Antibiotics Sensitivity Pattern of *Staphylococcus aureus* among Food Handlers in Lagos State, Nigeria

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ABSTRACT

Staphylococcus aureus, gram positive cocci has been recognized to be an important pathogen in both the community and the hospital. *Staphylococcus aureus* has contributed to the global food borne illnesses and food poisoning as well as the hospital acquired infections. Although *Staphylococcus aureus* can be carried by humans, especially in the nasal cavity, this organism can pose threat to human life. The emergence of the Methicillin-Resistant *Staphylococcus aureus* is at an alarming rate. The aim of this study is to determine the microbial colonization of nasal cavity with emphasis to *Staphylococcus aureus*, to detect the routes of transmission of staphylococcal infection in the community and to determine the antimicrobial susceptibility of the isolates recovered to various antibiotics used among these food handlers in Shomolu Local Government, Lagos State, Nigeria. A total of 35 samples was collected from various food handlers and was analyzed using standard conventional methods and materials in order to isolate, identify and carry out the antimicrobial susceptibility testing. Subsequent culturing using nutrient broth was carried out. Nutrient agar, mannitol salt agar was used for the isolation process. Biochemical Tests such as catalase test, coagulase test, DNase test, Antibiotic sensitivity test was carried out to identify the isolates. The microscopy analysis was also carried out for identification of the isolates. Strict sterilization processes of cultures and materials were used. The appropriate media was used throughout the bench work. The antibiotic susceptibility test was conducted using Kirby and Bauer disc diffusion method and the results were determined using the Clinical and Laboratory Standard Institute (CLSI) 2016 guide. Out of 35 samples collected, *Staphylococcus aureus* was isolated from 19 samples. The females had a percentage of 73.7% and the males had a percentage of 26.3%. From the antibiotic sensitivity test the Staph aureus isolates were found to be highly susceptible to Ciprofloxacin (63.15%), Streptomycin (68.42%), Pefloxacin (68.42%), and Zinnacef (68.42%), a lower percentage of susceptibility was observed in Septrin (57.89%). These isolates were highly resistant to Amoxicillin (84.2%), Erythromycin (73.68%), Ampiclox (63.15%), a lower resistance was observed in Gentamycin (57.89%), Rocephin (56.25%) The social characteristics also gotten from the food handlers showed that the highest age range of the food handlers was 29-39 with a percentage of (42.8%), and the lowest range was of the age range 18-28 (14.3%) the food handlers involved more females (88.6%), males(11.4%). The educational status of the food handlers was mostly of a school cert (62.8%), a percentage of 91.43% was not certified in food handling, also hand washing habit after touching the nose was 34.28%, and hand washing habit before preparing food was (85.71%). The presence of drug-resistance in *Staphylococcus aureus* strains isolated from this nasal swabs pose a great threat to public health. A food handler may contaminate food from the enterotoxin producing *Staph aureus* thereby causing staphylococcal food poisoning outbreak in these community. Therefore, a very good hygiene is required especially when handling food, usage of protective gadgets like apron, gloves when handling food should be used.

Keywords: *Staphylococcus aureus*; Infections; Antibiotic resistant; Food handlers; Antibiotics

INTRODUCTION

Staphylococcus aureus has been recognized as an important pathogen in the world of food borne illness and food poisoning and the community and hospital acquires infections as a whole [1,2]. *Staphylococcus aureus* Bacteremia (SAB) is presently ranked as the second in Finland with approximately 1000 cases annually, also it has been observed that the prevalence of Methicillin-Resistant *Staphylococcus aureus* (MRSA) infections is less than 3% [3]. From available results, it has been shown that in the human population, about 30%-50% is carriers of *Staphylococcus aureus* especially in the nasal cavity [4]. However, it is of great interest that food borne diseases can be spread by food handlers

and this has proven to be a common and persistent problem in the world [5] also, these food handlers with a poor personal hygiene pose as potential sources of pathogenic organisms like the *Staphylococcus aureus* [6]. Well such of this food poisoning could also be a result from the infection with enterotoxigenic strains of these organisms [7,8]. As the second, restaurants have been classified as an important place for acquiring Staphylococcal food poisoning. These poisoning accounts for 14% - 20% of outbreaks food contamination in the USA and UK. As reported by [9] 86% of meat products, 13% of cowpea-based food products and 55% of fish products from part of eastern Nigeria were contaminated with *Staphylococcus aureus*. Antimicrobial resistance associated with food and water has been a global concern, it is now widely accepted that there exist an association between the use of antimicrobial agents and the occurrence of resistance. These antimicrobials exert a selective pressure on microbes that acts as a driving force in the development of antibiotic resistance and their use has been considered as a key issue in epidemiological studies [10]. In this study, we investigated antibiotics sensitivity pattern of *Staphylococcus aureus* among food handlers in Lagos State, Nigeria.

MATERIALS AND METHODS

Sample collection

A total number of 50 samples were collected in aseptic conditions from the nasal cavity of the various food handlers in Shomolu local government area, Lagos using sterile swab sticks moistened with sterile saline (0.9%). Consent was sought from the right authorities before samples was collected with the identities of food handlers kept anonymous, after collection, the samples were transferred within a permitted time to the laboratory for microbiological analysis (Figure 1).

Isolation, identification and characterization

Each sample swab was inoculated into prepared sterile nutrient broth (Oxoid, UK) and incubated at 37°C for 24 hour for enrichment. Organisms isolated in the nutrient broth were transferred to the nutrient agar. Discrete colonies were later sub-cultured on a solid differential media; Mannitol salt agar and incubated at 37°C for 24 hours. Gram staining, morphological identification, catalase and coagulase tests, sugar fermentation analysis and antimicrobial

susceptibility trends of the isolate were conducted.

Antibiotic sensitivity testing

Antibiotic sensitivity testing was performed by the disk diffusion method as described by the (Bauer-Kirby) method modified by the National Committee for Clinical Laboratory Standard (NCCLS). The antibiotic sensitivity of S.aureus to the following 10 antibiotics was determined (Gentamycin (10 µg), Streptomycin (30 µg), Ampiclox (30 µg), Ciprofloxacin (10 µg), Erythromycin (10 µg), Amoxicillin (30 µg), Rocephin (25 µg), Septrin (30 µg), Pefloxacin (10 µg), and Zinnacef (20 µg)). A sterile cotton wool swab was inserted into each bottle containing inoculums suspensions. The swab was then used to inoculate well dried plates of Muller-Hinton agar. All plates were incubated at 37°C for 24 hours. The plates was then viewed to check for the clear zones of inhibition which indicates that the antibiotic used were efficient against the organism and the unclear zone indicating that the antibiotics used was not efficient.

RESULTS

A total of 35 samples were collected from the nasal cavity of various food handlers. 31 samples from females and 4 samples from males. The above Table 1 shows that samples were collected from both females and males, with the highest sample from the females. Total samples collected were 35. Isolates of *Staphylococcus aureus* obtained was 19. This Table 2 shows the susceptibility pattern of *Staphylococcus aureus* to various antibiotics. Resistance was observed in the following antibiotics: Amoxicillin, Rocephin, Erythromycin, Gentamycin and Ampiclox. Also sensitivity was observed in the following antibiotics: Ciprofloxacin, Streptomycin, Septrin, Pefloxacin, Zinnacef. The level of resistance of *Staphylococcus aureus* to some of the antibiotics poses a threat to the community. In the above Table 3 the age range 29-39 had the highest prevalence of *Staphylococcus aureus* this could be as a result of maturity and active sexually in this age range, the highest prevalence of Staph aureus in educational status of the food handlers was the School Cert. This can be as a result of no adequate knowledge about handling food at this education level. Hygienic practices of food handlers in shomolu local government (Figure 2).

Figure 1: The samples collection was carried out in shomolu local government area, Lagos. It is suited in Mushin, Lagos, Nigeria.

Table 1: The table below shows the number of samples and the percentage of Staph aureus obtained from food handlers in shomolu local government, Lagos state, Nigeria.

	Nasal swabs examined	Total *Staphylococcus aureus* isolates obtained N=19	Total *Staphylococcus aureus* isolates (%)
Female	31	14	73.7
Male	4	5	26.3

Table 2: The table below shows the percentage susceptibility pattern of *Staphylococcus aureus* to various antibiotics.

Antibiotics	% Resistant	% Sensitive	Intermediate	Total number of isolates tested
Amoxicillin	84.2	15.8	-	19
Rocephin	56.25	43.75	-	19
Ciprofloxacin	21.07	63.15	15.78	19
Streptomycin	26.32	68.42	5.26	19
Septrin	36.85	57.89	5.26	19
Erythromycin	73.68	10.54	15.78	19
Pefloxacin	31.58	68.42	-	19
Gentamycin	57.89	36.85	5.26	19
Ampiclox	63.15	36.85	-	19
Zinnacef	31.58	68.42	-	19

Table 3: The table below shows the percentage susceptibility pattern of *Staphylococcus aureus* to various antibiotics. The table below shows the data based on the Socio-demographic data of respondents of *Staphylococcus aureus* among food handlers in Shomolu local government.

Characteristics	Total number	Percentage of Prevalence of Staph aureus (%)
Age range of food handler (Years)		
18-28	5	14.3
29-39	15	42.8
40-49	8	22.9
50-59	7	20
Total	35	100
Sex of food handler	Total number	Percentage %
Female	31	88.6
Male	4	11.4
Total	35	100
Education status of food handler	Total number	Percentage %
Illiterate	10	28.6
School cert	22	62.8
HND	3	8.6
Total	35	100

Table 4: The table below shows that a larger percentage of the food handlers had no certification for handling food, there was no regular check as the percentage of no regular checkup was 88.58%, the habit of washing hands after touching the nose was low as it had a percentage of 65.72%. These unhealthy habits pose a threat to the public health as there could be a high rate of contamination of food.

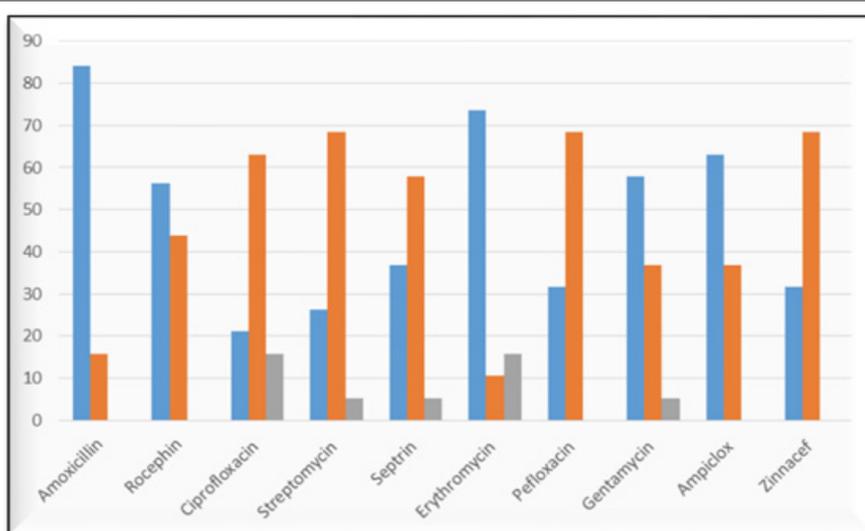| Variables	No.	Percentage (%)
Certified in food preparation in food handling	22	22
Yes	3	8.57
No	31	91.43
Medical check up	22	22
Yes	4	11.42
No	31	88.58
Hand washing after touching nose	22	22
Yes	12	34.28
No	22	65.72
Hand washing before preparing food	22	22
Yes	30	85.71
No	4	14.29
Total	35	100

Figure 2: Antibiotic sensitivity pattern of *Staphylococcus aureus* obtained from the nasal swabs of food handlers in shomolu.
Note: (▇) % resistance;(▇) % Sensistive;(▇) % Intermediate.

DISCUSSION

In this study, nasal swab of 35 food handlers was investigated for the occurrence of *Staphylococcus aureus*. From the results in the previous chapter, it shows that the prevalence of nasal carriage of *Staphylococcus aureus* among food handlers in shomolu local government was 19, the female constituted a larger percentage of 88.6% while the male constituted a smaller percentage of 11.4%. Although this findings do not agree with the reports of Eke SO [11]. Their study was carried out in Ekpoma, Edo state, Nigeria. Their study was aimed at assessing the nasal carriage of food handlers and restaurant workers in the area. The prevalence of *Staphylococcus aureus* and the nasal carriages of food handlers was 60%. The males had the highest prevalence rate of 58% while the female has a prevalence rate of 42%. Those within the age range of 30-39 had the highest prevalence of 42.8% followed by those within the age group of 40-49 as 22.9% and 50-59 as 20%. This study finding is also in in agreement with the findings of Omololu-Aso [12], carried out in Obafemi Awolowo University, Ile-ife, Osun state, Nigeria. In their study, the prevalence of *Staphylococcus aureus* in the nasal carriage of food handlers in Obafemi Awolowo University eateries was 37.14%. The male constituted 23.07% while the female constituted a larger rate of 76.92%. This can be attributed to the reason being that females are majorly involved in restaurants and food handling services in these study area. Staph aureus being normal flora has been shown to cause severe infections of the nasal cavity of food handlers Williams, Hiramatsu [13]. A food handler by chance could carry an enterotoxin producing Staph aureus which may contaminate the food and cause staphylococcal food poisoning outbreak in these community (CLSI) [14]. All isolates was found to be susceptible to Pefloxacin (68.42%), Ciprofloxacin (63.15%). Similar study performed by Omololu-Aso which showed that *Staphylococcus aureus* was susceptible to Pefloxacin (68.42%) and Ciprofloxacin (63.15%). Other susceptibility occurred among isolates with Rocephin, Streptomycin, and Septrin. High resistance occurred among the isolates in Amoxicillin (84.2%), Ampiclox (63.15%), Erythromycin (73.68%) and resistance in Gentamycin (57.89%). According to the results gotten from the socio-demographic characteristics, a total of thirty-five food handlers 31 females and 4 males was included in this study. The majority of the food handlers were adults within the age range of 29-39 years of age. Age has been identified earlier as a factor influencing nasal colonization with *Staphylococcus aureus* Bischoff [15]. This can be attributed to the maturity and sexually active age of the correspondents. Although not all studies agree with these findings. Only a percentage of 62.8% of the food handlers had education above primary education. These characteristics are shown in Table 4. In the washing practices, 34.28% of food handlers had a habit of washing hands after using the toilet and 65.72% had no habit of washing hands after using the toilet. Also, a percentage of 85.71% had a habit of washing hands before preparing food and 14.29% had no habit of washing hands before handling food. A percentage of 88.58% had no regular medical check-ups and 11.42% had regular check-ups.

CONCLUSION

The findings revealed in this study shows that food handlers with pathogenic strains of *Staphylococcus aureus* nasal cavity contaminant my pose significant threat to the consumers in Shomolu local government area. It is therefore important to educate food handlers and restaurant workers on the importance of a personal hygiene and also the use of protective gadgets like nose masks while handling food products. There should also be routine conventional screening to stand as a reliable means for the identification of MRSA in resource limited areas.

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