Prevalence of Methicillin Resistant *Staphylococcus aureus* (MRSA) Associated with Mobile Phone

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Abstract— *This study was carried out to determine the prevalence of methicillin resistant Staphylococcus aureus on mobile phone. A total of sixty samples were collected for this study, the samples were collected by swapping the surface of the mobile phones using swap sticks. Isolation of bacteria was done on blood agar, MacConkey agar and mannitol salt agar. The isolates were identified on the basis of their morphology, colour pigmentation, hemolysis on blood agar and certain biochemical test. Antibiotic susceptibility test was carried out on the isolates. The isolates were tested against Rifampicin, Ciproflaxacin, Chloramphenicol, Amoxicilin, Erythromycin, Ampicillin, Gentamycin and Streptomycin. 101 bacteria were isolated from mobile phones of which 42(41.58%) were isolated from specialist hospital, 37(36.63%) were isolated from Jimeta modern market and 22(21.78%) from Modibbo Adama university. However, 19 isolates were confirmed to be Staphylococcus aureus with 9(47.37%) from specialist hospital, 6(31.58%) from Jimeta modern market and 4(21.05%) from Modibbo Adama university. Antibiotic susceptibility test on the isolated Staphylococcus aureus revealed that some of the isolates were resistant to the antibiotic tested while some were susceptible. Isolates designated as SAU03 is susceptible to all the antibiotics tested. All the isolate were also found to be susceptible to Rifampicin except SAU11. The overall prevalence of methicillin resistance (MRSA) was obtained as 5(45.46%) from specialist hospital Jimeta. There was high prevalence of MRSA with high rates of resistance in hospital setting than community setting. MRSA isolates were multi-drug resistant. Regular surveillance studies as well as institutional protocol should be formed as control measures.*

Keywords— *Methicillin, Mobile, Phones, Prevalence, Resistant, Staphylococcus aureus.*

I. INTRODUCTION

Methicillin is an antibiotic that was formally used in the treatment of bacterial infection cause by microorganisms of the genus *Staphylococcus aureus.* Methicillin contains modification of the original penicillin structure. Most strain of *Staphylococcus aureus* produce enzyme penicillinase (beta-lactamase) which acts by hydrolyzing the beta-lactam ring which is the central antimicrobial activity of the antibiotic (MRSA Guideline, 2008). Methicillin resistance result from the production of an alternative penicillin binding protein PBP2A or PBP2, encoding by the Mac gene on the *Staphylococcus* cassette chromosome me (SCC me) which is a mobile genetic element supposedly acquired through horizontal gene transfer from Cons, MRSA strains have an altered protein penicillin binding protein (PBP2) that shows low affinity for all beta- lactam antibiotics (Penicillin and Cephalosporin's) (Asheeka *et al.,* 2015).

Mobile phones have become an indispensable part of our lives, although they have a lot of advantage, they can also serve as a breeding grounds for infectious pathogens in communities and hospitals. Mobile devices used in hospital, school and market are of particular interest, because they have been implicated in the spread of many infectious pathogens (Khan and Shaikh, 2012; Muzslay *et al.,* 2013). Microbial contamination is most commonly found on the mouthpiece, although while indirect contamination from person to person has decreased with the decline in the use of public payphones, cell phones with buttons and keyboards and other personal mobile phones which are found to be even more conducive for bacterial contamination (Ilusanya *et al.,* 2012; Edem *et al.,* 2013).

The present study was designed to detect, identify and determine the prevalence of methicillin resistant *Staphylococcus aureus* (MRSA) from mobile phones used by health workers (HCWs), students and market populations in Jimeta Yola Adamawa state, Nigeria; the study also investigate the antimicrobial resistant profiles of the isolate.

II. MATERIALS AND METHODS

A. Sample Collection

During this cross sectional study, a total of sixty samples were collected which comprises of 20 sample from specialist hospital Jimeta, 20 samples from Jimeta modern market and 20 from Modibbo Adama university. The samples were immediately transported to the laboratory in the department of microbiology Modibbo Adama University of technology, Yola. Each of the swabs was rotated over the surface of both sides of the tested mobile phone keypad and screen phones. Each cotton ends of these swabs was soaked separately in tubes containing 10 ml of sterile buffered peptone water (Montaha, 2017).

B. Isolation of Bacteria from Mobile Phones

Samples from mobile phones were cultured onto Blood, MacConkey, and mannitol salt agar then incubated at 37^0C for 24 hours. One ml (1mL) of the inoculated peptone water was taken from each sample into a sterile petridish, followed by the addition of 15 ml of melted over the sample, the agar was thoroughly mixed with the sample and allowed to set and solidity. The plates were then inverted and incubated aerobically at 370C for 24 hours. Pure cultures were obtained by sub-culturing distinct colonies (Montaha, 2017). The colonies produce were picked and identified by gram staining and biochemical test.

C. Identification of Bacterial Isolates

The bacterial isolates were identified according to the standard microbiological methods described by Cheesbrough, (2009). Identification was done using Gram's staining, colony morphology, pigment formation, appropriate biochemical tests and cultural characteristics such as lactose fermentation on MacConkey agar, golden yellow colour zone on mannitol salt agar (Cheesbrough, 2009).

D. Antibiotic Susceptibility Test (AST)

Antibiotic susceptibility pattern of *Staphylococcus aureus* was determined by using agar diffusion method on Mueller-Hinton agar as described by Clinical Laboratory Standard Institute (CLSI) (Kirby-Bauer NCCLS modified disc diffusion technique). The following antibiotic discs were used at the stated concentration, this drugs and their concentrations corresponding to those most commonly used in the treatment of human and animal infections caused by bacteria; Amoxicillin (AM) (20μg), Chloramphenicol (CH) (30μg), Erythromycin (ER) (30μg), Ciproflaxacin (CP) (10μg), Rifampicin (RF) (20μg), Gentamicin (GT) (10μg), Streptomycin (S) (30μg) and Ampicillin (AMP) (20μg). A standard inoculum was inoculated onto Muller-Hinton agar and the antibiotic dics were placed aseptically on the surface using the disc dispenser after drying the plates for 3-5min (Cheesbrough, 2009). The plates were incubated at 37^0C for 18 – 24hours. The diameter of zone of inhibition was measured, recorded and interpreted according to the guidelines of clinical laboratory standard institute (CLSI, 2009).

III. RESULT AND DISCUSSION

One hundred and one (101) bacteria were isolated from mobile phones throughout the study. Out of which 42(41.58%) were isolated from specialist hospital, 37(36.64%) were isolated from Jimeta modern market and 22(21.78%) from Modibbo Adama university as described in Table 1.

TABLE 1. Occurrence of Bacteria from Mobile Phones

Location	No of Samples	No of Isolates	% Occurrence
Specialist Hospital Jimeta	20	42	41.58%
Jimeta Modern Market	20	37	36.64%
Modibbo Adama University	20	22	21.78%
Total	60	101	100%

Out of the one hundred and one (101) bacteria isolated from mobile phones, nineteen isolates were identified as *Staphylococcus aureus* as presented in Table 2. The result showed that specialist hospital has the highest isolates and percentage frequency with 9(47.37%), followed by Jimeta modern market with 6(31.58%) and the least is Modibbo Adama university with 4(21.05%).

TABLE 2. Prevalence Staphylococcus aureus from Mobile Phones

Location	No of Samples	No of Isolates	% Occurrence
Specialist Hospital Jimeta	20	9	47.37%),
Jimeta Modern Market	20	6	31.58%
Modibbo Adama University	20	4	31.58%
Total	60	19	100%

Table 3 depicted the result of the antibiotic susceptibility test. The result showed that the antimicrobial susceptibility patterns of the isolates differ, some of the isolate were found to be resistant to tested, while some are found to be resistant to most of the tested antibiotics. The result showed that all the *Staphylococcus aureus* isolates were found to show resistant to antibiotics like Ampicillin, Erythromycin and Gentamycin but they are susceptible to ciproflaxacin and streptomycin.

TABLE 3. Antibiotic susceptibility Profile of Staphylococcus aureus isolated from Mobile Phones

Isolates	CP	AM	CH	ER	RF	GT	AMP	S
Specialist Hospital								
SAU01	S	S	S	R	S	S	R	S
SAU02	S	R	R	R	S	S	R	R
SAU03	S	S	S	S	S	S	S	S
SAU04	S	S	R	R	S	R	R	S
SAU05	S	R	S	R	S	S	R	R
SAU06	R	R	S	R	S	S	R	S
SAU07	S	R	R	R	S	R	R	S
SAU08	S	S	R	S	S	S	R	R
SAU09	R	R	S	R	S	S	R	S
Jimeta Modern Market								
SAU10	S	S	R	R	S	R	R	S
SAU11	S	R	S	R	R	S	R	R
SAU12	R	R	R	R	S	R	R	S
SAU13	S	S	S	S	S	S	S	S
SAU14	S	R	R	R	S	S	R	S
SAU15	S	R	R	R	S	R	R	S
Modibbo Adama University								
SAU16	S	S	S	S	S	S	R	S
SAU17	S	S	R	R	S	S	R	S
SAU18	S	R	R	R	S	S	R	R
SAU19	S	R	R	R	S	R	R	S

Key: CP = Ciproflaxacin, AM = Amoxicillin, CH = Chloramphenicol, ER = Erythromycin, RF = Rifampicin, GT = Gentamycin, AMP = Ampicillin, S = Streptomycin, Susceptibility (S), Resistance (R)

The prevalence of methicillin resistant Staphylococcus aureus from mobile phones is presented in Table 4. The result showed that 5(45.46%) of the isolate obtained from specialist hospital Jimeta are methicillin resistant *Staphylococcus aureus,* followed by Jimeta modern market with 4(36.36%). The lowest prevalence was obtained from Modibbo Adama University with 2(18.18%).

TABLE 4. Prevalence of Methicillin Resistant *Staphylococcus aureus* from Mobile Phones

Location	No of Isolates	% Occurrence
Specialist Hospital Jimeta	5	45.46
Jimeta Modern Market	4	36.36
Modibbo Adama University	2	18.18
Total	11	100

IV. DISCUSSION

All the mobile phones swap for this study were found to be contaminated with bacteria. The overall prevalence of MRSA of 45.46% of *S. aureus* isolates in this study can be considered high although the prevalence of this study falls above the range determined in a previous report by Abdullahi and Iregbu, (2018) who's reported 26.9%. The prevalence in this study is also higher than those reported by Gorwitz *et al*. who put the prevalence of MRSA in Nigeria at the range of 21% – 30% (Gorwitz *et al*., 2006). Similar proportions of 28.6% and

28% have been reported from various studies conducted in Kano and Bauchi, respectively (Nwankwo *et al.,* 2010; Ghamba *et al.,* 2012).

However, the finding of the present study was found to be lower than 56.00% reported by Sunjib *et al.,* (2018) on their work methicillin resistant *Staphylococcus aureus* associated with mobile phones. Ulger *et al.,* reported the prevalence of 52.00% in their studies on nosocomial infection associated with mobile phones (Ulger *et al.,* 2009). Furthermore, in a research conducted in Ethiopia by Gashaw *et al.,* on the prevalence and antimicrobial susceptibility of pattern of bacteria isolated from mobile phones of health care professionals working in Gondar town health center, they reported a lower prevalence of 21.00% compared with this study (Gashaw et al., 2014).

Moreover, in another research conducted by Ilusanya *et al.,* on personal hygiene and microbial contamination of mobile phones of food vendors in Ago-Iwoye town, Ogun state, Nigeria reported a prevalence of 50.00% which is also higher than those reported in this study. This higher prevalence can result from the fact that most of the food vendors do not wash their hand before picking their calls while they are selling their foods (Ilusanya *et al.,* 2012). The food vendors also collect money with their hand while they are holding their phones at the same time (Ilusanya *et al.,* 2012). This contributes to the microbial contamination on mobile phones by most business owners.

The prevalence of methicillin resistant *Staphylococcus aureus* obtained in this study is found to be higher in samples collected from specialist hospital Jimeta. Presence of MRSA in hospital setting can pose a serious treat; it can lead to blood stream infection and if not properly treated in can lead to sepsis and even death. Lower prevalence of methicillin resistant *Staphylococcus aureus* was obtained from samples collected from Modibbo Adama University; this could be attributed to the level of intellectuality and also awareness on the risk associated with methicillin resistant *Staphylococcus aureus* (MRSA) especially on mobile phones.

V. CONCLUSION

This study revealed that there is high prevalence of methicillin resistant *Staphylococcus aureus* in hospital settings compared to the other study areas. This indicated that there is need for good control measures and proper cleaning of mobile phones by the health workers before and after work so as to reduced microbial contamination on mobile phones of health care workers. The food vendors and business owners in the market should also observed personal hygiene.

VI. RECOMMENDATION

The is awareness campaign to the general public as well as medical personnel for the need of proper hygienic practices in other to prevent the spread of antibiotic resistance bacteria such as MRSA. Protocols should be established to restrict the use of mobile phones in sensitive areas of the hospital. Disinfection of mobile phone is also important as it may prevent the spread of nosocomial infection.

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