Available online at http://www.ssstj.sci.ssru.ac.th

Suan Sunandha Science and Technology Journal

Bacterial Contamination of Microphones used in places of worship in Umuahia, Abia State, Nigeria

OSITA GABRIEL APPEH [1*], TOCHUKWU FRANK EGWUATU [2], ONWUBIKO EMMANUEL NWANKWO [1] and ADURE CHRISTABEL IBE [1]

[1] **Department of Microbiology , College of Natural Sciences, Michael Okpara University of Agriculture Umudike, P.M.B. 7267. Umuahia, Abia State, Nigeria**

[2] **Department of Cell Biology and Genetics, Faculty of Science, University of Lagos, Akoka-Yaba, Lagos, Nigeria.**

Corresponding author e-mail: ositaappeh@yahoo.com

Received: ***13 Dec 2018*** **/ Accepted:** ***24 Jun 2019***

Abstract

Bacteria can survive on the surface of the microscopic grooves and cracks and will go unnoticed, hence the presence of pathogenic bacteria on the user interface of microphone possesses a potential risk to vulnerable, immune compromised individuals. The aim of this study was to study the antibiotics patterns of bacteria isolated from microphones used at different churches in Umuahia, Abia State, Nigeria. 100 samples were collected from the mouthpiece and handles of the various microphones from 22 different churches in Umuahia with sterile swab sticks moistened with normal saline. A total of 85 isolates comprising of eight (8) genera were characterized from the samples. These organisms included *Staphylococcus* sp*, Coagulase negative Staphyococcus* (CoNS)*, Streptococcus* sp, *Micrococcus* sp, *Bacillus* sp, *Proteus* sp, *Escherichia coli and Pseudomonas* sp. Frequency distribution of the isolates was as follows *Staphylococcus* sp. (5.88% of total), *Coagulase negative Staphylococcus* (CoNS) were (11.76%), *Streptococcus* sp. (9.41%), *Micrococcus* sp. (1.18%), *Bacillus* sp. (3.53%), *Proteus* sp. (17.65%)*, Escherichia coli* (36.47%) and *Pseudomonas* sp. (14.12%). The sensitivity and resistance testing of the bacteria to different antibiotics showed that all the isolates were 100% sensitive to Peflacine, Ciprofloxacin and Gentamicin. The highest percentage resistance of 42.85% was recorded for Ampicillin while the least percentage resistant of 14.28% was recorded for Ofloxacin, Streptomycin and Cefalexin each. This study showed that microphones can aid in the spread of pathogenic microorganisms between individuals and among groups at large.

Keywords: Mouthpiece, Microphone, Antibiotics, Sensitivity, Resistance

1. Introduction

Bacteria can survive in the microscopic grooves and cracks on surfaces and will go unnoticed. Oils in the skin, dust, grime moisture and warmth from central heating systems provide an ideal environment for these bacteria to accumulate. Bacteria, such as *Escherichia coli,* can survive on dry air or sunlight (Ashgar and El-said, 2012). Bacteria that can cause severe gastroenteritis have been found on frequently touched surfaces. Majority (80%) of infection (Chandra *et al.,* 2014) are spread through hand contact with surfaces. Various Gram negative bacteria and Gram positive cocci were isolated from daily used gadgets like computer, microphones, mobile phones, stethoscopes etc. (Chandra *et al.,* 2014) computer keyboards, mice, elevator buttons and shopping carts (Al-Ghamdi *et al.,* 2011). Roxburgh (2005), demonstrated that bacteria can be readily transferred from hands to almost any frequently used surfaces. Scientific research has shown that commonly used surfaces are potential sources of infectious bacteria leading to the spread of sickness and diarrhea (Reynolds *et al.,* 2005). Fomites such as Microphones carry germs and when one touches it and then touches the mouth, nose, eye etc., there may be transfer of germs in the body. The presence of pathogenic bacteria on the user interface of Microphone possesses a potential risk to vulnerable, immune compromised individuals. It has been shown that hard, nonporous surfaces have the highest bacteria transfer rates to hands (Rusin *et al.,* 2002). Microphones are commonly used in churches, schools, seminars, ceremonies and public gatherings. Bacterial contamination of microphones is a major health hazard and plays an important role

Suan Sunandha Science and Technology Journal

in the transmission of different diseases in public gatherings, schools and churches. The aim of this study was to study the antibiotics patterns of bacteria isolated from microphones used at different churches in Umuahia, Abia State, Nigeria.

1 Materials and Methods

Sample Collection

A total of 100 (≤5 microphones per centre) microphones were sampled at random from 22 places of worship within Umuahia, Abia State, Nigeria with the aid of sterile cotton swab sticks moistened with 0.85% normal saline before swabbing the mouthpiece and handle of the microphones. The cotton swab sticks were transferred into an ice-box and transported immediately to the laboratory for bacteriological analysis (Cheesbrough, 2006).

Bacterial Isolation

After sample collection, the specimens were transported to the Department of Microbiology Laboratory, Michael Okpara University, Umuahia, Nigeria where they were cultured using the streak plate method on MacConkey agar, 5% blood agar and nutrient agar respectively and incubated at 37˚C for 24 hours (Cheesbrough, 2006).

Characterisation of Bacterial Isolates

The identification of bacteria from the surface of microphones was carried by standard methods. The isolates were identified by the modification of the methods described by Cheesbrough (2006), based on their morphological characteristics and biochemical tests. The isolates were examined for shape, elevation, opacity, size, edge and pigmentation. The following biochemical tests were carried out to identify and characterize the isolates: Gram staining, coagulase test, citrate test, motility test, indole test, urease test, catalase test, triple sugar iron test and oxidase test.

.

Antibiotic Sensitivity Testing

Antibiotic disc sensitivity testing was performed on the identified isolates using disc diffusion method on Mueller-Hinton agar as described by Bauer *et al.,* (2009). In this method, standard paper discs impregnated with known amounts of antibiotics were placed on the Mueller-Hinton agar inoculated with the test organism and incubated at 37˚C. The plates were incubated aerobically at 37^0C for 24 h and the zones of inhibition developed were measured and recorded. The zones of inhibition (IZDs) of all the antibiotics in the discs measured and recorded were used to establish the antibiogram of the clinical isolates by comparing their IZDs with the IZD breakpoints already established by European Committee on Antimicrobial Susceptibility Testing (EUCAST, 2009). The isolates were classified as either resistance or intermediately sensitive or sensitive based on the guidelines of EUC AST, 2009. The antibiotics (Expert Diagnostics) used were Ofloxacin 10µg, Pefloxacin 10µg, Ciprofloxacin 10µg; Amoxicillin-Clavulanic acid 30µg, Gentamicin 10µg, Streptomycin 30µg, Cefalexin 10µg, Septrin 30µg and Ampicillin 30µg.

Data Analysis

Percent resistance/sensitive for each species of bacteria was calculated using SPSS version 23 and presented as simple percentages.

Results

Table 1 shows the source of the samples and the distribution of bacterial count according to the sample sources. In the table, churches L and M have the least number of microphone samples (2) and number of positive growth (1) while sample V has the highest number microphone sample (13) and the number of positive growth (10).

Vol.06, No.2 DOI: 10.14456/ssstj.2019.7

Suan Sunandha Science and Technology Journal

Table 1: Source of Samples and Number of Samples

CHURCHES/FELLOWSHIPS	NUMBER SAMPLED (%)			NUMBER OF RECOVEED ISOLAES (%)		
	HANDLE (%)	**MP (%)**	**TOTAL**	**HANDLE (%)**	**MP (%)**	**TOTAL**
A	3 (50)	3(50)	6	1(33.33)	2(66.67)	3
B	2(50)	2(50)	4	2(100)	1(50)	3
C	2(40)	3(60)	5	2(100)	2(66.67)	4
D	2(66.67)	1(33.33)	3	1(50)	1(100)	2
E	1(33.33)	2(66.67)	3	1(100)	2(100)	3
F	2(50)	2(50)	4	2(100)	2(100)	4
G	4(57.14)	3(42.86)	7	4(100)	3(100)	7
H	3(60)	2(40)	5	3(100)	2(100)	5
I	1(33.33)	2(66.67)	3	1(100)	2(100)	3
L	2(66.67)	1(33.33)	3	2(100)	1(100)	3
K	1(33.33)	2(66.67)	3	1(100)	2(100)	3
	_	2(100)	2	_	1(50)	1
M	1(50)	1(50)	2	__	1(100)	1
N	2(50)	2(50)	4	1(50)	2(100)	3
O	3(75)	1(25)	4	2(66.67)	1(100)	3
P	2(33.33)	4(66.67)	6	2(100)	4(100)	6
Q	4(66.67)	2(33.33)	6	3(75)	2(100)	5
R	2(50)	2(50)	4	2(100)	2(100)	4
S	1(33.33)	2(66.67)	3	1(100)	1(50)	2
T	2(33.33)	4(66.67)	6	2(100)	4(100)	6
U	2(50)	2(50)	4	2(100)	2(100)	4
	8(61.54)	5(38.46)	13	5(62.5)	5(100)	10
			100			85

KEY: MP = Mouthpiece

Vol.06, No.2 DOI: 10.14456/ssstj.2019.7

Suan Sunandha Science and Technology Journal

Morphological characteristics and biochemical identification of the bacterial isolates are shown in table 2 and 3 respectively, which indicate the recovery of 85 isolates comprising of 8 genera of bacteria namely *Staphylococcus aureus, Micrococcus* sp, *Streptococcus* sp*, Bacillus* sp*, Proteus* sp*, Escherichia coli, Pseudomonas aeruginosa* and *coagulase negative Staphylococcus.*

Table 2: Morphological characteristics of bacteria isolates

ELEVATION	SHAPE	OPACITY	SIZE	EDGE	PIGMENTATION	ISOLATES
Convex	Circular	Opaque	Medium	Entire	Golden yellow	*Staphylococcus aureus*
Umbonate	Oval	Transparent	Medium	Undulate	Green	*Pseudomonas aeruginosa*
Raised	Circular	Opaque	Small	Entire	Haemolytic on blood agar	*Streptococcus sp*.
Raised	Circular	Translucent	Small	Entire	Pink on MacConkey	*Escherichia coli*
Convex	Circular	Translucent	Small	Entire	White	Coagulase negative *Staphylococcus*
Convex	Circular	Opaque	Small	Entire	Non diffusible Bright yellow	*Micrococcus sp.*
Convex	Circular	Transparent	Small	Entire	Yellow	*Proteus sp*.
Umbonate	Irregular	Opaque	Large	Undulate	White	*Bacillus sp*.

Vol.06, No.2 DOI: 10.14456/ssstj.2019.7

Suan Sunandha Science and Technology Journal

Table 3: Biochemical identification of the isolates

	GRAM	REACTION CATALASE	COAGULASE	TSI	MOTILITY	INDOLE	UREASE	CITRATE	OXIDASE	PROBABLE ORGANISMS
Cocci	+	+	+	-	-	-	-	-	-	*Staphyococcus aureus*
Rod	-	+	-	-	+	-	+	+	+	*Pseudomonas aeruginosa*
Cocci	+	-	-	-	-	-	-	-	-	*Streptococcus sp*
Rod	-	+	-	+	+	+	-	-	-	*Escherichia coli*
Cocci	+	+	-	-	-	-	-	-	-	CoaN. *Staphylococcus*
Rod	+	+	-	-	+	-	-	+	+	*Bacillus sp*
Rod	-	+	-	-	+	+	+	+	-	*Proteus sp*
Cocci	+	+	-	-	-	-	-	-	+	*Micrococcus sp*

KEYWORDS

+ = Positive

- = Negative

CoaN = Coagulase Negative

Results for the percentage of occurrence of different bacteria isolate are represented in table 4 which show that *Escherichia coli* has the highest percentage of occurrence (36.47%) followed by *Proteus* with (17.65%) and *Micrococcus* has the lowest percentage of occurrence with (1.18%).

Vol.06, No.2 DOI: 10.14456/ssstj.2019.7

Suan Sunandha Science and Technology Journal

Table 4: Percentage of occurrence of different isolates

Isolates	Number	Percentage (%)
Staphylococcus aureus	5	5.88
Coagulase negative *Staphylococcus*	10	11.76
Streptococcus sp	8	9.41
Micrococcus sp	1	1.18
Bacillus sp	3	3.53
Proteus sp	15	17.65
Escherichia coli	31	36.47
Pseudomonas aeruginosa	12	14.12
Total	85	100

Antibiotic susceptibility pattern result is showed in table 5. *S. aureus* has the highest susceptibility to streptomycin (100%) and *Micrococcus* is completely resistant to streptomycin (0%). *E. coli* has the highest susceptibility to Tarivid (80.7%) and *Micrococcus* is resistant (0%). *Micrococcus* has the highest susceptibility to Peflacine (100%) and *Staphylococcus aureus* has the least susceptibility (20%).

Table 5: Antibiotic sensitivity pattern of isolates

ISOLATES	NUMBER TESTED	NUMBER SENSITIVE (%)								
		OFX	PEF	CPX	AU	S	CEP	SXT	PN	CN
Staphyococcus aureus	5	2(40)	1(20)	4(80)	2(40)	5(100)	3(60)	0(0)	1(20)	3(60)
CoaN. Staphylococcus	10	8(80)	9(90)	8(80)	5(50)	8(80)	5(50)	2(20)	7(70)	8(80)
Streptococcus sp.	8	2(25)	3(37.5)	4(50)	2(25)	6(75)	4(50)	2(25)	2(25)	5(62.5)
Micrococcus sp.	1	0(0)	1(100)	1(100)	0(0)	0(0)	1(100)	1(100)	0(0)	1(100)
Bacillus sp.	3	—	—	—	—	—	—	—	—	—
Proteus sp.	15	12(80)	13(86.67)	12(80)	6(40)	12(80)	6(40)	4(26.67)	0(0)	13(86.67))
Escherichia coli	31	25(80.7)	20(64.5)	20(64.5)	10(32.3)	26(83)	8(25.8)	3(9.7)	5(16.1)	25(80.7)
Pseudomonas aeruginosa	12	6(50)	5(54.16)	4(33.33)	0(0)	7(58.33)	0(0)	0(0)	0(0)	7(58.33)

OFX – Tarivid (10µg) S– Streptomycin (30µg) SXT–Septrin (30µg) CN– Gentamicin (10µg)
PEF– Peflacine (10µg) CEP– Ceporex (10µg) PN–Ampicillin (30µg) CPX–Ciprofloxacin (10µg)
AU–Augmentin (30µg)

Vol.06, No.2 DOI: 10.14456/ssstj.2019.7

Suan Sunandha Science and Technology Journal

Discussion

Microphones are of the most commonly touched surfaces today. In this study, the microphones examined were contaminated with a considerable number of Gram positive and Gram negative bacteria and this is in agreement with the research findings of Adamu *et al.,* (2012) and Catano *et al., (*2012) who obtained Gram positive and Gram negative bacteria from surfaces from currency banknote and computer keyboards, curtains, cell phones, white coats and ties respectively. Findings from this study revealed *Escherichia coli* to be the most frequently occurring isolate with the percentage occurrence of 36.47%. This was found to be at variance to the findings of Oluduro *et al.,* 2011 who reported *Staphylococcus aureus* (35.8%) as the frequent bacteria contaminant of electronic hardware in Ile-Ife. *Escherichia coli* is a normal flora of the gastrointestinal tract which can be picked up easily from toilet door handles. In a society of low hygiene, this probably explains its preponderance as a bacterial contaminant of surfaces. *Escherichia coli* has also been associated with various infectious disease conditions and nosocomial infections. Since users constantly touch interfaces, there is every chance of introducing *Escherichia coli* onto the interface in use.

Bacillus sp. were isolated from the findings in this research, and their presence could be explained by the fact that *Bacillus* sp. are ubiquitous in nature with their spores able to resist environmental changes, withstand dry heat and certain chemical disinfectants for moderate period. This finding is in agreement with the research carried out by Datta *et al.,* (2009) who reported that large number of *Bacillus* spp was transferred from fingertips or hands touching inanimate surfaces.

Staphylococcus aureus that was isolated from the samples is a major component of the normal floral of the skin and nostrils. This probably explains its high prevalence as a contaminant, as it can be easily discharged by several human activities including sneezing, talking, and contact with moist skin (Itah and Ben, 2004). It has also been associated with numerous infectious disease conditions and nosocomial infections. It follows that since users constantly touch interface and often sneeze, there is every chance of introducing *Staphylococcus aureus* on to the interface in use. Also, airborne organisms can be transported from users to passerby. The isolation of *Micrococcus sp*. from this study was in conformity with the work of Opera *et al.,* (2013) and Bashir *et al.,* (2016) who reported the isolation of *Micrococcus* sp. from public toilet.

Conclusion

The findings of this study showed that microphones can aid in the spread of microorganisms between individuals and among groups at large. Pathogenic bacteria isolated from microphones in this study indicate that they can be vehicles for disease transmission. Microbes present on the mouthpiece and handle of a microphone can aid in the transfer of germs to the body and also cause infections. Cleaning and disinfection of hands and microphones (mouthpiece and handle) will help in the removal and interruption of the growth of these pathogenic organisms thus reducing the rate of disease transmission and contamination.

References

Adamu, Y., Jairus. Y. & Ameh, J. A. (2012). "Bacterial contaminants of Nigerian currency notes and associated risk factors" *Medwell Research Journals of Medical Sciences* 6(1):1-6. Doi:10.3923/rjmsci.2012.1.6

Al-Ghamdi., A, Abdelmalek S, Ashshi A, Faidah H, Shukri, H. & Jiman-Fatani, A. (2011). "Bacterial contamination of computer keyboards and mice, elevator button and shopping carts". *African Journal of Microbiology Research* 5(23)3998-4003

Ashgar, S. S. & El-Said, H. M. (2012). Pathogenic bacteria associated with different public environmental sites in Meca City. *Open Journal of Medical Microbiology*. 2:133-137.

Bashir S.F., Muhammad H., Sani N.M & Kawo A.H. (2016). Isolation and identification of bacterial contaminants from door handles of public toilets in Federal University of Dutse, Jigawa State Nigeria. *Journal of Pharmacy and Biological Sciences* 11(5):53-57

Suan Sunandha Science and Technology Journal

Bauer, A.W., Kirby W.M., Sherris J.C. & Truck, M. (2009). Antibiotic susceptibility testing by a standardized single disc method. *American Journal of Clinical Pathology* 45(4):493 - 496

Catano L, Echeverri. & Szela, C. (2012). Bacterial contamination of cloths and environmental items in a third level Hospital in Colombia. *Interdisciplinary Perspectives on infectious Disease*. 5:40-45.

Chandra J., Sowndarya A., Sirisha & Sharma (2014). How safe ladies handbags are: a microbioogical view. *Journal of Biology and Medicine* 6:212

Cheesbrough M. (2006). *Medical Laboratory Manual for tropical countries volume II*. Second edition, university press, Cambridge, Great Britain, 377

Datta, P. Rami, H. Chander, J. & Gupta, V. (2009) "Bacterial contamination of mobile phones of healthcare workers" *Indian Journal of Medical Microbiology* 27(3):279-281

EUCAST.(2009). Breakpoint tables for interpretation of MIC and Zone diameters version 1.0 .

Itah., A.T. & Ben A.E (2004). Incidence of enteric bacteria and *Staphylococcus aureus* in day care centers in Akwa-Ibom State, Nigeria. *Southeast Asian Journal of Tropical Medicine and Public Health* 35(1):202-209.

Oluduro, A.O., Ubani, E.K. & Ofoezie, I.E. (2011). Bacterial assessment of electronic hardware user interfaces in Ile-ife, Nigeria. *Journal of Basic and Applied Sciences*. 93:585-592

Opera, B.O., Ojo, J.O., Omonighenin, E. & Bamidele, M. (2013). Antibiotic susceptibility and plasmid profile analysis of pathogenic bacteria isolated from environmental surfaces in public toilets. *Transnational Journal of Science and Technology* 3(2):22-30

Reynods, K.A., Watt, P.M., Boone S.A & Gerba, C.P (2005). Occurrence of bacteria and biochemical markers on public surfaces. *Internat*ional Journal of Environmental Health Research 15:225-234

Roxburgh, J.C. (2005). "swabbing of ATM machines" Rentokil initial technical report, Rentokil initial PLC, London, 2005

Rusin P, Maxwell, S. & Gerba, C. (2002). Comparative surface-to-hand and fingertip to- mouth transfer efficiency of Gram positive bacteria, Gram negative bacteria and phage. *Journal of Applied Microbiology.93: 585-592.*