Nasal Colonization of Methicillin Resistance *Staphylococcus aureus* among Food Handlers in the Eateries Obafemi Awolowo University Ile Ife, Nigeria

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Abstract

Food handlers have been recognized to play a major role in the transmission of food borne diseases; contributing significantly to the global incidence and burden of diseases. This study assesses nasal carriage of *Staphylococcus aureus* among food handlers in the Obafemi Awolowo University eateries. A total of 35 nasal swab samples were collected and analyzed using standard conventional methods of microbial analysis in isolation and identification of *S. aureus* including catalase, coagulase and DNase tests as well as the antibiotic susceptibility of the isolates. The result showed that the prevalence of nasal carriage of *S. aureus* in Obafemi Awolowo University eateries was 13 (37.14%). The antibiotic susceptibility shown that all isolates were 100% sensitive to pefloxacin, zinnacel and ciprofloxacin while gentamycin (84.61%), ampiclox (30.77%), amoxicillin (30.77%), rocephin (61.53%), streptomycin (69.23%), septrin (23.07%), and erythromycin (46.18%) respectively. Concerted effort need to be made to educate food handlers and restaurant workers on the importance of personal hygiene and the use of protective gadget like nose masks while handling food products.

Keywords: Food handlers; Eateries; *Staphylococcus aureus*; Antibiotic; Nasal cavity

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Introduction

Staphylococcus aureus is implicated in almost all *Staphylococcal* food poisoning [1]. Although it is difficult to determine the origin of the strains involved in *Staphylococcal* food poisoning outbreaks, food handlers are usually regarded as one of the primary sources of these organisms [2]. It is generally accepted that hands are an important vehicle of food cross-contamination and that improved personal hygiene and scrupulous hand washing would lead to the basic control of feces-to-hand to-mouth spread of potentially pathogenic transient microorganisms [3]. Food handlers carrying enterotoxin-producing *S. aureus* in their noses or on their hands are regarded as the main source of food contamination via direct contact or through respiratory secretions [4].

Staphylococcus aureus (D-value at 60°C of >15 min in broth) has been recovered from a foodborne outbreak in India [5]. Several chemical preservatives, including sorbates and benzoates inhibit the growth of *S. aureus.* The effectiveness of these preservatives increases as the pH is reduced. Methyl and propyl parabens are also effective in inhibiting the growth of *S. aureus* [6].

Staphylococcus aureus is resistant to freezing and survives well in food stored below -20°C. However, viability is reduced at temperatures of -10°C to 0°C. *S. aureus* is readily killed during pasteurization or cooking. Growth of *S. aureus* occurs over the pH range of 4.0-10.0, with an optimum of 6-7. *S. aureus* uniquely resistant to adverse conditions such as low water activity, high salt content and osmotic stress [7].

Strains of methicillin resistant *Staphylococcus aureus* (MRSA), which had been largely confined to the hospitals and long term care facilities, are emerging in the community. Even though the origin of

emerging MRSA is not known, the prevalence of these strains in the community seems likely to increase substantially [8].

Multidrug resistance is now the norm among these pathogens. *S. aureus* is perhaps the pathogen of greatest concern because of its intrinsic virulence, its ability to cause a diverse array of life-threatening infections and its capacity to adapt to different environmental conditions [9]. *S. aureus* is now the leading overall cause of nosocomial infections [10].

This research work was designed to identify, isolate *S. aureus* from the nasal cavity of food handlers from different eateries located in the Obafemi Awolowo University Campus and to determine their susceptibility to various antimicrobial agents used.

Materials and Methods

Samples collection

Samples were taken from the nasal cavities of the 35 food handlers who agreed to participate in the study at 5 different locations in the Obafemi Awolowo University Campus Eatery Centers of the New market between September- November, 2015 within the Obafemi Awolowo University campus community using sterile swab sticks moistened with sterile saline (0.9% NaCl) solution and transported to the laboratory immediately for analysis. Informed consent was sought and obtained before the analysis from the Food and Beverage Managers of various restaurants and from the interested food handlers within the community. The identities of the participants involved in the study were kept anonymous.

Methods of isolation

A swab stick was used to swab areas in between the nasal cavity. Each swab collected from the nasal cavity was inserted aseptically into test tubes that contain freshly prepared nutrient broth and then incubated at room temperature (37°C). After 24 h, the broth culture was inoculated into Mannitol Salt Agar (MSA) plates using the inoculating loop. The streaking was done and the plates were incubated at 37°C for 24 h. Golden yellow color showed the fermentation of the mannitol which is a presumptive test for *Staphylococcus aureus*. Conventional method of using catalase and coagulase tests for isolation of Gram positive coagulase positive staphylococci were adopted.

DNAse test

A loopful of the 24 h agar culture was smeared on freshly prepared DNase agar plates and incubated at 37°C for 24 h. After 24 h, the plates were flooded with 1 N HCl and left for 5 min allowing for penetration before pouring away. A clear zone was observed around the colonies. This confirms the presence of *Staphylococcus aureus.*

Antibiotics sensitivity

The following antibiotics were used: Pefloxacin (10 μg), gentamicin (10 μg), ampiclox (30 μg), zinnacel (20 μg), amoxicillin (30 μg), rocephin (25 μg), ciprofloxacin (10 μg), streptomycin (30 μg), septrin (30 μg), erythromycin (10 μg).

The susceptibility of the isolates to the antibiotic used was indicated by zones of inhibition. The diameters of the zones were measured and compared with CLSI.

Results

A total of 19 (54.28%) Staphylococcal isolates was obtained from the 35 samples screened from the food handlers. Out of these, 13 (37.14%) were confirmed MRSA as indicated in the **Table 1** in which Food Handlers with age range between 21-30 constituted majorly of 8 (61.5) MRSA strains, while individuals handlers whose age range fall between 31-60 constituted 7.7% of MRSA colonization of nasal cavities. Meanwhile, handlers with age range between 10-20 and 41-50 tends to be colonized readily with Methicillin Sensitive *Staphylococcus* aureus (MSSA) in the study area.

Table 2 shows the profile of the food handlers in which the male and female constituted 20% and 80% of population from which the samples were collected respectively. The age group between 21-30 years constituted a larger percentage of the profile which was 54.28%.

Antibiotics were tested by the disc diffusion method with Mueller Hinton Agar

4 isolates (30.77%) were resistant to streptomycin, 10 (76.92%) to septrin, 7 (53.85%) to erythromycin, 2 (15.38%) to gentamycin, 9 (69.23%) to ampiclox, 9 (64.23%) to amoxacillin and 5 (38.46%) to rocephin. In contrast, 9(69.23%) were sensitive to streptomycin, 3 (23.09%) to septrin, 6 (46.15%) to erythromycin, 11 (84.61) to gentamycin, 4 (30.77%) to ampiclox, 4 (30.77%) to amoxacillin and 22 (75.86%) to rocephin.

Discussion

In this study, nasal swab culture of 35 food handlers was investigated for the presence of *Staphylococcus aureus.* The results show that the prevalence of nasal carriage of *S. aureus* among food handlers in Obafemi Awolowo University eateries was 13 (37.14%). The male constituted 3 (23.07%) while the female constituted a larger rate of 10 (76.92%). These findings is in agreement with the reports of Eke *et al*. (2015) in their study aimed at assessing the nasal carriage of *S*. *aureus* among food handlers and restaurant workers in Ekpoma, Edo State, Nigeria. In their work, total of 100 nasal swab samples were collected and analysed for *S. aureus* using standard methods. The result showed that the prevalence of nasal carriage of *S. aureus* among food

Table 1: Samples analysis determining MRSA and MSSA nasal colonization among food handlers at OAU Bukateria.

Age range	Isolates recovered	%MRSA isolates	MSSA isolates	%MSSA
10-20	4	2 (15.4)	2	2 (33.3)
21-30	19	8 (61.5)	0	0 (0)
31-40	7	1 (7.7)	1	1 (16.7)
41-50	3	1 (7.7)	2	2 (33.3)
51-60	2	1 (7.7)	1	1 (16.7)
Total	35	13	6	6

Table 2: Showing the profile of the distribution of food handlers.

Age range	Gender status of food handlers (M/F)	Frequency of distribution	Percentage occurrence
10-20	M=1, F=3	4	11.43
21-30	M=4, F=15	19	54.28
31-40	M=2, F=5	7	20
41-50	M=0, F=3	3	8.57
51-60	M=0, F=2	2	5.71

handlers was 60%. The males had the highest prevalence of 58%, while the females had a prevalence rate of 42%. Those within age range 26-30 had the highest prevalence of 67% followed by those within the age group of ≤25 (17%) and 31-35 (17%). In this study, it was discovered that isolates of S. *aureus* recovered were 100% sensitive to gentamycin, levofloxacin, rocephin, ciprofloxacin, pefloxacin and 4(31%) to ampiclox used. Ampicillin showed no sensitivity. The findings of Eke et al. [11] on antibiotic sensitivity pattern are similar to the pattern of 100% sensitivity showed by our isolates towards pefloxacin, zinnacel and ciprofloxacin.

The highest prevalence being among males population as reported by Eke et al. [11] is in contrast to that obtained in this study, with female's dominant having the highest incidence of *S. aureus* infection. This might be attributed to females majorly involving in restaurant and food handling services in the study area. Several workers have shown that *S. aureus causes* severe infections being member of normal flora of the nasal cavity [12-14]. If by chance, a food handler carries an enterotoxin producing *S. aureus,* this may contaminate the food and cause staphylococcal food poisoning outbreak in that community [15].

Conclusion

The findings revealed that food handlers with pathogenic strains of *Staphylococcus aureus* nasal base contaminant may pose significant risk to consumers in the university community mostly the student's population. It is therefore important to educate food handlers and restaurant workers on the importance of personal hygiene and the use of protective gadgets like nose masks while handling food products. This study reveals that routine conventional screening is reliable for identification of MRSA in resource limited areas.

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