



Occurrence of Bacterial Species from Mobile Phones of Students from Two Departments in Niger State Polytechnic Zungeru, Nigeria

¹Abubakar I., ²Bello A.Y., ³Mohammed, S.S.D., ⁴Nata'ala, M.K. and ³Aliyu, I.M.

¹Department of Biological Science, Microbiology Unit, Niger state Polytechnic, Zungeru, Niger State, Nigeria.

²Department of Basic Science and General Studies, Federal College of Forestry Mechanization, Afaka, Kaduna State, Nigeria.

³Department of Microbiology, Kaduna state University, Kaduna, Nigeria.

⁴Department of Microbiology, Usmanu Danfodiyo University Sokoto, Nigeria.

ABSTRACT

Mobile phones have become essential accessories in our daily activities. However unlike our skin and clothes that we wash regularly, our mobile phones are seldom cleaned thereby serve as fomites for a variety of infections. Isolation and characterization of bacteria species from mobile phones were investigated. A total of 50 samples were collected from the cell phones of the volunteers from the two departments at the school premises using swab stick and were cultured on Nutrient agar, MacConkey and Centrimide agar using spread plate method. Bacterial species encountered from phones of students in Biological sciences include: *Staphylococcus aureus* (40%), *E coli* (20%), *Klebsiella* sp (16%), *Salmonella* sp (8%), and *Bacillus* sp (16%). While those encountered from phones of students in Estate managements include: *Staphylococcus aureus* (36%), *E coli* (28%), *Klebsiella* sp (12%), *Salmonella* sp (8%) and *Pseudomonas* sp (16%). In general, personal hand hygiene is very important and phone decontamination with disinfectants such as ethanol and the likes should be adopted by phone users to prevent cross and self-contamination by these bacteria species.

Keywords: Mobile phones, fomites, bacteria, personal hygiene, decontamination.

INTRODUCTION

The mobile phone (GSM) was invented in Europe in 1982 with the aim of providing and improving communication networks (Neubauer *et al.*, 2005), though was introduced into Nigeria on 27th August, 2000. Since then, the number of subscribers has to a great extent increased to over forty millions with about eight service providers (Nwadike, 2007). Mobile phones or handsets or cell phones as it is popularly called, has become extremely indispensable accessories in our daily activities. However unlike our skin (hands and body surfaces) and clothes that we wash regularly, our mobile phones are seldom cleaned thereby serve as fomites (inanimate reservoir of pathogens) for a variety of infections such as nosocomial infections (Yusha'u *et al.*, 2010). Meanwhile, because of their usefulness and benefits to our social and economic life, we simply ignore its health hazard, even though most of its users and the number of people who may use the same phone may lack personal hygiene. Despite the fact that they are usually stored in bags or pockets, mobile phones are

handled frequently and held close to the face (Smith *et al.*, 2009). This constant handling of the phones by different users exposes them to a range of microorganisms and the heat generated by the phones creates a prime breeding site for all sorts of microorganisms, thus making them an excellent carrier for microbes, particularly those related with the skin contributing to the spread of different microorganisms from one user to another. Researchers have discovered that contaminated fomites or surfaces play an important role in the spread of bacterial infections (Kawo *et al.*, 2012; Kawo and Musa, 2013).

The study therefore, aimed at investigating the bacterial contamination of mobile phones of students from department of Biological science

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Address Correspondence to:

eedreez98@yahoo.com

and department of Estate Management in Niger State Polytechnic Zungeru, Niger State, Nigeria.

METHODOLOGY

Study Area

This research study was conducted at Microbiology laboratory of Department of Biological science, Niger State Polytechnic Zungeru Campus, Wushishi Local Government Area of Niger State, Nigeria, on coordinates 9° 48'N 6° 9'E and elevation of 149 m (489 ft), between March 30 to April 17 2016.

Sample Collection and Preparation

A total number of 50 mobile phones samples were randomly collected and were used for this study. Out of which 25 were from students in the department of Biological science and the remaining 25 mobile phones were from students in the department of Estate Management both of which were from the same campus. Written and oral consents were taking from all the participants before using their phones for this study. The samples were collected aseptically by swabbing over the surface of the targeted mobile phones held with the help of sterile gloves using sterile cotton swab moistened with the sterile (0.85%) normal saline solution after which the swab was quickly placed into its container and sealed. The swab sticks were labeled with the , were numbered and immediately transferred to the laboratory with an hour of collection. Sampled mobile phone swab were streaked onto an already prepared nutrient agar. The petri- plates were incubated in the incubator aerobically in an inverted position at 37 °C for 24 hours (Kawo and Rogo, 2008). The plates were then observed for the presence of bacterial colonies and their distribution. Specific colonies were sub-cultured on nutrient agar in petri-plates to obtain pure culture.

Characterization and Identification of Bacteria Isolates

Single colonies were selected from each cultured plate and the isolates were subsequently characterized and identified by Gram staining, growth on Mac-Conkey agar, Cetrimide agar and the biochemical tests as described by Ekrakene and Igeleke, (2007). The

biochemical tests include; IMViC [Indole, Methyl Red, Voges Proskauer test and Citrate utilization test] (Aneja, 2003; Verma *et al.*, 2013). While Gram positive cocci were identified on the bases of their reaction in catalase, and coagulase test as described in Cheesbrough (2000); Ryan and Ray, (2004). On the other hand a slide coagulase test was conducted in other to differentiate between *Staphylococcus* and *Streptococcus*. Isolates were purified, identified based on the morphological, physiological and the biochemical characteristics as described in Bergey's Manual of Determinative Bacteriology (Holt *et al.*, 1994).

RESULTS

All of the fifty (50) mobile phones that were analyzed had shown bacterial growth, consisting of six genera of bacteria, which were identified as *Staphylococcus*, *Bacillus*, *Escherichia*, *Pseudomonas*, *Klebsiella*, and *Salmonella*. The morphological and biochemical characteristics of the bacterial those were isolated from the phones of the students in Biological Science which revealed the presence of the presences of *Staphylococcus aureus*, *Escherichia coli*, *Klebsiella* and *Salmonella* sp and *Bacillus* sp (Table 1). The morphological and biochemical characteristics of the bacterial isolates from the phones of students in department of Estate Management which also revealed the occurrence of *Staphylococcus aureus*, *Escherichia coli*, *Klebsiella* species, *Salmonella* species and *Pseudomonas* species (Table 2). The type, number and the prevalent rates (in percentage) of bacterial isolate from mobile phones of the students from the two departments (Biological Science and Estate Management) were with variations. The Table 3 revealed that *Bacillus* sp were only found on the phones of students from the department of Biological Science while *Pseudomonas* sp were only discovered on the phones of Estate Management students among other bacteria isolates characterized and identified. More so the number of *Salmonella* sp observed were the same for both department although at a very low occurrence (8%) (Table 3)

Table 1 Morphological and Biochemical Characteristics Bacterial Isolates from Phones of Students in Department of Biological Science

Gram's reaction	Indole	MR	VP	Citrate	Catalase	Urease	Motility	Oxidase	Coagulase	TSI	Probable Bacterial
GPC	NA	NA	NA	NA	+	+	-	-	+	NA	<i>Staphylococcus aureus</i>
GNR	+	+	-	-	NA	NA	NA	NA	NA	NA	<i>Escherichia coli</i>
GNR	-	-	+	+	NA	+	-	NA	NA	+	<i>Klebsiella species</i>
GNR	-	+	-	+	NA	-	+	NA	NA	NA	<i>Salmonella species</i>
GPR	-	-	+	+	+	-	+	+	-	NA	<i>Bacillus species</i>

Keys: - = Negative, + = Positive, NA = Not applicable,

Table 2: Morphological and Biochemical Characteristics of Bacterial Isolates Phones of Students in Department of Estate management.

Gram's reaction	Indole	MR	VP	Citrate	Catalase	Urease	Motility	Oxidase	Coagulase	TSI	Probable Bacterial
GPC	NA	NA	NA	NA	+	+	-	-	+	NA	<i>Staphylococcus aureus</i>
GNR	+	+	-	-	NA	NA	NA	NA	NA	NA	<i>Escherichia coli</i>
GNR	-	-	+	+	NA	+	-	NA	NA	+	<i>Klebsiella species</i>
GNR	-	+	-	+	NA	-	+	NA	NA	NA	<i>Salmonella species</i>
GNR	-	-	-	+	+	-	+	+	-	NA	<i>Pseudomonas species</i>

Keys: - = Negative, + = Positive, NA = Not applicable,

Table 3 Occurrence of Bacterial species from mobile phones of students from the two departments.

Bacterial isolates	No. of bacterial isolates (DBS)	No. of bacterial isolates (DEM)	Prevalence rate (%) (DBS)	Prevalence rate (%) (DEM)
<i>Staphylococcus aureus</i>	10	9	40	36
<i>Escherichia coli</i>	5	7	20	28
<i>Klebsiella species</i>	4	3	16	12
<i>Salmonella species</i>	2	2	8	8
<i>Bacillus species</i>	4	ND	16	0
	ND	4	0	16

Keys: DBS= Department of Biological Science, DEM= Department of Estate Management, ND= Not Detected, Total number of mobile phones n= 50

DISCUSSION

The presence of bacterial species such as *Staphylococcus aureus*, *Escherichia coli*, *Klebsiella* and *Salmonella* species and *Bacillus* sp in analyzing the phones from the two departments is similar to the study of Suganya and Judia (2012) who worked on covered and uncovered phones and revealed bacteria species such as *Staphylococcus aureus*, *Escherichia coli*, *Klebsiella* *Salmonella* species and *Bacillus* sp, *S. epidemidis* and *Serratia* species. Some of these bacteria were known to be associated with the human skin (for example *Staphylococcus aureus*) and the environment (for example *Pseudomonas* sp). These bacteria have played various important roles in nosocomial and other community acquired infections (Sridhar *et al.*, 2013). The presence of *S. aureus* as also documented by Akinyemi *et al.* (2009) who suggested that the presence of *S. aureus* may be because this type of bacterium increases in optimum temperature as phones are kept warm in pockets, hand bags and brief cases. In addition, occurrence of *S. aureus* could be traced to the fact that it is abundant in human body especially as a normal flora of the skin. The discovery of *E coli*, *Klebsiella* sp and *Salmonella* sp is not surprising in this particular study this might be associated with the fact that these bacteria are present in the respiratory tract and faeces of about 5% normal individuals as reported by Chesebrough (2000). These bacterial species could have been encountered with the cell phones through soil, clothing, food and/or hands of the users as revealed by Uabol-Egbenni (2003). The phones of students of Estate Management also revealed the occurrence of *Staphylococcus aureus*, *Escherichia coli*, *Klebsiella* sp and *Salmonella* species but *Bacillus* sp were not isolated, *Pseudomonas* sp that was isolated instead. Bacterial species such as *E. coli*, *Pseudomonas aeruginosa* and *Staphylococcus aureus* were revealed from the phone studied by Famurewa and David (2009). *Staphylococcus aureus* was the most prevalent bacterial agent isolated in this study with 40% and 36% for the mobile phones of the students in the department of biological science and estate management respectively, Followed by *E coli* with 20% and 28% for the two departments respectively. *Klebsiella* species had 16% and 12% for each department respectively. It was observed that *Pseudomonas* sp was not found in the samples

of phones from department of biological science whereas *Bacillus* sp was likewise not found in the samples of phones from department of estate management. Interestingly *Salmonella* sp was observed in phone samples from the two departments with the same percentage of occurrences (8%). The highest prevalence for *S. aureus* was observed in sample from the two departments. This could be as a result of *S. aureus* been a normal flora of the skin. This is in agreement with the findings of kawo and Musa, (2013) who reported *S. aureus* as the most frequently isolated bacterial with 15 (53.3%) of all the mobile phones evaluated in their study. This also agreed with Famurewa and David (2009) who revealed that *S. aureus* was the most recurrently bacterial agent that were observed, comprising about 32.9% of the phone samples evaluated. The students of biological sciences, especially microbiology units from whom most of the sample were collected usually receive lecture in the same laboratory where practical are conducted and their phones are mostly charged even when lectures or practical are not on. This practice could be the reason for the presence of *Bacillus* sp and other species of bacteria isolated from their phones. According to Haider *et al.* (2016) they attributed the presence of *Bacillus* sp to the unhygienic practice of the phone users and frequent handling by many users with different hygiene profiles producing regular skin contact with the phones which may have resulted in the frequency and the degree of population of the isolates. The phone of students from estate management were observed to contain *Pseudomonas* sp this result can be linked to the fact that this student on a number of occasion go on field trips and field trainings where there is frequent contact and exposure of cell phones to sand and environmental contamination. The frequency of use and exposure of mobile phones to environmental surfaces including the hands and skins of users could have also determined the degree of contamination of these phones as reported by Mohammed *et al.* (2006), this inconsequence is in agreement with the findings of Rusin *et al.* (2000) who revealed that the highest transfer rates from formites to the hands were seen with the hard, non-porous surfaces.

Conclusion

This study revealed that the mobile phones examined were loaded with a considerable high numbers of bacterial as well as potential disease-causing ones. The results also revealed the microbial contaminations of mobile phones of student from two different departments on the same campus. Thus highlight the health implications of using other people's phones as they could be loaded with microorganisms capable of causing various diseases and infections. Hence, handsets could serve as vehicles of diseases (fomites) transmission from one person to another without prior knowledge.

RECOMMENDATIONS

Since mobile phone has become an important accessory that make life much easier, strategies for avoidance of disease transmission are needed, especially given the risk of continuing contamination through persons to persons cell phone contact. It is therefore recommended that; Frequent hand cleansing, especially with instant hand sanitizers and general hygiene should be practiced; The cell phones should be handled in a manner that does not get contaminated especially by biological science students that are exposure to contaminations in the laboratory where practical works are conducted. The laboratory should not also be used as lectures halls or classes this will really reduce the level of contaminations. The cell phones should be regularly cleaned with relevant disinfectants such as ethanol. Enlightening the public on the microbial colonization of mobile phones and the use of regular cleansing agents and regular cleaning of their environment. Further research should be conducted to ascertain the level of microbial load on mobile phones, compare with the WHO accepted limit for microbial contamination of any surface sample.

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