boils), furuncles, and cellulitis. Although most staph infections are not serious, *S. aureus* can cause serious infections such as bloodstream infections (sepsis), pneumonia, or bone and joint infections.

The study is justified by the fact that many hospitals and laboratories in Nigeria have reported many diseases such as boils, furuncles and cellulitis caused by *Staphylococcus aureus* [3] and many MRSA bacteria isolated from noncritical surfaces [1]. Notably, limited numbers of studies have been conducted in this area, therefore, the findings of this research will be documented for future reference. The findings of this study may also aid in creating awareness to the Staff, Students and to the general public on the route and danger of this infection.

The findings may also be used by health authorities to better target preventive measures and enhance access to at least basic sanitation and regular disinfection of laboratories including training institutions laboratories. Studies abound in Clinics, Hospitals and diagnostic Laboratories but not noticeable among medical laboratory training institutions especially in Nigeria. This study therefore was aimed at determining the prevalence of *Staphylococcus aureus* on noncritical surfaces of laboratories in a teaching institution including Benches, chairs, Doors and Windows in Federal College of Medical Laboratory Science & Technology, Jos Nigeria.

Materials and Methods

The study was conducted in Federal College of Medical Laboratory Science & Technology Jos, Nigeria in the training and Research laboratories. The study was carried out between May and July 2022. The sample size was based on the numbers of Benches, Chairs, Windows, and Doors present in the laboratories. Main Laboratory has 8 Benches, 67 Chairs, 12 Windows and 8 Doors, Side laboratory One has 5 Benches, 5 Chairs, 3 Windows and 1 Door, Side laboratory Two has 4 Benches, 3 Chairs, 3 Windows and 1 Door. Therefore, a total of 120 Samples were examined. A verbal consent was obtained from head of the main Laboratory, and the side laboratories respectively before using the laboratories Samples were collected from different locations using sterile swap sticks, and each sample was labeled properly and was transported to the appropriate bench for culturing. The preparation of Blood Agar and Chocolate Agar was done according to the procedures highlighted by Ochie & Kolhatka [7] followed by inoculation and culturing (incubation). After incubation at 37°C for 24 hr, the morphological and appearances examination of cultured plates as described by Cruick, et al. [8] which include: color, shape, size, edge, pigmentation, consistency, opacity and fermentation of lactose and mannitol on the media were noted. Preparation of Smear and Gram Staining Techniques were done in line with Ochie & Kolhatka [7] followed by Biochemical tests were used for the identifications of *Staphylococcus aureus* based on the differences in the biochemical activities of the bacteria especially with Catalase Test and Coagulase Test according to method described by Ryan, et al. [9]. All data obtained from this research were analyzed statistically using percentage prevalence method.

Results

It was observed that out of the 120 samples examined, 8 were gram positive cocci in clusters. Specific biochemical tests were used to identify the organisms, and the 8 organisms were *Stapylococcus aureus* with a prevalence rate of 6.67%.

The Tables 1-5 shows the nitty-gritty of the results with the Figures 1-3 showing Growths of *Stapylococcus aureus,* Gram positive cocci under the microscope (X100) and Coagulase positive results respectively.

Source	No. Examined	No. Negative	No. Positive	Percentage Positive (%)
Benches	17	14	3	2.5
Chairs	75	73	5	4.17
Windows	18	17	0	0
Doors	10	8	0	0
Total	**120**	**112**	**8**	**6.67**

Table 1: Distribution of *Staphylococcus aureus* in the Laboratories.

Laboratories	No. Examined	No. Negative	No. Positive	Percentage Positive (%)
Main Laboratory	95	69	6	5
Side Laboratory one	14	12	2	1.67
Side Laboratory two	11	11	0	0
Total	**120**	**112**	**8**	**6.67**

Table 2: Distribution of *Staphylococcus aureus* in Relation to Laboratory Sections.

Noncritical Surfaces	No. Examined	No. Negativity	No. Positive	Prevalence (%)
Benches	17	14	3	2.5
Chairs	75	70	5	4.17
windows	18	18	0	0
Doors	10	10	0	0
Total	**120**	**112**	8	6.67

Table 3: Result of the Gram Stain of the Colonies.

Noncritical Surfaces	No. Examined	No. Negative	No. Positive	Prevalence (%)
Benches	17	14	3	2.5
Chairs	75	70	5	4.17
windows	18	18	0	0
Doors	10	10	0	0
Total	**120**	**112**	**8**	**6.67**

Table 4: Results of Catalase Test.

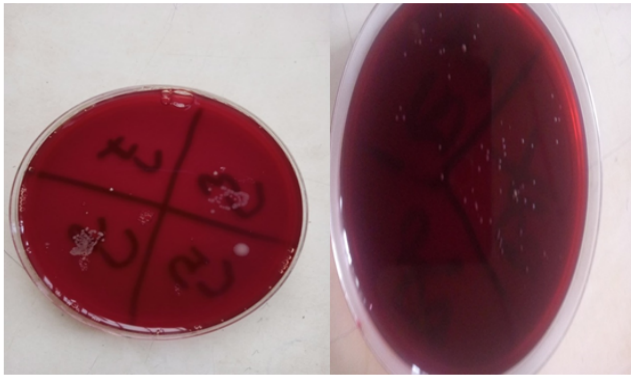| Noncritical Surfaces	No Examined	No. Negative	No. Positive	Prevalence(%)
Benches	17	14	3	2.5
Chairs	75	70	5	4.17
Windows	18	18	0	0
Doors	10	10	0	0
Total	**120**	**112**	**8**	**6.67**

Table 5: Results of Coagulase Test.

Figure 1: *Stapylococcus aureus* growth on blood agar plates.

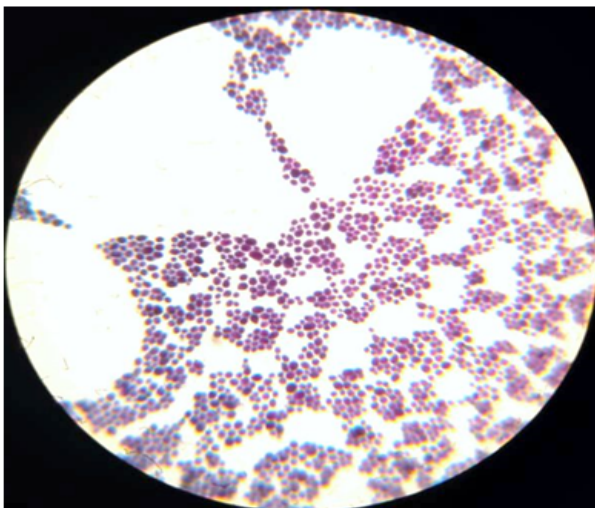**Figure 2:** *Staphylococcus aureus* growth on chocolate agar plate.

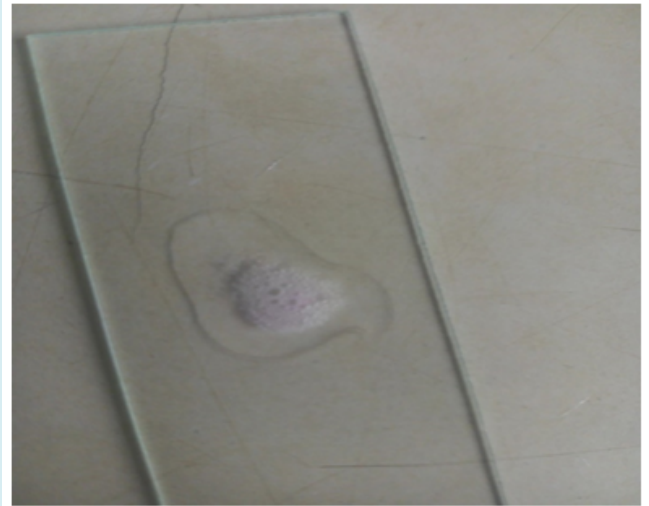**Figure 3:** *Staphylococcus aureus* seen after gram staining (X100).

Figure 4: Positive Catalase Test in the study.

Discussion

Staphylococcus aures being a bacterium that causes germs mostly on noncritical surfaces was isolated from such areas in the laboratories of Federal College of Medical Laboratory Science & Technology Jos, though with a lower prevalence rate of 6.67%. This prevalence obtained from this research is lower when compared to the work of Uzomoh, et al. [10], who documented the prevalence rate of 12.5%. This may be due to different time of study of the researchers. It can equally be attributed to the fact that the hygiene of the laboratory might have increased especially in the training institution under study. Agbo, et al. [1] and Amare, et al. [11] in their studies identified such MRSA from noncritical and inanimate surfaces of hospitals closer to patients and not medical laboratory area.

The isolation *Staphylococcus aureus* from the laboratory should not be surprised since the laboratory is used frequently by laboratory personnel, lecturers and students, and as a result of this, the bacteria can easily be distributed on Benches, laboratory Doors, Seats and other noncritical areas. Though the laboratory is cleaned and sterilised always, a single table or seat that is left un-cleaned or disinfected can lead to the contamination of others according to Chambers, et al. [12].

It was discovered also that *Staphylococcus aureus* was isolated from working Chairs (seats) more than the working benches. This though in Laboratory chairs is just like the work of Amare, et al. [11] that showed high prevalence of bacteria in chairs in the hospital studied. This could be attributed to the fact that the Benches are always disinfected and cleaned

with less emphasis on the chairs after use. Samples are kept on Benches to be examined always and some of those samples might have been contaminated by *Staphylococcus aureus* and even other pathogens. According to Joseph [13], the isolation of *Staphylococcus aureus* from hospital surfaces such as working Benches and Chairs is a clear indication that the professionals needs strict compliance to infections control than allowing only the cleaners to concentrates more in cleaning and disinfecting the floors, giving less attention to the working Benches and Chairs which lead to the build up of *Staphylococcus aureus* infections on various surfaces. The laboratory personnel and students on the other hand during practicals distribute these bacteria to other places especially on the seats.

It is therefore advised that preventive measures such as improved personal hygiene and regular cleaning and disinfection of the Laboratory Chairs and Benches are highly recommended to avoid the tendency for the bacteria to be present in every laboratory noncritical surfaces and laboratory equipment since there are students and Staff using the same laboratory and equipment.Several studies [14-17] on *Staphylococcus aureus* infections provides direction towards the epidemiology, infectivity and susceptibility with regards to *Staphylococcus aureus* therefore more attention should be given to disinfection in medical laboratory surfaces. The study is limited by the fact that Only *Staphylococcus aureus* was the organism of interest in this study due to logistics and financial challenge.

Conclusion

The isolation of *Stapylococcus aureus* from the furniture of the laboratory is dangerous to both the Staff and Students as these contaminants have the ability to cause diseases, ranging from food poisoning, to cellulitis, fever, nausea, and diarrhea or to a more dangerous infections. Though the prevalence of 6.67% obtained in this study is low, the safety of the laboratory should not be taken for granted because the isolation of *Staphylococcus aurous* from these locations shows that the laboratory needs to be cleaned and disinfect regularly to maintain a healthy working environment for both staff and students of the College. This therefore stresses the urgent need for public enlightenment campaigns by the appropriate authorities to educate the laboratory worker as well as the masses on the etiological agents, the possible risk factors, routes of transmission and health implication of *Staphylococcus aureus* as well as ways of preventing and control of these bacteria in the Laboratories. The authors hereby recommend that:
- Students and Staff involved the Laboratories should be made aware of the possible risk factors associated with *Staphylococcus aureus* and the health implications.
- The management of the College should intensify efforts

to implement the quality of the Laboratories through public enlightenment campaigns and re-training of cleaning personnel in addition to adequate supervision of the cleaning and disinfection of the Laboratory.
- Regular and proper environmental sanitation should be practice in the Laboratory in order to bring back good sanitary condition in the laboratories.
- Disinfection of Benches, chairs, Doors and windows should be done regularly in the College laboratories because bacteria are everywhere, they can easily get into the hands and items touched during daily activities and cause infection.
- Regular cleaning of hands with soap and water or hand sanitizer that contain at least 60% alcohol is one of the most important step to avoid the spread of bacteria in the laboratory.
- Prompt diagnosis and treatment of infected students and staff is highly recommended.

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