SCREENING FOR METHICILLIN RESISTANT *Staphylococcus Aureus* FROM HANDS, KNIVES AND TABLES OF MEAT AND MEAT PRODUCTS VENDORS IN SOME SELECTED AREAS IN KANO, NIGERIA

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ABSTRACT

A total of 120 swab samples of hands, knives and tables of Fresh meat, *Balangu, Kilishi* and *Tsire* vendors were investigated for the presence of Methicillin Resistant *Staphylococcus aureus* (MRSA). Samples were randomly taken using sterile swab stick at different retailing points within the local governments constituting Kano Metropolis. *Staphylococcus aureus* isolates were isolated using mannitol salt agar. Identification of isolates was done using biochemical tests. From the 120 swab samples analyzed, 12 *S. aureus* isolates were detected. Out off the 12 isolates, 6(50%) were from the hands of the vendors, 2(16.67%) from knives and 4(33.33%) were from tables. The isolated organisms were subjected to sensitivity tests using clinical laboratory standards Institute (CLSI) break point procedure. Only 8% out of the 12 *S. aureus* isolates was confirmed MRSA positive but with no statistical significant difference at P- value 95% in the occurrence rate of MRSA among the samples. This is a challenge to public health policy makers in the state.

Keywords: Swabs of hands, Fresh Meat, Meat products, MRSA, Antimicrobials.

INTRODUCTION

Staphylococci generally are naturally found everywhere. *S. aureus* is mainly found on the skin and mucous membranes of mammals and birds (Melissa *et al.,* 2016). The ability of *S. aureus* to cause foodborne diseases qualifies it to be among the most important pathogen of humans and the domestic animals (Carmen *et al.,* 2015). They cause skin, and soft tissue infections, pneumonia, hospital–acquired postoperative wound infections, among other complications which are difficult to treat (Udobi *et al.,* 2013). *Staphylococcus aureus* appeared in London civilian hospitals very soon after the introduction of penicillin in the 1940s, and shortly thereafter, similar cases emerged in Japan, New Zealand, Australia, and the United States (Rajeshwari *et al.,* 2014).

Being ambiguous, detection of *S. aureus* in meat and meat products cannot be discounted (Dahiru and Shamsuddeen, 2018). For instance, in the United States of America, Staphylococcal food poisoning, characterized by vomiting and diarrhea, takes the lead in food-borne illness (CDC, 2013). Similarly, the ability of *S. aureus* to cause Staphylococcal food poisoning has recently extended to include retail meat products from food-producing animals such

as poultry, and cattle (Charlene *et al.*, 2013).

Methicillin-resistant *Staphylococcus aureus* (MRSA) is a bacterium that is resistant to many antibiotics. According to Centre for Disease and Control, (CDC 2013) MRSA is responsible for most of the life-threatening systemic infections, pneumonia and surgical site infections. In infants, 8 of 17 (47%) cases of *S. aureus* bacteremia were found to be due to MRSA. All MRSA isolates, in comparison to susceptible strains, have a *mec* gene which provides the ability to *S. aureus* to express methicillin resistance. Lee *et al.*, (2013) reported that the structural component of the *mec* gene, *mecA*, encodes the penicillin-binding protein 2a (PBP2a) that establishes resistance to methicillin and other semi synthetic penicillinase-resistant beta-lactams. The regulatory genes present in MRSA do contribute to MRSA virulence while the beta-lactamase genes assist in cleaving the functional component of penicillins with mecA gene being the most prominent (Monecke *et al.*, 2011), and according to CDC (2013), improper or too much use of antibiotics is likely to cause MRSA bacteria..

MRSA isolates have been reported from African countries such as Egypt, Algeria, Ivory Coast, Ethiopia and Nigeria with a prevalence of 39%–55% from the year 2000 (Matthew *et al.*, 2013). MRSA, like all *staphylococci bacteria*, can be spread from one person to another through casual contact or through contaminated objects. It is commonly spread from the hands of someone who has MRSA (Ogata *et al.;* 2012). Therefore meat and meat products can be contaminated through contacts with utensils and equipments such as knives, copping boards, bowls, grinders and blenders (Ananias and Roland, 2017). Therefore, the aim of this study is to establish the incidence level of MRSA from hands, knives and tables of meat and meat products vendors in some selected areas in Kano State Nigeria.

MATERIALS AND METHODS

Field Survey for the Study Area and Population

The research was conducted in Kano, North-Western part of Nigeria. Kano is a commercial center for the production and export of agricultural products like hides and skins, peanuts and cotton. Kano is the most populous state in Nigeria with 15 million people (NPC, 2017).

Sample Collection

Fourty (40) swab samples each of Hands, Knives and Tables of the vendors were randomly collected from vendors at different selling centers within eight Local Government areas constituting the Kano Metropolis using sterile cotton buds. The swabs were then placed in sterile foil paper containing 1ml peptone water and brought to post graduate research laboratory of

Isolation of *Staphylococcus aureus* from Swab Samples

Fifteen milliliters (15ml) of Mannitol Salt agar was poured on three Petri dishes (10^1 - 10^3) containing 1ml each of the prepared samples and incubated at a temperature of 37°C for 24 hours. Change of color of the MSA from pink to yellow confirms the mannitol utilization (Shamsuddeen, 2016). *S. aureus* has the ability to ferments

mannitol and to grow on agar containing 70–100 g/l sodium chloride.

Identification of Isolates

Gram's staining was carried out to observe the visible Gram-positive cocci. Catalase and Coagulase tests were conducted as biological markers, according to standard procedure for the identification of bacterial colonies described by Cheesbrough, (2005).

For Catalase test, a portion of the bacterial growth was spread on an agar and the plate incubated at 37 ºC for 18-24 hrs. Bacteria was picked from one of the colonies and smeared on a microscope slide using sterile inoculating loop, to which one drop of 3% H_2O_2 was added and observed for gas formation. Oxygen gas (O_2) formation in the form of bubbles indicated that the bacterium is catalase positive (Panda, 2009).

For Coagulase test, portion of the colony from the axenic culture plate was suspended in 0.5 ml of human plasma and incubated at 37 ºC for 18-24hrs. The test was read after 4 hrs and finally after 24hrs. Formation of a stable plasma coagulant was an inference of positive reaction as described by Cheesbrough (2005).

Screening of Isolates for MRSA: Antibiotic Sensitivity Testing

The *S. aureus* isolates were streaked on prepared Brain Heart Infusion (BHI) Agar (Biotech, England) plates and incubated at 37 ºC for 24 hours so as to obtain confluent growth for sensitivity test. Few colonies of isolates from BHI plates were dispensed in sterile normal saline to match the 0.5 McFarland standards for sensitivity tests (CLSI, 2005). The antibiotics susceptibility testing of all *S. aureus* isolates was performed on Mueller–Hinton Agar by Kirby-Bauer disk diffusion technique. The coagulase positive isolates were tested against Cefoxitin antibiotic and results interpreted according to the CLSI (2005).

Statistical Analysis

Chi Square test of independence contingency tables ware used to analyze the data using Maxstat software version 3.0. A threshold value of less than 0.05 was considered as significant.

RESULTS AND DISCUSSION

From the 120 swab samples analyzed for the presence of *S. aureus*, 12 were confirmed positive. This study establishes the presence of *S. aureus* from meat contact surfaces among vendors in Kano Nigeria. This is in line with the findings of Hanson, (2011) and Ananias and Roland (2017) in similar studies conducted on meat and meat products contact surfaces. Results indicated 3(25%) *S. aureus* count from Ungogo Local Government which was said to be the highest count then followed by Dala, Kumbotso and Nasarawa with 2(16.67%) each (table 1).

However, the high counts might not be unconnected with the sanitary condition of the area and that of the handlers. Ungogo Local Government had been reported to be having unsafe drinking water and for the people's low level of awareness about the importance of hand washing using soap and water or an alternative cleansing agent when necessary.

Table 1: Distribution of MRSA and Non-MRSA on Hands, Knives and Tables among the Local Governments

Local Government	Sources	*Staphylococcus aureus* No. Isolated	MRSA	Non MRSA
	Hands	2	0	2
Dala	Knives	0	0	0
	Tables	0	0	0
	Hands	0	0	0
Fagge	Knives	0	0	0
	Tables	0	0	0
	Hands	1	0	1
Gwale	Knives	0	0	0
	Tables	0	0	0
	Hands	0	0	0
Kumbotso	Knives	1	0	1
	Tables	1	0	1
	Hands	0	0	0
Municipal	Knives	0	0	0
	Tables	1	1	0
	Hands	1	0	1
Nassarawa	Knives	1	0	1
	Tables	0	0	0
	Hands	1	0	1
Tarauni	Knives	0	0	0
	Tables	0	0	0
	Hands	1	0	1
Ungogo	Knives	0	0	0
	Tables	2	0	2
Total		**12**	**1**	**11**

People's access to latrine sanitation facilities was also quite low. Meat processing and retailing in these areas may increase the potential of contamination from environment and food handling personnel (Ndahi *et al.,* 2013). Dala, Kumbotso and Nasarawa Local Governments although congested but, the level of awareness and the sanitary condition of the people living in the area are appreciable. This might reduce the level of contamination on the contact surfaces during processing and vending in these areas (Maigari2014)

Table 2: Frequency of *Staphylococcus aureus* from swab samples of Hands, Knives and Tables

Sources	No. Isolated (%)	MRSA +ve (%)	MRSA –ve (%)
Hands	6 (50.00)	0 (0)	6 (54.55)
Knives	2 (16.67)	0 (0)	2 (18.18)
Tables	4 (33.33)	1 (100)	3 (27.27)
Total	12 (100)	1 (100)	11 (100)

Results from this study indicated that 6(50%) of the isolates were detected from hands, 2(16.67%) were from knives and 4(33.33%) from tables as presented in Table 2. Reports from studies on the sources of contamination of ground meat by Bronko *et al.,* (2007) revealed that hands contamination was 50% and had increased to 58.33% after handling of five slaughtered

carcasses. The hands of workers as well as the hands of vendors are an important primary source of *S. aureus* contamination of meat products during processing. Besides being a skin flora, *S. aureus* can contaminate hands during evisceration. Infected hands with cuts or bruises/sores could be sources of contamination with *S. aureus* in the absence of good hygienic practices (Hanson *et al.,* 2011). *Staphylococci* are so enduring to the extent that they can live long on inanimate objects such as pillowcases or towels thus, are transferred from person to person and, approximately 20% of food-related affectivities are due to food handlers (CDC, 2011). Research findings in Molecular and Epidemiologic food poisoning outbreak indicated that *S. aureus* carried by food handlers was the major source of contamination (Charlene *et al.,* 2013)**.** Enterotoxins produced by. *S. aureus* can be heat stable and is capable of causing gastroenteritis in humans (Khalifa *et al.,* 2014). *S. aureus* counts from tables might be as a result of table engagement in all activities from slaughter to the retailing of meat and meat products (Dahiru and Shamsuddeen, 2018). This might be as a result of cross contamination from contact surfaces during processing of the meat products (Ananias and Roland, 2017).

Clinical and Laboratory Standard Institute (CLSI, 2005) break point procedure was used to screen the 12 isolates of *S. aureus* for the presence of MRSA using Cefoxitin antibiotic where only one isolate from table swab was confirmed MRSA positive. The existence of MRSA on table is an indication of poor microbiological quality which might be due to cross contamination as a result of inadequate sanitary practices in the production chain (Feben *et al,*. 2018) Antibiotic resistance exhibited by *S. aureus* is a growing global public health setback. It occurs when strains of bacteria do not respond to antibiotic treatments due to improper use and abuse of antibiotics (Yusha'u, 2010). MRSA was originally recognized exclusively in clinical settings but, now frequently found outside the healthcare environment (Melissa *et al.,* 2016). It has been implicated in a number of illnesses in humans, ranging from minor, to more severe infections, such as pneumonia and infections of the blood stream (Charlene *et al.,* 2013).

Chi square analysis of results showed no significant difference ($P \leq 0.05$) in the occurrence of MRSA among Hands, Knives and Tables of vendors of meat and eats products consumed in Kano metropolis. The null hypothesis is therefore accepted.

CONCLUSION

Results from this study indicated that the hands, knives and tables of meat and meat product vendors were contaminated with *S. aureus*. The presence of MRSA has been confirmed from the table swab sample of Fresh meat vendor in Municipal Local Government, therefore, may be among the most important sources for the transfer of *S. aureus* to meat or its products either from their skin, hand, process water, contaminated processing equipments or the environment. Hence, one could deduce that directly or indirectly, hands are particularly important as the last line of defense in the chain of transmission of gastrointestinal pathogens. Poor environmental sanitation accounts for much of the contamination in meat and meat products, poor personal hygiene among the food handlers and the processing utensils. These bacteria can encounter the meat products when they are

prepared especially in unhygienic conditions. Thus, hand washing has been identified as the single most important means of preventing the spread of infection, if poorly done can lead to foodborne illness outbreaks.

Prompt hand washing prior to and during processing, storage and marketing of meat and meat products is highly recommended. Government should create room for educating our local food producers and vendors on the importance of general hygiene as well as the recommended use of antibiotics for medication.

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