**Prevalence of Methicillin-Resistant Staphylococcus aureus in Nasal Cavity of Medical Students at Shendi University, Sudan**

**Abstract:**

***Background*:** *Methicillin-resistant Staphylococcus aureus* (MRSA) is becoming ever more prevalent in Sudan, and the proportion of *MRSA* to *methicillin-sensitive Staphylococcus aureus* (MSSA) seems to be increasing. New strains of MRSA are ever-developing resistance to antibiotic treatment, increasing morbidity and mortality rate. ***Objectives:*** To detect the prevalence of *methicillin-resistant Staphylococcus aureus* in the nasal cavity of medical students at Shendi University and to detect variations of MRSA Colonization between student smokers and non-smoker students. ***Methodology:*** 60 swabs were collected from medical students of Shendi University, culture, and direct gram stain were done, then the plates were examined for any significant bacterial growth. The isolated bacteria were then identified by colonial morphology, indirect gram stain, and biochemical tests. ***Results:*** All data were analyzed using Statistical Package for Social Sciences (SPSS). Of these, 66.7 % (40/60) were males. 33.3% (20/60) were females. The isolated organism was *Staphylococcus aureus* 24 (40%), with no growth 36 (60%). The study showed that the overall resistance *of Staphylococcus aureus* to Methicillin was 21 (35%) and 3 (5%) Sensitive to Methicillin. 9(100%) of Smoker students were resistance *S Staphylococcus aureus* to Methicillin, 12(80%) of non-Smoker students were resistance *Staphylococcus aureus* to Methicillin. 3 (20%) of non-Smoker students were *Staphylococcus aureus* Sensitive to Methicillin. ***Conclusion:*** The carriage rate of *S. aureus* is consistent with similar studies. MRSA carriage in this university study appears high as compared to the general population. Although this study did not confirm a variety of risk factors for the carriage of MRSA previously identified by others, university healthcare personnel should be aware of the changing epidemiology of MRSA and the preventive measures needed to avoid outbreaks.

***Keywords:*** MRSA, *Staphylococcus aureus*, Smoker, Shendi, Sudan.

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**Introduction:**

*Staphylococcus aureus* (SA) is a Gram-positive opportunistic bacterium that commonly colonizes the mouth, nasal passages, and skin of healthy individuals. This can lead to a variety of local and invasive problems, ranging from superficial skin infections to life-threatening pneumonia and bacillus infections.SA infections have been occurring in humans since ancient times. Rice field. Shortly after penicillin was first used to treat his SA infection in 1940, the first penicillin-resistant SA strains emerged **[1].** Antibiotic-resistant SA strains are considered a major health problem **[2].** Meta-analysis of studies of *S. aureus* bacteremia that were published from January 1980 through December 2000 demonstrated significantly increased mortality associated with MRSA infection, compared with infection due to *methicillin-susceptible S. aureus* (MSSA) **[3].** There is strong evidence that SA is transmitted between patients and dentists through the clinical setting **[4].** The presence of SA has been demonstrated to be associated with oral mucosal disorders such as angular stomatitis, erythema, swelling, and burning, suggesting a role for SA in oral mucosal disorders. Nasal and oral transport of methicillin-resistant SA (MRSA) serves as a reservoir for recolonization of other body sites and cross-infection between patients and medical staff **[5].** In addition to genetic differences, infections with CA-MRSA are generally different. Although CA pathogens are most commonly associated with skin and soft tissues (abscesses, boils, folliculitis), pathogens acquired in healthcare facilities are associated with respiratory, cardiovascular, urological, and surgical sites. More likely to become infected. In addition, CA-MRSA is susceptible to non-lactam antibiotics (clindamycin, trimethoprim-sulfamethoxazole, tetracycline, etc.) **[6].** MRSA can cause highly invasive, rapidly progressive, life-threatening infections, such as necrotizing pneumonia, severe sepsis, and necrotizing fasciitis **[7,8].** Individuals with MRSA colonization or carriage (that is, the presence of bacteria that do not cause a detectable host immune response, cellular damage, or clinical signs and symptoms of infection) have an increased risk of subsequent infection and are an important source of person-to-person transmission. Healthcare facilities host persons who are predisposed to infection (for example, owing to invasive procedures and/or immune compromise) and are environments with high antibiotic selection pressure (which can contribute to the selection of antimicrobial resistance in bacteria) and frequent contact between

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individuals. These conditions have facilitated the epidemic spread of MRSA in hospitals; MRSA is now endemic in many healthcare facilities throughout the world and, as a consequence, it has become a major focus for infection control efforts globally.

**Materials and methods:**

**Study design:**

It was a descriptive cross-sectional based study, conducted to detect the Prevalence of *Methicillin-Resistant Staphylococcus aureus* in the Nasal Cavity of Medical Students at Shendi University.

**Study area:**

This study was conducted at Shendi University was be collected nasal swab samples. Then the collected samples were transferred to the Microbiology lab at Shendi University where they were processed and examined

**Study duration:**

This study was conducted from July to December 2022.

**Study populations:**

Participants involved in this study were all-age medical students at Shendi University

**Study sample:**

A nasal swab sample was taken from each participant to detect *staphylococcus aureus* and MRSA after culturing and Susceptibility testing

**Sample size:**

A Sixty (60) Nasal swab sample was taken from participants.

**Sample collection:**

Best results were obtained by using a flocked swab in combination with Amies transport medium." Flocked swabs provide better sample collection due to their brush-like tip, which releases higher numbers of target cells and retains more liquid samples than foam swabs. Once a swab and transport medium, like Puritan's Opti-Swab Media Transport System, was selected, the tester should wash their hands and put on clean gloves.

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**Culturing method:**

Used to detect *staphylococcus aureus* and antimicrobial resistance or sensitivity was detected by using the susceptibility method.

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**Susceptibility testing:**

Both disk diffusion and MIC methods employed the phenotypic identification of susceptibility. Disk diffusion method (also known as the Kirby-Bauer test) is appropriate for rapidly growing organisms. In this procedure standard turbidity (McFarland 0.5) solution wasis prepared to compare its color with the turbidity of the bacterial suspension by using sterile loop touch 3_5 well-isolated colonies of the tested organism in 3_4 ml of saline or nutrient broth. Using a sterile swab inoculate a plate of Mueller Hinton agar. Streak the swab over the media in three directions. By sterile forceps place antibiotic-impregnated disks on Mueller Hinton agar plates inoculated with the test organism. After incubation (typically 16 to 18 hours) examine the diameter of the zone of inhibition around each disk. Each organism-antibiotic combination has different diameters.

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**Quality controls:**

Sterile disposable swabs are used to collect the samples, and nasal swab samples must be cultured. Wet preparation Smear‹air dry ‹fixed the air-dried smear by flame. Staining by gram stain. All dishes and slides will be washed before and after use. The quality of staining solutions will be checked before used. During work, all swabs will be closed well to avoid contamination. Contamination also will be avoided during culturing by culture near the flame.

**Data analysis and presentation:**

Data will be computed and analyzed by using Statistical Package for Social Sciences software program; version (21.0). The means will be obtained; other variables, frequencies, and percentages will be calculated and presented in the form of tables. The value will be used to assess the significance of the results.

**Ethical consideration:**

The study will be approved by the department of Microbiology in Medical Laboratory Sciences at Shendi University; the study will be matched to the ethical review committee

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board. Sample collection will be done after signing a written agreement with the participants. Permission for this study will be obtained from the local authorities in the area of study. The aims and the benefits of this study will be explained with the assurance of confidentiality.

## Results

A total of 60 nasal swabs were taken from a medical student at Shendi University. In this study, 17 (28.3%) samples are aged ranged from17-20 years, 43(71.7%) age ranged from 20-45years, there is no statically significant association between the carrying of *S. aureus* and age (*P. value* = 1.00) **(Table 1).** 66.7 % (40/60) were males. 33.3% (20/60) were females, there is no statically significant association between the carrying of *S. aureus* and gender (*P. value* = 0.75) **(Table 2).** The isolated organism was *S. aureus* growth of 24 (40%), with no growth of 36(60%) **(Table 4).** The study showed that the overall resistance of S. *aureus* to Methicillin was 21 (35%) and 3 (5%) Sensitive to Methicillin **(Table 5).** 9(100%) of Smoker students were resistance S. *aureus* to Methicillin .12(80%) of non-Smoker students were resistance S. *aureus* to Methicillin. 3(20%) of non-Smoker students were S. *aureus* Sensitive to Methicillin, and there is no statically significant association between Smokers students and non-smokers on resistance *S. aureus* to Methicillin (*P. value* = 0.75 ) **(Table 6).**

**Table (1): Distribution of study population according to age**

| *Age* | *Frequency* | *Percent%* |
|---|---|---|
| 17-20 *years* | 17 | 28.3% |
| 21-24 *years* | 43 | 71.7% |
| **Total** | **60** | **100.0%** |

**Table (2): Distribution of the study population according to gender**

| *Sex* | *Frequency* | *Percent %* |
|---|---|---|
| *Male* | 40 | 66.7 |
| *Female* | 20 | 33.3 |
| **Total** | **60** | **100.0%** |

**Table (3): Distribution of the study population according to Smoking**

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| *Smoking* | *Frequency* | *Percent%* |
|---|---|---|
| *Smoker* | 20 | 33.3 |
| *Non smoker* | 40 | 66.7 |
| **Total** | **60** | **100.0%** |

**Table (4): Distribution of the study population according to *S. aureus* growth**

| *Growth of S. aureus* | *Frequency* | *Percent%* |
|---|---|---|
| *Growth* | 24 | 40.0 |
| *No growth* | 36 | 60.0 |
| **Total** | **60** | **100.0%** |

**Table (5): Distribution of study population according to *S. aureus* Susceptibility to Methicillin**

| *Susceptibility to Methicillin* | *Frequency* | *Percent%* |
|---|---|---|
| *Sensitive* | 3 | 5.0% |
| *Resistance* | 21 | 35.0% |
| **Total** | **24** | **40.0%** |

**Table (6) Variation of Susceptibility to Methicillin between smokers and non-smokers**

| Variable | Sensitive | Resistance | Total |
|---|---|---|---|
| *Smokers* | 0 | 9 | 9 |
| *Non smokers* | 3 | 12 | 15 |
| **Total** | **3** | **21** | **24** |



**Discussion:**

The nasal carriage of *S. aureus* varies depending on the different populations studied. This study was conducted in River Nile State, Shendi University from March 2021 to February 2022. 60 nasal swab samples were collected randomly from healthy students and smoker students of both sexes, where 20 students of them were male non-smokers

and 20smoker and the other 20 students were females. 24 samples of students show growth of *S. aureus* on the selective media mannitol salt agar and 36 samples show no growth. Age ranged between (17-20 years) showing 1 sensitive and 7 resistance. Age ranged between (21-24years) showing 2 sensitive and 14 resistance. 14 samples from the male show 12 resistance and 2 sensitive. 10 samples from females show 9 resistances and 1senstive. We found 9 samples from smoker students show resistance and 0 Sensitive. 15 samples from non-smoker students show 12 resistance and 3 sensitive. This study found 40% of the population are carriers of *S. aureus* and 95% are resistant to methicillin. 60 (29.6%) carried *S. aureus. S. aureus* carrier (OR=3.0, 95% CI 1.28-7.03). Of the 60 participants that carried *S. aureus*, 15 were identified as MRSA. This relates to a 7.4% MRSA carriage rate among generally healthy university students. This result is in agreement with the result obtained by Rodney E Rohade at Texas University (2009) **[9].** MRSA nasal colonization was found to be low outside of the healthcare environment. Smokers and oral contraceptive users have high nasal carrier rates. Comparison with our result shows smoking increases MRSA colonization. 9(100%) of Smoker students were resistance *S. aureus* to Methicillin .12(80%) of non-Smoker students were resistance *S. aureus* to Methicillin. 3(20%) of non-Smoker students were *S. aureus* Sensitive to Methicillin. but the result was not statically significant may be due to the low sample size.

**Conclusion:**

The carriage rate of *S. aureus* is consistent with similar studies. MRSA carriage in this university study appears high as compared to the general population. Although this study did not confirm a variety of risk factors for the carriage of MRSA previously identified by others, university healthcare personnel should be aware of the changing epidemiology of MRSA and the preventive measures needed to avoid outbreaks.



**References:**

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