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Isolation of bacteria and fungi from personal and public mobile cellphones: A case study of Bayero University, Kano (Old Campus)

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ABSTRACT: The effect of constant handling of personal and public handsets by various users was investigated. 50 samples were collected randomly from both students and public business centres. For each mobile phone, two sterile swab moistened with normal saline was rotated over the surface of both sides of the mobile phone. Both swabs were cultured on MacConkey Agar and nutrient Agar for bacterial growth and Sabouraud Dextrose Agar for fungi growth. Plates were incubated aerobically at 37°C for 48h for bacterial growth. The plates were incubated at 25°C for 2 week for fungi growth. It was found that personal and public cellphones showed an association of microorganisms as a result of this constant handling. The organisms consistently isolated in this research, with their frequency of occurrence based on colonial, microscopical, morphological and biochemical characters comprised of *Staphylococcus aureus* (84%), *Streptococcus* species (16%), *Aspergillus* spp (32%), *Candida* spp (16%), *Mucor* spp (43%) and *Rhizopus* (4%) in public mobile phones. However, *Staphylococcus aureus* (76%), *Streptococcus* spp (48%), *Candida* spp (12%) and *Mucor* spp (40%) were isolated from personal mobile phones. Factors such as environment, hygiene and number of user were found to affect the microbial count. Personal mobile phones have less microbial colonization than public mobile phones. Consequently, these handsets could serve as a vehicle for the transmission of pathogenic organisms. Good personal hygiene, and the need for general reduction in call tariff globally as well as cost of purchasing handsets to reduce the incidence of microbial transmission at call centres is highly advocated.

Keywords: Environmental contamination; Bacteria, Fungi, Mobile cellphones; Kano; Nigeria.

Introduction

Until the late 1980s, most mobile phones were sufficiently large in that they were permanently installed in vehicles as car phones. With the advancement in technology however, leading to the miniaturization of circuitry, the vast majority of mobile phones are hand held. In addition to the standard voice function of a telephone, a mobile phone can support many additional services such as SMS for text messaging, email, pocket switching for access to the Internet, and MMS for sending and receiving photos and video (Ekrakene and Igeleke, 2007).

The human surface tissue (skin) is constantly in contact with environmental microorganisms and become readily colonized by certain microbial species. The adult human is covered with approximately 2m² of skin, with surface area supporting about 10¹² bacteria (Mackowiak, 1982). The normal microbiota of the skin include among others; coagulase negative staphylococci, Diphtheroids, *staphylococcus aureus*,

streptococci (various species), *Bacillus* spp., *Mallassezia furfur* and *Candida* spp. Others include *Mycobacterium* spp (occasionally), pseudomonads and, Enterobacteriaceae (occasionally) (Roth and Jenner, 1998). The normal Microbiota is harmless and may be beneficial in their normal location in the host in the absence of coincident abnormalities. They can produce disease condition if introduced into foreign locations or compromise host (Ekrakene and Igeleke, 2007).

This study was aimed at detecting the contamination rates of mobile phones using cultural techniques and biochemical identification with the view to determine the relationship between microorganisms on public and personal mobile phones.

Materials and Methods

The samples were collected and analysed in accordance with the method of Gholanireza *et al.*, (2009). Using streak plate technique, fifty cell phones belonging to 25 students and 25 commercial centres at Bayero University Kano (old site) were screened. The mobile phone of each participant was obtained and the following schematic procedure was carried out for the specimen collection. The mobile phone was first held with the aid of sterile gloves. Two sterile swabs moistened with the sterile saline and each was rotated over the surface of both sides of the mobile phones. The sampled mobile phone swabs were streaked onto two plates that consist of MacConkey Agar and Nutrient Agar. The inoculated plates were incubated aerobically at 37⁰C for 48hours. The isolated microorganisms were identified using Gram's staining and further subjected to biochemical analysis.

The second sample of each mobile phone swab was streaked onto plate containing Sabouraud Dextrose Agar. The plates were incubated at 25⁰c. The cultures were examined every 2-2 day for evidence of growth. The fungi were identified by colonial morphology and microscopic examination. A drop of 95% Ethanol was placed on microscope slide. Sterile needle was used to gently remove a portion of fungal growth. When most of the ethanol has evaporated, a drop of lactophenol cotton blue were added and covered with a cover slip. It was examined under a microscope.

Results

The rate of bacterial contamination of personal mobile phone was 80.0% and public mobile phone was 100%. The isolated bacteria from public mobile phones and personal mobile phones are similar. The finding of this research indicates that *Staphylococcus aureus* and *Streptococcus species* isolated are known to cause infections in humans.

The rate of fungi contamination of personal mobile phone and public mobile is 100% and the isolated organisms are similar, some of which isolates are known to cause human infections most especially among the immuno-compromised. These isolates include; *Aspergillus species*, *Candida species*, *Rhizopus species*, and *Mucor species*.

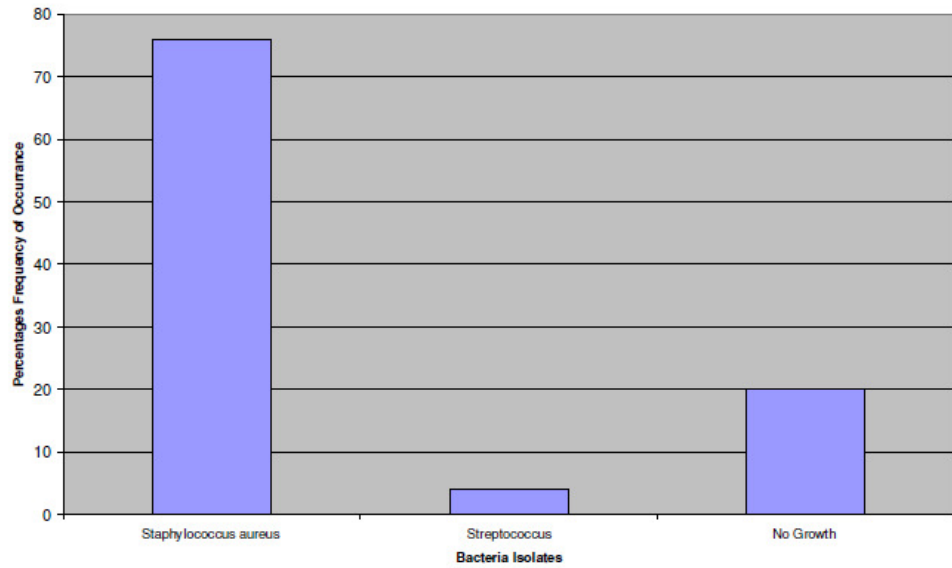


Figure 1: Percentage frequency of occurrence of bacterial isolates on personal mobile phones

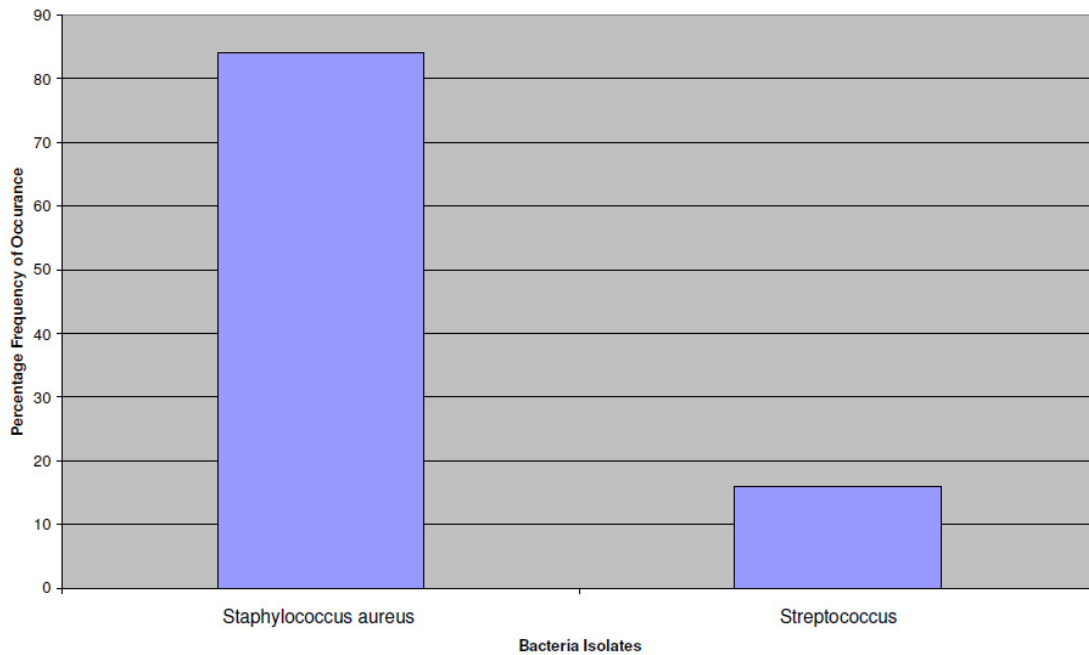


Figure 2: Percentage frequency of occurrence of bacterial isolates on public mobile phones.

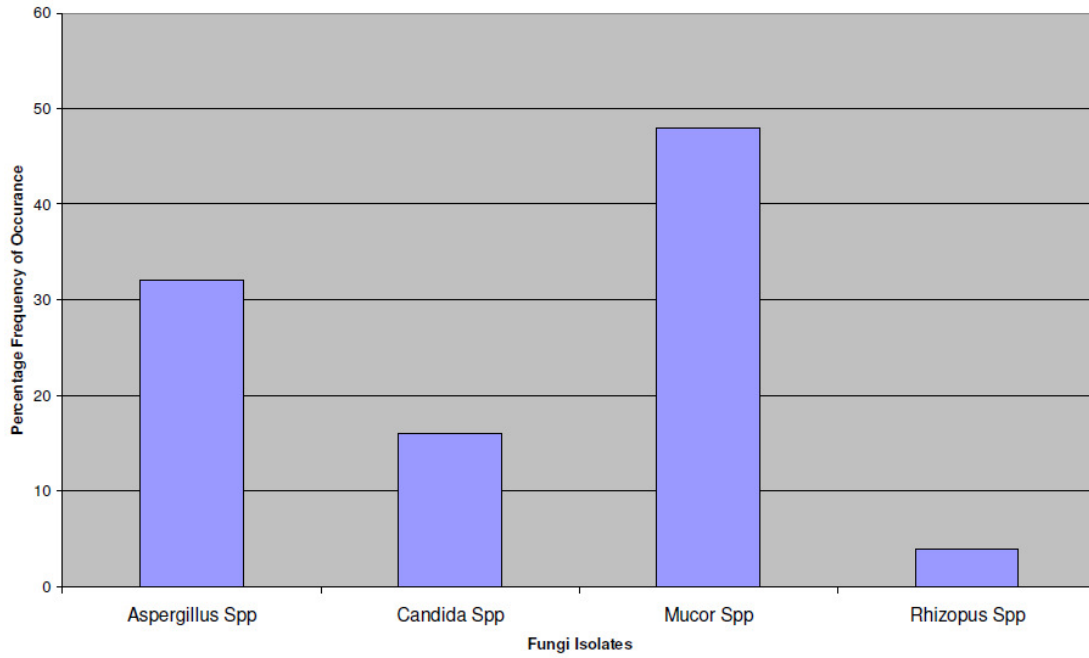


Figure 3: Percentage frequency of occurrence of fungi isolates on public mobile phones

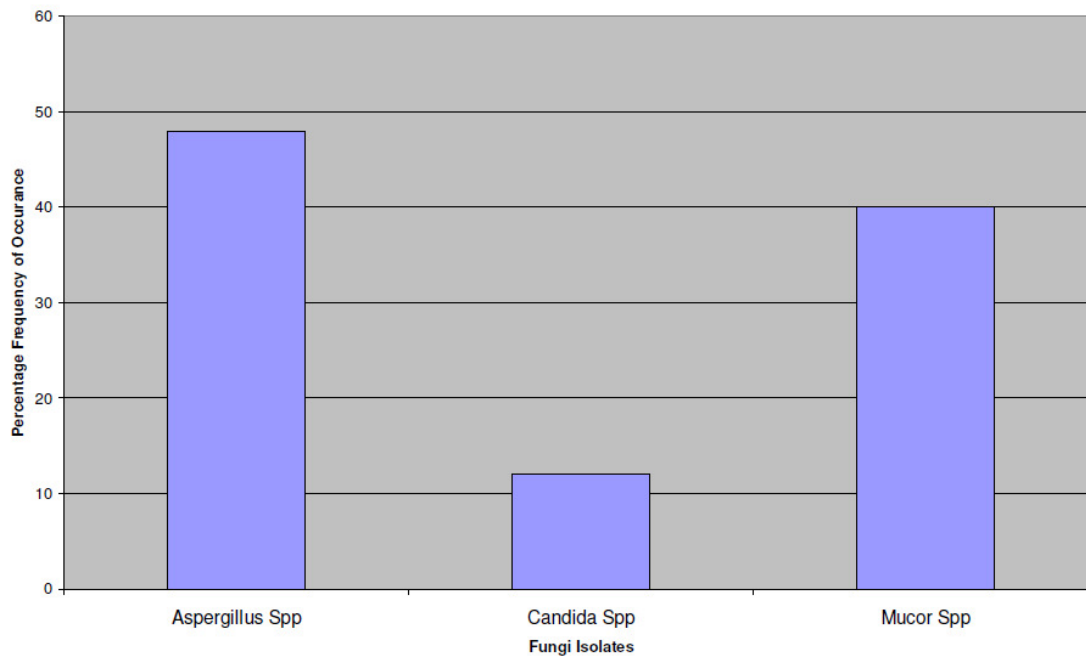


Figure 4: Percentage frequency of occurrence of fungi isolates on personal mobile phones.

Discussion

In the world over, microbiology standards in hygiene are prerequisite for a health living. It is not uncommon however to observe shift in hygienic practices that deviate from standards in developing and developed world. This investigation confirms such deviation, as arrays of microbe are found association with personal and public mobile phones.

Also important in this investigation are the factors of location, duration of usage of the phone and possible number of users as in the case of the public mobile phone.

The research findings indicate that *staphylococcus aureus* and streptococcus species are the main bacterial isolates frequently associated with personal and public mobile phones as shown in Table 2 above. These organisms may probably have their entry to the phone through the skin and hand to hand mechanism. This is because the isolated bacteria are subset of the normal microbiota of the skin as advanced by earlier researchers (Roth and Jenner, 1998). Frequent handling by many users of different hygiene profile having regular skin contact with the phones may have resulted in the frequency and the degree of population of the isolates. This has a lot of health implication (Ekkrakene and Igeleke, 2007).

Table 1: Distribution of bacteria isolated from personal and public phones.

Bacteria	Personal mobile phones N= 25 (%)	Public mobile phones N=25 (%)
<i>Staphylococcus aureus</i>	19 (76)	21 (84)
<i>Streptococcus spp.</i>	1 (4)	4 (16)
No growth	5 (20)	

Table 2: Distribution of fungi isolated from personal and public mobile phone.

Fungi	Public mobile phone N (%)	Personal mobile phone N (%)
<i>Aspergillus spp</i>	8 (32)	12 (48)
<i>Candida spp</i>	4 (16)	3 (12)
<i>Mucor spp</i>	12 (48)	10 (40)
<i>Rhizopus spp</i>	1 (4)	-

Staphylococcus aureus is known to cause illness ranging from pimples and boils to pneumonia and meningitis, which are not unlikely as corroborated by the high population of colonies (Brooks *et al.*, 2007). Streptococcus species is also known to cause illness ranging from pneumonia, meningitis, pharyngitis (Brooks *et al.*, 2007).

This study shows that 100% of public mobile phone and 80% personal mobile phones had bacterial contaminations. Figure 1 reveals the percentage frequency of occurrence of bacteria in personal mobile phone *Staphylococcus aureus* occurred in 76%, 4% occurrence was recorded for Streptococcus species and 20% no growth.

Figure 2 reveals the percentage frequency of occurrence of bacteria in public mobile phone. *Staphylococcus aureus* occurred in 84% and 16% occurrence was recorded for Streptococcus species. Significantly present also are *Aspergillus spp*, *Candida spp* and *Rhizopus spp*. respectively in public mobile phone.

Figure 4 with 48%, 40% and 12% of *Aspergillus spp*, *Mucor spp* and *Candida spp* respectively in personal mobile phone. These organisms may probably have found their entry to the phone through skin as in the case of *Candida spp*. This is because most of the isolated fungi are inhabitants of soil and air (Joanne *et al.*, 2008). *Candida spp* and *Aspergillus spp* can be pathogenic causing infection like Aspergillosis and

candidiasis (Brooks *et al.*, 2007). Rhizopus and Mucor add significantly to food spoilage and food infection through the production of toxins (Ekrakene and Igeleke, 2007). The frequency of occurrence of the fungi being more than that of the bacteria could be as a result of the period in which the research work was carried out.

Conclusion

These results showed that mobile phones which are made to make communication easy to many, if not all, is gradually assuming the status of pathogenic agent of disease transmission and if care is not taken it could be vehicle for the transmission of biological weapon of mass destruction.

Recommendations

Developing active preventive strategies like decontamination of mobile phones with alcohol containing disinfectant might reduce cross-infection. Another way of reducing microbial contamination on mobile phones is by enlightening the public on the microbial colonization of mobile phones and the use of regular cleansing agents and rearranging of their environment.

Besides soliciting for general hygiene improvement by all, there is need for cost of mobile phone to be reduced as well as the tariff. This is to enable individuals to have access to personal mobile phones together with having the financial ability to make calls without resorting to the use of public call centres. In the future mobile phone could be produced by using protective material against the microbial contaminations.

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