

# Methicillin-Resistant *Staphylococcus aureus* Nasal Colonization Among Food Handlers in Eateries: A Study at Obafemi Awolowo University, Ile-Ife, Nigeria

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## Abstract

Food handlers significantly contribute to the transmission of foodborne diseases, posing a global health risk. This study investigates the prevalence of *Staphylococcus aureus* nasal carriage among food handlers in Obafemi Awolowo University eateries. Nasal swab samples from 35 participants were analyzed using standard microbial isolation methods, and the antibiotic susceptibility of the isolates was assessed. Results indicated a 37.14% prevalence of nasal carriage of *S. aureus*. Antibiotic susceptibility revealed high sensitivity to pefloxacin, zinnacel, and ciprofloxacin. However, some resistance was observed against gentamycin, ampicillin, amoxicillin, rocephin, streptomycin, septrin, and erythromycin. The study emphasizes the importance of educating food handlers on personal hygiene and the use of protective measures like nose masks.

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

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**Citation:** Otusanya OO. (2023) Methicillin-Resistant *Staphylococcus aureus* Nasal Colonization Among Food Handlers in Eateries: A Study at Obafemi Awolowo University, Ile-Ife, Nigeria. J Nutr Diet Nutraceuticals. Vol 1(1): 106.

**Received:** June 05, 2023; **Accepted:** June 21, 2023; **Published:** June 28, 2023

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## Introduction

*Staphylococcus aureus*, a prominent culprit in Staphylococcal food poisoning, is often linked to food handlers as a primary source of contamination during outbreaks. The role of hands as a significant vehicle for food cross-contamination underscores the importance of enhanced personal hygiene and thorough handwashing to mitigate the spread of potentially pathogenic microorganisms. Food handlers, harboring enterotoxin-producing *S. aureus* in their nasal passages or on their hands, stand out as a crucial factor in contaminating food through direct contact or respiratory secretion [1].

In various foodborne incidents, *S. aureus*, characterized by its resistance to freezing and robust survival in temperatures below -20°C, has been identified. While pasteurization or cooking effectively eliminates *S. aureus*, the bacterium exhibits resistance to adverse conditions such as low water activity, high salt content, and osmotic stress. Additionally, the emergence of methicillin-resistant *Staphylococcus aureus* (MRSA) in the community, outside traditional healthcare settings, raises concerns about the increased prevalence of these strains [2-5].

Notably, *S. aureus* strains have developed multidrug resistance, posing a significant challenge due to their intrinsic virulence, capacity to cause diverse life-threatening infections, and adaptability to various environments. As a leading cause of nosocomial infections, *S. aureus* demands attention and understanding of its prevalence and antimicrobial susceptibility.

This research aims to identify and isolate *S. aureus* strains from the nasal cavities of food handlers in different eateries within the Obafemi Awolowo University Campus. Furthermore, the study

seeks to evaluate the susceptibility of these isolated strains to various antimicrobial agents, providing insights into the potential risks associated with food handling practices.

## Materials and Methods

### Sample Collection

Nasal swab samples were collected from 35 consenting food handlers at five different locations in the Obafemi Awolowo University Campus Eatery Centers of the New Market. Sterile swab sticks moistened with sterile saline (0.9% NaCl) were used for collection. The samples were promptly transported to the laboratory for analysis. Informed consent was obtained from the Food and Beverage Managers of respective restaurants and participating food handlers, ensuring anonymity for the study participants [6-10].

### Isolation Methods

**Swabbing:** Swab sticks were used to sample the nasal cavities, and swabs were aseptically inserted into test tubes with nutrient broth. The tubes were incubated at room temperature (37°C) for 24 hours.

**Mannitol Salt Agar (MSA):** After incubation, the broth cultures were inoculated onto MSA plates using an inoculating loop. Incubation at 37°C for 24 hours facilitated the presumptive test for *Staphylococcus aureus*, indicated by a golden yellow color due to mannitol fermentation.

**Catalase and Coagulase Tests:** Conventional tests for Gram-positive coagulase-positive staphylococci were performed to isolate and identify *Staphylococcus aureus*.

### DNase Test

A loopful of the 24-hour agar culture was smeared on DNase agar plates and incubated at 37°C for 24 hours. Following incubation, plates were flooded with 1 N HCl, forming a clear zone around colonies, confirming the presence of *Staphylococcus aureus*.

## Antibiotic Sensitivity

The antibiotic susceptibility of isolates was assessed using the following antibiotics: Pefloxacin, gentamicin, anilox, zinnacel, amoxicillin, rocephin, ciprofloxacin, streptomycin, septrin, and erythromycin. Zones of inhibition were measured, and results were compared with CLSI standards to determine susceptibility.

## Results

From the 35 samples obtained from food handlers, a total of 19 (54.28%) Staphylococcal isolates were identified. Among these isolates, 13 (37.14%) were confirmed as Methicillin-Resistant *Staphylococcus aureus* (MRSA). The distribution of MRSA strains was higher among food handlers in the age range of 21-30, constituting the majority at 61.5%. Individuals aged 31-60 represented 7.7% of MRSA colonization in nasal cavities. Meanwhile, those in the age range of 10-20 and 41-50 showed a higher prevalence of Methicillin-Sensitive *Staphylococcus aureus* (MSSA) colonization [11-13].

Table 1 and 2 provides a profile of the food handlers, with males constituting 20% and females 80% of the sampled population. The age group between 21-30 years accounted for the majority, representing 54.28% of the profile.

The antibiotic susceptibility testing using the disc diffusion method on Mueller Hinton Agar revealed the following resistance and sensitivity patterns:

### Resistance

- Streptomycin: 30.77%
- Septrin: 76.92%
- Erythromycin: 53.85%
- Gentamycin: 15.38%
- Ampiclox: 69.23%
- Amoxicillin: 64.23%
- Rocephin: 38.46%

**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

### Sensitivity

- Streptomycin: 69.23%
- Septrin: 23.09%
- Erythromycin: 46.15%
- Gentamycin: 84.61%
- Ampiclox: 30.77%
- Amoxicillin: 30.77%
- Rocephin: 75.86%

### Discussion

In this study, the nasal swab culture of 35 food handlers was examined for the presence of *Staphylococcus aureus*. The results indicated a prevalence of 37.14% nasal carriage of *S. aureus* among food handlers in Obafemi Awolowo University eateries. Notably, females showed a higher rate (76.92%) compared to males (23.07%).

This finding aligns with a study by Eke et al. (2015) conducted in Ekpoma, Edo State, Nigeria, which reported a 60% prevalence of nasal carriage of *S. aureus* among food handlers and restaurant workers. However, there are variations in gender prevalence, with Eke et al. reporting a higher prevalence among males (58%), whereas this study found females to be dominant. The difference might be attributed to the higher involvement of females in restaurant and food handling services in the study area [14-15].

The antibiotic sensitivity pattern observed in this study is comparable to the findings of Eke et al., where isolates of *S. aureus* were sensitive to pefloxacin, zinnacel, and ciprofloxacin. Both studies emphasize the importance of understanding antibiotic sensitivity to manage *Staphylococcus aureus* infections effectively.

### Conclusion

The study highlights that food handlers with pathogenic strains of *Staphylococcus aureus* in their nasal cavity pose a significant risk to consumers, particularly the student population in the university

community. The results emphasize the need for educating food handlers and restaurant workers on the importance of personal hygiene and the use of protective gear, such as nose masks, during food handling. The routine conventional screening employed in this study is deemed reliable for the identification of Methicillin-Resistant *Staphylococcus aureus* (MRSA) in resource-limited areas.

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