wjpmr, 2018,4(2), 196-200

SJIF Impact Factor: 4.639

WORLD JOURNAL OF PHARMACEUTICAL AND MEDICAL RESEARCH

www.wjpmr.com

Research Article

ISSN 2455-3301

WJPMR

NASAL CARRIAGE OF STAPHYLOCOCCUS AUREUS AMONG HEALTHY STUDENTS IN A NIGERIAN UNIVERSITY

***[1]Dr. James Garba Damen, [1]Essien Unyime Cosmas and [2]Victoria M. Daminabo**

[1]Department of Medical Laboratory Science Faculty of Medical Sciences University of Jos.
[2]Department of Science Laboratory Technology, School of Science and Technology, Port Harcourt Polytechnic, Rumuola, P.M.B. 5936, Port Harcourt, Rivers State.

***Corresponding Author: Dr. James Garba Damen**

Department of Medical Laboratory Science Faculty of Medical Sciences University of Jos.

Article Received on 19/12/2017 **Article Revised on 09/01/2018** **Article Accepted on 30/01/2018**

ABSTRACT

Background: *Staphylococcus aureus* (*S. aureus*) nasal carriage is potential source for their continuous spread as well as risk factor for subsequent infections. Studies on *S. aureus* nasal carriage are important in determining the epidemiology of staphylococcal infections and a guide to infection control and preventive measures. **Aim of the study:** The present study was conducted to investigate the carriage prevalence and antibiotic susceptibility of *S. aureus* among students studying Medical Laboratory Science at the University of Jos. **Materials and methods:** Two hundred and forty one (241) nasal swab specimens were obtained from Medical laboratory science students of the University of Jos. Swabs were plated on Mannitol salt agar (MSA), culture plates were incubated at 37°C for 18-24hours. After incubation *S. aureus* isolates were identified by their characteristic yellowish colony on MSA. Standard inocula were prepared by adjusting density of saline suspension of *S.aureus* to 0.5 McFarland's standard. Antibiotic sensitivity was performed on Mueller Hinton agar by disc diffusion method. Zone diameter was read according to Clinical and Laboratory Standards Institute (CLSI) interpretative break point (CLSI 2004). **Results:** This study has established an overall carriage prevalence of 37.3%. The carriage rate was more in female 51 (40.4%) than male students 39 (33.9%). Regarding year of study 300level students 53 (46.4%) recorded the highest carriage rate while the least was noted among 500 level 8 (21.6%). Antibiotic susceptibility testing was performed using eight (8) antibiotics disc, all the isolates tested (n=90) were susceptible to vancomycin 90 (100.0%). **Conclusion:** There is high prevalence of *S. aureus* nasal carriage among Medical Laboratory Students at University of Jos. We recommend that studies on other potential sources like health care workers, medicine students, nursing students etc. be carried out in our setting.

KEYWORDS: *Staphylococcus aureus*, nasal carriage, Medical laboratory science students.

INTRODUCTION

Staphylococcus aureus is carried by 20-30% of the human population (Van Belkum *et al.*, 2009). Healthy individuals may be persistent carriers of *Staphylococcus aureus* (*S. aureus*) for periods ranging from a few weeks to many years and mostly in the anterior nares (Kluytmans *et al.*, 1997). Also carriers can be healthy human or animal host, carrying potentially pathogenic microorganisms without their knowledge or showing any clinical signs and symptoms of illness (Nester *et al.*, 2004).

Colonization of the anterior nares is a recognized risk factor for subsequent *S. aureus* infection (Wertheim *et al.*, 2005). Risk factors for colonization include young age, gender, hospitalization and exposure to livestock (Von Eiff *et al.*, 2001; Aubry-Damon *et al.*, 2004; Wertheim *et al.*, 2005; Gorwitz *et al.*, 2008).

Although *Staphylococcus aureus* can be regarded as human commensal, it is a potential lethal opportunistic pathogen causing varieties of community-acquired and hospital acquired bacterial infections. *S.aureus* is the main cause of opportunistic infections and diseases such as skin infections including staphylococcal scalded skin syndrome (SSSS), osteomyelitis, meningitis, pneumonia, septicemia (Shanmugam *et al.*, 2009). However, *S.aureus* spreads more likely from healthy nasal carriers from their hands, nose or throat by way of touching, sneezing, talking and coughing (Shanmugam *et al.*, 2009).

In addition, several reports have further revealed the serious problem posed by *S. aureus* infections due to its spread between healthy hospital personnel and patients and vice versa, medical students as well as non clinical students were not left out in the cycle of transmission (Lamikanra *et al.*, 2006; Adesida *et al.*, 2007; Santhosh

et al., 2007; Baliga *et al.*, 2007; Shanmugam *et al.*, 2009).

Although a variety of studies have been conducted to examine the prevalence of nasal carriage of *S. aureus* among general population, but only little or no study had been conducted among students in the University of Jos. Therefore, this study was aim to determine the prevalence and antibiotic susceptibility profile of nasal carriage of *S. aureus* among medical laboratory science students at the University of Jos.

MATERIALS AND METHOD

Study area/population

This study was carried out among Medical Laboratory Science Students University of Jos, Plateau State, Nigeria. Jos is a city located in the middle belt geopolitical zone in Nigeria and it is the administrative capital of Plateau State.

Sample size

The minimum sample size for this study was calculated using the formula (Daniel, 1999).

$$N = \frac{Z^2 P(1-P)}{d^2}$$

N= minimum sample size, Z= (1.96) constant mean deviation, 1= constant.
P= local prevalence of similar previous study, d^2= Degree of precision adopted for the study = 0.05.

Collection of specimen

Two hundred and forty one (241) students of the department of medical laboratory science at the University of Jos were used in this study. After informed consent of each student was obtained, questionnaires were administered to all students who volunteered for the study. The data obtained from the questionnaires include student's age, sex and level of study.

The specimens were collected as follows: a sterile cotton tipped swab was moistened in sterile normal saline and swirled inside the anterior nares and rotated clock wise and anticlock wise. Swabs were streak-inoculated onto mannitol salt agar (MSA) (Oxoid), a selective medium for the isolation of *S. aureus.* The plates were incubated at 37^0C for 24hours and observed for growth. After growth, *S.aureus* were identified on the basis of colonial characteristics, Gram stain, biochemical tests namely, catalase and coagulase.

Preparation of standard inoculum

The agar diffusion method recommended by the CLSI (2004) was employed to determine the susceptibility to antibiotics. Briefly, the standard inoculum of pure isolates of *S.aureus* was prepared by transferring 2-4 representative isolates from culture plates into a universal bottle containing sterile normal saline. The preparation was shaken to achieve a homogenous suspension. Standard inoculum was achieved by adjusting the turbidity of homogenous suspension with 0.5 McFarland standard.

Antimicrobial sensitivity testing

Mueller Hinton Agar (MHA) was used to perform antimicrobial sensitivity testing. The dried agar surface was inoculated by using a sterile swab dipped in a standardized *S.aureus* cell suspension. Antibiotic discs were dispensed on dried surface of Mueller Hinton agar and the plates were incubated aerobically for 35°C and read at 24 h. Zone diameter were read manually using ruler and interpreted according to CLSI interpretative break point (CLSI, 2004). The following antibiotics were tested: vancomycin, gentamicin, ciprofloxacin, chloramphenicol, tetracycline, streptomycin, ampicillin, and erythromycin.

STATISTICAL ANALYSIS

The data was subjected to statistical analysis using SPSS statistical package 21 to determine any significant relationship between nasal carriage and age, gender and level of study. P value < 0.05 was considered significant at 95% confidence interval.

RESULT

Out of 241 nasal swab samples collected and screened, 90(37.3%) yielded *S.aureus.* The prevalence of nasal carriage of *S.aureus* according to gender shows that female students 51(40.4%) had the highest colonization rate compared to their male 39(33.9%) counterpart. There was a statistically significance difference in gender colonization rate (P=0.00). Regarding age group, the nasal colonization rate of *S.aureus* occurred in this order: 16-20 years (5 isolates, 50.0%), 26-30years (20 isolates, 42.5%), 21-25years (60 isolates, 37.0%), 31-35years (6 isolates, 35.0%) and 36-40years (1 isolate, 20.0%). There was no observed significance difference in the colonization of *S.aureus* in relation to age group as recorded in table 1.

Table 2 shows the colonization rate of *S.aureus* in relation to year of study. Results revealed that 300 level students 53(46.4%) had the highest carriage of *S.aureus*, while the least colonization rate was observed among 500 level students 8(21.6%). However, there was significant difference in colonization rate of *S. aureus* in relation to year of study (p=0.01).

Susceptibility pattern of nasal isolates was in this order: vancomycin 90 (100.0%), > gentamicin 71 (78.8%), > ciprofloxacin 48 (53.3%) ~ chloramphenicol 48 (53.3%), > tetracycline 45 (50.0%), > streptomycin 39 (43.3%), > ampicillin 8 (8.8%), > erythromycin 3 (3.3%) (figure 1.).

Table 1: Distribution of *Staphylococcus aureus* nasal carriage among Medical Laboratory Science Students at the University of Jos in relation to gender and age.

Variables	No. examined	No. Positive (%)	p-value
Gender			
Male	115	39 (33.9)	0.00
Female	126	51(40.4)	
Age group			
16-20	10	5(50.0)	
21-25	162	60(37.0)	0.76
26-30	47	20(42.5)	
31-35	17	6(35.0)	
36-40	5	1(20.0)	
TOTAL	**241**	**90(37.3)**	

Table 2: Distribution of *Staphylococcus aureus* nasal carriage among Medical Laboratory Science Students at the University of Jos in relation to year of study.

Year of study	No. examined	No. positive (%)	p-value
100	18	8(44.4)	
200	26	11(42.3)	
300	114	53(46.4)	0.01
400	46	10(21.7)	
500	37	8(21.6)	
TOTAL	**241**	**90(37.3)**	

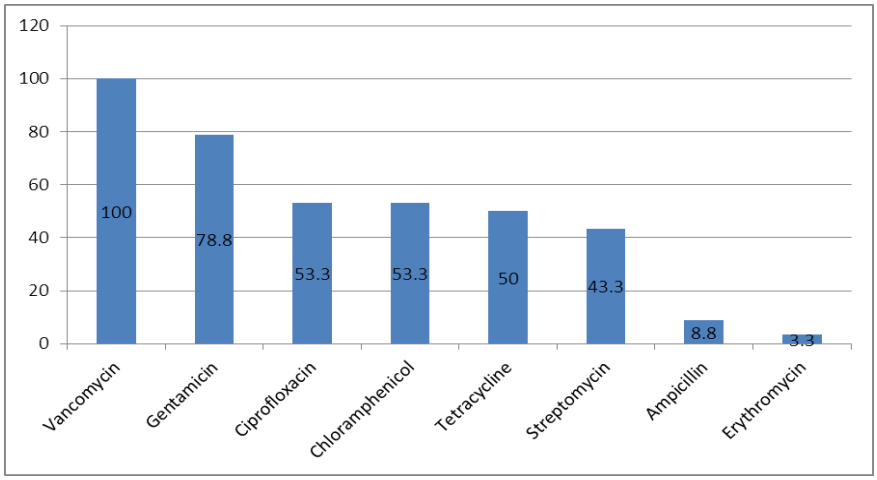

Figure 1: Antibiotic sensitivity pattern of *Staphylococcus aureus* nasal carriage among Medical Laboratory Science Students at the University of Jos.

DISCUSSION

S. aureus is a normal commensal in the nose of about 20-30% of healthy people (Van Belkum *et al.*, 2009). Different factors contribute to the transmission of this microorganism, such as crowded living conditions and poor hygiene (David and Daum, 2010; Shibabaw *et al.*, 2013). The presence of *S. aureus* on the skin appears to play a key role in the pathogenesis of infection with *S. aureus* (Casewell and Hill, 1986; Wertheim *et al.*, 2005). Eradication of *S. aureus* from the nose reduced the incidence of invasive infection (VonEiff *et al.*, 2001; Wertheim *et al.*, 2005).

In this study, the prevalence of *S. aureus* nasal carriage among students was 37.3%. This value is higher than the results 26.7% of previous study conducted by Muhammad *et al.*, (2014) from Maiduguri, Nigeria, 19.3% by Chen *et al.*, (2012) from Taiwan and 17.5% by Assafi *et al.*, (2015) from Iraq. However, our prevalence was relatively low compare to similar study reports 72.7% by Ugwu *et al.*, (2016) from Delta, South South Nigeria, 70.0% by Akinjogunla *et al.*, (2014) from Uyo South South Nigeria, 56.3% by Nsofor *et al.*, (2015), from Owerri and 69.4% Okamo *et al.*, (2016) in Tanzania. We attribute the variation in the prevalence to the difference in the geographical location of the study areas.

With respect to gender, the prevalence rate from female to male students were 51(40.4%) and 39 (33.9%) respectively. This observation is in line with the findings of Ugwu *et al.*, (2016) in Delta, Nigeria, Assafi *et al.*,

(2015) in Iraq, Lamikanra *et al.*, (1985) in Ife, Nigeria and Muhammad *et al.*, (2014). However, our results is inconsistent with the report of Abdulhadi *et al.*, (2008) who revealed that male 61.5% had higher prevalence of *S. aureus* nasal carriage than their females 38.5% counterpart among students population in Kano metropolis.

A total of 8 different antibiotics were used to test for susceptibility pattern of *S. aureus* nasal carriage isolates (n=90). Our study revealed that all isolates were sensitive to vancomycin 90 (100.0%). This finding is the same as the susceptibility result obtained in a similar study in Tanzania where all the *S. aureus* nasal isolates were sensitive to vancomycin (Okamo *et al.*,2016). However, contrary reports from similar studies has been documented: 81.3 % susceptibility to ciprofloxacin and pefloxacin Muhammad *et al.*, (2014) from Maiduguri, Nigeria, 100.0% sensitivity to cotrimoxazole Lamikanra *et al.*, (1985) in Ife, Nigeria.

CONCLUSION

To the best of our knowledge, this is the first study investigating nasal carriage prevalence, antimicrobial resistance of S. aureus among Medical laboratory science students at the University of Jos, Nigeria. The study recorded an overall prevalence of 37.3%. The carriage rate was higher in female 51 (40.0%) than male 39 (33.9%). Further studies may be required to established carriage rate in health workers, Medicine and surgery students and Nursing students so as to further the niches of this strain.

REFERENCE

1. Abdulhadi, K. S., Hassan, H. A., and Da'u, A. Nasal carriage of *Staphyloccus aureus* among students in Kano Nigeria. *International journal of Biomedical and Science*, 2008; 4(4): 151-154.
2. Adesida, S.A., Abioyi, O.A., Banero, B.S., Brai, B.T.C., Smith, S.I., Amisu, K.O., Ehichioya, D.U., Ogunsola, E.T. and Coker, A.O. Associated risk factors and pulse-field gel electrophoresis of nasal isolated of S*taphylococcus aureus* from medical students in a tertiary hospital in Lagos, Nigeria. *Brazilian J Infect. Dis.*, 2007; 11(1).
3. Akinjogunla, O. J., Ajayi, A.O., Ekeh, N.O. Virulence factors and antibiotic resistant *Staphylococcus* spp from the anterior nares of apparently healthy undergraduate students in Uyo. *American Journal of Research Communication*, 2014; 2(11): 158-180, 2325-4076.
4. Aubry-Damon, H., Grenet, K., Sall-Ndiaye, P., Che, D., Cordeiro, E, et al. Antimicrobial resistance in commensal flora of pig farmers. *Emerg Infect Dis*, 2004; 10: 873–879.
5. Baliga, S., Bansil, R., Suchitra, V., Bharati, B., Vidyaniketan, K. and Shenoy, S. Nasal carriage of MRSA in medical students. *J. Hosp. Infect.*, 2007; 91-92.
6. Okamo, B., Moremi, N., Seni, J., Mariam, M. M., Kideny, B.R., and Mshana, S.E. Prevalence and antimicrobial susceptibility profiles of *Staphylococcus aureus* nasal carriage among pre‑clinical and clinical medical students in a Tanzanian University. *Biomed central*, 2016; 9: 47, 1-6.
7. Casewell, M.W. and Hill R.L. The Carrier state: Methicillin- resistant staphylococcus aureus. *Journal of Antimicrobial chemotherapy*, 1986; 18: 1-12.
8. Chen, C.S., Chen, C.Y.C., and Huang, Y.C. Nasal carriage rate and molecular epidemiology of methicillin-resistant Staphylococcus aureus among medical students at a Taiwanese university. *International Journal of Infectious Diseases*, 2012; 16(2012): e799–e803.
9. Clinical and Laboratory Standards Institute (CLSI). Method for antifungal disk diffusion susceptibility testing of yeasts: approved standard, M44-A. Wayne (PA): CLSI, 2004.
10. Daniel, W.W. Biostatistics: A Foundation for Analysis in the Health Sciences. 7th edition. New York: John Wiley & Sons, 1999.
11. David, M.Z and Daum R.S. Community-associated methicillin-resistant *Staphylococcus aureus*: epidemiology and clinical consequences of an emerging epidemic. *Clin Microbiol Rev*, 2010; 23: 616-87.
12. Gorwitz, R.J., Kruszon-Moran, D., McAllister, S.K., McQuillan, G., McDougal, L.K, et al. Changes in the prevalence of nasal colonization with Staphylococcus aureus in the United States, 2001–2004. *J Infect Dis*, 2008; 197: 1226–1234.
13. Kluytmans, J., van Belkum, A., Verbrugh, H. Nasal carriage of *Staphylococcus aureus*: epidemiology, underlying mechanisms, and associated risks. *Clin Microbiol Rev.*, 1997; 10(3): 505–20.
14. Lamikanra, B. D., Paul, O. B., Akinwole and Paul M. O. Nasal carriage of *Staphylococcus aureus* in a population of healthy Nigerian students. *J Med Microbiol*, 1985; 55; 317-324.
15. Assafi, M S., Mohammed, R.Q., and Hussein, N.R. Nasal Carriage Rates of *Staphylococcus aureus* and CA-Methicillin Resistant *Staphylococcus aureus* among University Students. *Journal of Microbiology Research*, 2015; 5(4): 123-127.
16. Muhammad, I. A., Bello, S.H., Isa, M. A. and Abdullah, U. A. Prevalence of Nasal Carriage of *Staphylococcus Aureus* Among Students in Ramat Polytechnic, Maiduguri, Nigeria. *International Journal of Research*, 2014; 1(1): 517-522.
17. Nester, E.W., Evans, C.R., Nancy, P., Denise, G.A., and Martha, T.T. The Genus: *Staphylococcus* In: Nester EW ed. Microbiology – a Human Perspective. 2nd McGrew Hill, New York, 2004; 693-695.
18. Nsofor, C., Nwokenkwo, V.N., and Nwaokpa, C. Nasal Carriage of Staphylococcus Aureus among Apparently Healthy School Children in Owerri

Metropolis, Nigeria. *MOJ Cell Sci Rep*, 2015; 2(5): 00038, 1-5.

19. Santhosh, D.V., Shobha, K.L., Bairy, I., Rao, G. ,Anand, KM and D' Souza, J. Nasal screening and survey of pre-clinical medical students from Malaysia for nasal carriage of coagulase positive MRSA and rate of nasal colonization with *Staphylococcus* species. *Journal of Clinical and Diagnostic Research*, 2007; 1(6): 494-499.
20. Shanmugam, J., Gopal, R., and Kumar, S. S. The prevalence, antibiogram and characterisation of *staphylococcus aureus* including MRSA among the healthy staff, medical students and patients from Sri Manakula Vinayagar Medical College and Hospital (SMVMCH), Puducherry. DSTE project report (Government of Puducherry), 2009.
21. Shibabaw A, Abebe T, and Mihret A. Nasal carriage rate of methicillin resistant *Staphylococcus aureus* among Dessie Referral Hospital Health Care Workers; Dessie, Northeast Ethiopia. *Antimicrob Resist Infect Control*, 2013; 2: 25. doi:10.1186/2047-2994-2-25.
22. Ugwu, M.C1., Anie, C.O., Ibezim, E.C and Esimone, C.O. Antimicrobial Evaluation of Methicillin-Resistant Staphylococcus Aureus Nasal Carriage amongst Healthy Students in Agbor, Delta State, Nigeria. Archives of Clinical Microbiology. *Archives of Clinical Microbiology*, 2016; 7(13): 1-4.
23. Van Belkum, A., Verkaik, N.J., de Vogel, C.P., Boelens, H.A., Verveer. J, et al. Reclassification of Staphylococcus aureus nasal carriage types. *J Infect Dis*, 2009; 199: 1820–1826.
24. von Eiff, C., Becker, K., Machka, K., Stammer, H., and Peters, G. Nasal Carriage as a Source of *Staphylococcus aureus* Bacteremia. *New England Journal of Medicine*, 2001; 344: 11-16.
25. Wertheim, H.F.L., Melles, D.C., Vos, M.C., van Leeuwen, W., van Belkum, A., Verbrugh, H.A., and Nouwen, J.L. The role of nasal carriage in *Staphylococcus aureus* infections. *The Lancet Infectious Diseases*, 2005; 5: 751-762.