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RESEARCH PAPER

ISOLATION AND CHARACTERIZATION OF BACTERIA FROM MOBILE PHONES OF STUDENTS AND EMPLOYEES AT UNIVERSITY OF GONDAR, ETHIOPIA

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Present study was designed to isolate and characterize bacteria from mobile phones of University of Gondar students and employees to show that mobile phones are potential reservoir for number of bacteria. Total 50 mobile samples included in this study for isolation of bacteria and 17 selected colonies of bacteria isolated from mobile phones were further processed. Out of these colonies, we found *E. coli, E. aerogenes, Streptococcus spp.* and *S. aureus* in the percentage of 23.53%, 23.53%, 17.65% and 35.30% respectively. The finding of this research indicates that bacteria isolated and characterized from mobile phones are known to cause infections in human beings; therefore sharing of mobiles, usage of mobile during eating should be discouraged. Personal hand hygiene is very important and also washing of hand before and after handling of food and phone decontamination should be adopted by people to prevent cross and self contamination by these bacteria.

Key words: Bacteria, Mobile phone, Personal hygiene, Contamination.

INTRODUCTION

A mobile phone is a long range, portable electronic device for personal telecommunication. Aside the standard voice function of a mobile phone, 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 (Al-Abdalall, 2010; Ekrakene and Igeleke, 2007). At present, Ethiopia has the fastest growth rate of mobile phone subscribers from different parts of the world. The use of mobile phones by individuals may serve as a potential vehicle for the spread of pathogenic microorganisms (Brady *et al* 2006).

A mobile phone can spread infectious diseases by its frequent contact with hands (Kilic *et al* 2009). Mobile phones are increasingly becoming an important means of communication. The vast majority of mobile phones are hand held (Al-Abdalall, 2010). Today mobiles have become one of the most indispensable accessories of professional and social life. Although they are usually stored in bags or pockets, mobile phones are handled frequently and held close to the face station. Thus the present study was conducted to determine whether mobile phones play a vital role in the spread of bacterial pathogens and to proffer possible control or preventive measures that could be instituted to avoid this likely vehicle of infections.

It is also focused to show the necessity of cleanliness in handing personal objectives like cell phones carefully with proper cover which would prevent the multiplication of microorganisms both pathogenic and non pathogenic (Suganya and Judia Harriet Sumathy, 2012).

Research has shown that the combination of regular handling and the heat generated by the phones creates a prime breeding ground for all sorts of microorganisms that are normally found in our skin and environment. The human body surface is constantly in contact with environmental microorganisms and become readily colonized by certain microbial species. Because of the achievements and benefits of the mobile phones, it is easy to overlook its hazard to health; this is against the background that many users may have to regard for personal hygiene, and the number of people who may use the same phone. This constant handling of the phone by different users exposes it to an array of microorganisms, and makes it good carrier for microbes living on each square inch of the phone (Ibrahim *et al* 2013).

In hospitals, laboratories or while in intensive care, mobile phone use often occurs. Although, patients do not have direct contact with these phones, colonized bacteria on the devices may be transmitted to them by healthcare staff. This may cause nosocomial infections if patients' immune system is weak (Brady *et al* 2006; Karabay *et al* 2007). This study was aimed at isolation and characterization of bacteria associated with mobile phones.

Most of time people go to hotels and cafeterias and order food to the waiter for their meal of interest. Then they wash their hand and waiting for foods. Until food come they try to play games, chatting with some body, calling and picking up calls on their mobile phones. Then as soon as food comes, they try to eat while assuming mobile phones as a neat thing. Even if during dining time they pick up calls, which is a major condition to contaminate themselves with pathogenic bacteria from mobile phone. Also some medical laboratory workers who work with those pathogenic organisms; touch their mobile phone with gloves during working and when they finish work, they touch their mobile phone on bare hand.

We used to carry mobile phones in our palm, these comes into a direct contact with human body and thus microbes prompting transfer from the skin and hands to face, ears or hair. Therefore appropriate hand and body hygiene is very important. In Ethiopia, accessibility of water is problem in many parts of the country including in higher educational institutions of the country. This shows that hand washing and drying could be difficult in different parts of the country where there is no/low access of water, therefore hand gel sanitizer will serve as an alternative to sanitize our hands. Furthermore, poor environmental hygiene and group living of students in the dormitory of higher institution of Ethiopia seems to increase the risk of hand contamination (Verma *et al* 2013). These situation and living conditions leads to the contamination of mobile phones.

This pilot study was designed to access the presence of bacteria on the mobile phones of University of Gondar students and employees. Currently, mobile phones are the most popular mobile communication devices for business and personal use. It has become necessity of everyday life and an indispensable attribute of the modern society which imposes change in human behaviour. This study was carried out to gain insight into the isolation and characterization of bacteria which is found in mobile phone due to poor personal hand hygiene and could be of potential health risk of our society.

MATERIALS AND METHODS

This study was conducted between March 25 to May 30, 2015 at Department of Biotechnology, University of Gondar, which is located in Gondar town in Amhara Regional State, Ethiopia. A total of 59 mobile samples from University of Gondar students and employees were included in this study. Out of 59 samples collected from mobile phones 20, 17, 13 and 9 samples belongs to students, staff members, cleaners and health professionals respectively. Mobile phones of students and employees were randomly sampled by taking written and oral consents from all the participants included in this study.

The samples were collected aseptically using sterile cotton tipped applicators which was immersed in 0.85% sterilized normal saline solution (NSS). All the collected samples were analyzed and screened in accordance with the previously reported method (Sepehri *et al* 2009). The mobile phone was first held with the aid of sterile gloves. Sterile cotton swab moistened with the sterile (0.85%) normal saline solution was rotated over the surface of both sides of the mobile phone. The cotton swabs were transferred immediately to the laboratory with one hour of collection to prevent dryness. Sampled mobile phone swab was streaked onto nutrient agar. The inoculated plates were incubated aerobically in an inverted position at 37 °C for 48 hours. The plates were then observed for the presence of isolated

colonies and 17 selected colonies were again sub-cultured on nutrient agar in petri-plates to isolate pure culture. After isolating pure cultures, bacterial isolates were further identified and characterized by Gram staining, Mac-Conkey agar and biochemical tests (Ekrakene and Igeleke, 2007).

Biochemical tests were performed on pure culture for final identification of the isolates on the basis of their biochemical reaction. Gram-negative rods were identified by performing a series of biochemical tests IMViC [Indole, Methyl Red, Voges Proskauer test and Citrate utilization test] (Verma *et al*, 2013; Aneja, 2003). Gram-positive cocci were identified based on their reaction in catalase, and coagulase test (Cheesbrough, 2000; Ryan and Ray, 2004; Suganya and Judia Harriet Sumathy, 2012). A slide coagulase test was performed to differentiate between *Staphlococcus* and *Streptococcus*. Isolates were purified, identified and named based on the morphological, physiological and the biochemical characteristics presented in Bergey's Manual of Determinative Bacteriology (Holt *et al* 1994).

RESULTS

Most of our isolates gave positive reaction for catalase test hence, they belong to *Enterobacteriaciae.* Isolates C-09, C-05, S-14 and Sm-02 which was identified as Gram-negative and gave positive reaction for Indole and MR test and negative reaction for VP test, therefore identified as *Escherichia coli.* Isolates H-07, C-01, H-12, C-08 which was identified as Gram-negative, gave positive reaction for VP and catalase test identified as *Enterobacter aeurogenes.*

Isolates H-04, C-10, and S-01 which was identified as Gram positive cocci and gave negative reaction for all the performed biochemical tests except MR test were identified as *Streptococci* isolates S-06, S-02, S-07, C07, S-05 and S-08 which was identified as Gram positive cocci and gave positive reaction for MR, catalase and coagulase test and variable reaction for VP test and negative reaction for indole and citrate test were identified as *Staphylococcus aureus*. When the isolates again sub-cultured on Mac Conkey agar, pink colour colonies were observed for those isolates which were identified as *E. coli* and *E. aerogenes* in biochemical test (**Table 1**). After calculating the total percentage of each isolate, we found *E. coli*, *E. aerogenes, Streptococci* and *Staphylococcus aureus* in the percentage of 23.53%, 23.53%, 17.65% and 35.30% respectively (**Figure 1**).

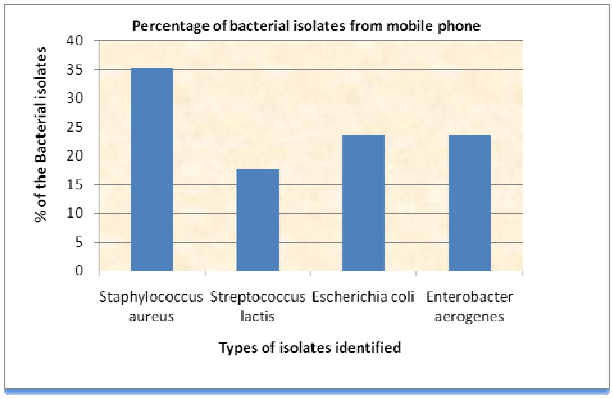

Fig. 1. Percentage of bacterial isolates from the samples collected from mobile phones

DISCUSSION

We are living in a world, which is full of microbes, it is not possible to make this world microbe free but microbiological standards and hygiene practices should be adapted by the society for a healthy life. This investigation aimed to isolate and identify bacteria and create awareness that mobile could also serve as vector for transfer these bacteria from one individual to another, therefore personal hygiene and mobile decontamination is very important.

The presence of Gram-negative rod, *E. aerogenes*, a member of the coliforms, indicates the possibility of the presence of the faecal contamination on the mobile phone. Gram negative sepsis is most commonly caused by *E. coli*, *Klebsiella* spp *Enterobacter* spp and *Pseudomonas aeruginosa* (Bone, 1993). Out of these four bacteria used to cause sepsis, we isolated and identified *E. coli* and *E. aerogenes* from mobile and the percentage of both the bacteria found to be 23.53% in our investigation (**Table 2**). The percentage of *E. coli* isolated from mobile phone was found 28.2% in another study, which is slightly higher than our study (Famurewa and David, 2009).

In previous study, it is already reported that mobile phones may get contaminated with such bacteria such as *E. coli*, *Enterococci*, *S. aureus.* They reported that 16.7% of the samples were positive for pathogens known to cause nosocomial infections. The percentage all the bacteria identified in our study were found higher than this study. *Streptococcus* species is also known to cause illness ranging from pneumonia, meningitis, pharyngitis. *S. aureus* is a common bacterium found on the skin and the

Table 1. Results of Gram staining, Biochemical test and culture characteristics on Mac-Conkey agar

Sample code	Gram stain	Shape of bacteria	Biochemical test						Mac-Conkey culture
			Indole	MR test	VP test	Citrate	Catalase	Coagulase	
S-06	+	Cocci	-	+	+	-	+	+	-
S-02	+	Cocci	-	+	-	-	+	+	-
Sm-02	-	Bacilli	+	+	-	-	+	-	+
S-07	+	Cocci	-	+	+	-	+	+	-
H-04	+	Cocci	-	+	-	-	-	-	-
H-07	-	Bacilli	-	-	+	+	+	-	+
S-14	-	Bacilli	+	+	-	-	+	-	+
C-07	+	Cocci	-	+	-	-	+	+	-
C-01	-	Bacilli	-	-	+	+	+	-	+
C-05	-	Bacilli	+	+	-	-	+	-	+
H-12	-	Bacilli	-	-	+	+	-	-	+
C 09	-	Bacilli	+	+	-	-	+	-	+
C-10	+	Cocci	-	+	-	-	-	-	-
C-08	-	Bacilli	-	-	+	+	+	-	+
S-05	+	Cocci	-	+	-	-	+	+	-
S-08	+	Cocci	-	+	+	-	+	+	-
S-01	+	Cocci	-	+	-	-	-	-	-

***+** = Positive reaction; **-** = negative reaction; **Sample codes: S** refers to students; **Sm** refers to stiff members; **C** refers to cleaners and **H** refers to health professionals.*

Table 2. Percentage of bacteria isolated from the mobile phones of University of Gondar students and employee

S. No.	Bacterial isolates	Percentage
1	*Escherichia coli*	23.53%
2	*Enterobacter aerogenes*	23.53%
3	*Streptococceus spp.*	17.65%
4	*Staphylococcus aureus*	35.30%

noses of up to 25% of the healthy human beings and animals can cause illness from pimples and boils to pneumonia and meningitis, and is a close relative of methicillin resistant *S. aureus* (MRSA). The main reservoir of *S. aureus* is the hand from where it is introduced into food during preparation. In previous study, the percentage of *Streptococcus spp.* and *S. aureus* from personal mobile phone was reported 1% and 19% respectively (Yusha'u *et al* 2010).

In present course of investigation percentage of *Streptococcus spp.* and *S. aureus* was found 17.65% and 35.30% respectively, which was very much higher than the previous report.

The presence of Gram-negative rods indicated faecal contamination of mobile phones. Phones of cleaners had the largest variety of bacteria in this study. This may be as a result of long time exposure to the environment and usage while cleaning.

Multiple usage and exposure of mobile phones to environmental microbes on the hand and skin of the users may have contributed to the level of isolation of bacteria from commercial phones in the present study. This agrees with the previous findings (Rusin *et al* 2000).

The results showed that mobile phones were contaminated with different types of bacteria mentioned above. Therefore, due to personal nature of individuals and proximity to sensitive part of our bodies in usage such as faces, ears, lips and hands of users could become veritable reservoirs of pathogens that could result in infections.

CONCLUSION

We isolated and characterized bacteria based on biochemical test and differential staining. In our findings *E. coli*, *E. aerogenes, Streptococcus spp.* and *S. aureus* bacterial species were identified. This study showed that mobile phones would serve as vector to transmit these bacteria from one individual to another.

Most of these bacteria are harmful and cause morbidity and mortality in to humans. So that personal hygienic and sanitation measures such as washing of hand before and after handling of food and phone decontamination should be adopted by people to prevent bacterial infections.

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