



Microbial Contamination and Identification of Bacterial for Mobiles Phones in Iraq

Mays Talip Abd-alla *

Mohsen Hashim Risan **

Athraa H. Muhsin***

*College of Biotechnology, Al-Nahrain University, Baghdad-Iraq.

**College of Biotechnology, Al-Nahrain University, Baghdad-Iraq.

* ** College of Science, University of Kufa, Najaf-Iraq.

E-mail: Mays_talip@yahoo.com

Received, 2018

Accepted, 2018

Abstract

This study was conducted to isolate and identify bacteria contaminants on a mobile phone. The samples were collected randomly from 20 mobile phones. This study was conducted between October to December, 2016 at College of Biotechnology, Al-Nahrain University. The isolated colonies were then sub cultured in nutrient agar and slants in order to obtain pure culture of all the six colonies. Six genera of bacteria were identified from positive cultures. In all, 20 swab samples of mobile phone were randomly examined, 19 bacterial isolates were identified from mobile phones were found contaminated with microbiota. The highest prevalence of *Staphylococcus aureus* was observed in mobile phones. The research findings indicated that *S. aureus* (8 isolates), *Escherichia coli* (4 isolates), *Enterobacter spp* (2 isolates), *Bacillus* (1 isolates), *Streptococcus spp* (1 isolates), and *Pseudomonas spp* (3 isolates), were the main isolates frequently associated with the mobile phones. Showed Percentage of bacterial isolates from the samples collected from mobile phones after calculating the total percentage of each isolate, found *S. aureus*, *E. coli*, *Enterobacter spp*, *Bacillus*, *Streptococcus spp* and *Pseudomonas spp* in the percentage of 42.10 %, 21.05 %, 10.52%, 5.26 %, 5.26 % and 15.78 % respectively. The results showed that mobile phones were contaminated with different types of bacteria mentioned above. Gram positive cocci, *Streptococcus* and *Staphylococcus spp*. were identified based on morphological characteristics. Gram negative bacilli, *E. coli*, *Enterobacter*, *Bacillus* and *Pseudomonas* were identified based on morphological characteristics. Nineteen isolates from 20 observed mobile phones belonging to the students. The highest prevalence in male was (13 isolates) and were percentage of bacteria isolated 66.66%, while in female were (6 isolates) and percentage of bacteria isolated 33.33%. Also showed results Percentage of total bacteria isolated of female and male, were 31.57% and 68.42 % respectively.

KEYWORDS: Bacterial contaminants, mobile phones, Iraq

Introduction

Iraq has more 15 million mobile phone users. *Staphylococcus aureus*, *Enterococcus faecalis*, *P. aeruginosa*, *Escherichia coli*, *Klebsiella spp.*, *Serratia spp.*, *Proteus vulgaris* and *Bacillus spp.* were frequently isolated from the mobile phone of health workers in turkey, marketers, food vendors, fingernails, lecturer and students in Nigeria [1] [2] [3] [4]. A mobile phone can spread infectious diseases by its frequent contact with hands [5]. Mobile phones are increasingly becoming an important means of communication. The vast majority of mobile phones are handheld [6]. The home and School environment are particularly concerned for the



transmission of infection among young children who are at the greatest risk [7]. Communicable diseases like diarrhoea (23%), respiratory diseases (19%) and urinary tract infection most commonly caused by *E. coli*, *Klebsiella* spp. and *Staphylococcus* spp. are the main disease burden in Kashmir [8] [9]. Cell phone of doctors and other health care workers carry nosocomial pathogens. This study was conducted to isolate and identify bacteria contaminants on a mobile phone.

Methods

Collection of samples A total of 20 swab samples. The samples were collected randomly from mobile phones. This study was conducted between October to December, 2016 at College of Biotechnology, Al-Nahrain University, with sterile cotton swab sticks. The sample was collected in duplicate by rotating the moist cotton swab stick with the surface of the both sides of mobile phones. The cotton swabs were transferred immediately to the laboratory with one hour of collection to prevent dryness. Each swab was immediately streaked on three plates of Nutrient agar. The plates were incubated at 37°C for 24 hours. The plates were then observed for growth and colonial description of the isolates. 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 size and shape and gram staining of colonies.

Microbiological study

Nutrient agar was used in the present study for isolation of the microbes. The classical culture techniques were used as standard practices in detection of the pathogens and our previous bacterial isolates from mobile phones were used as standard to confirm the microbes. Mobile phones along swab samples, the detail information were collected based on age and sex. Morphological description of colonies, gram stains [10] [11] with identification keys [12] [13][14] were used for bacterial identification.

Spread plating

The nutrient agar was prepared in 250 ml flask and was sterilized by autoclaving at 121°C at 15 psi for 20 minutes, 20 ml of the media was poured in the petri plates before getting solidified. The media was allowed to solidify. The swab was spread on the nutrient agar medium. The petri plates were incubated in an inverted position at 37°C for 24 hours. The plates were then observed for the presence of isolated colonies.

Isolation and identification

One set of the swab stick was then soaked in nutrient broth and incubated aerobically at 37°C for 24 h for the growth of microorganisms. After that each sample was streaked on the nutrient agar plate for growing of non-fastidious organisms. Then the streaked nutrient agar plates were incubated at 37°C for 24 h for the growth of microorganisms. The microbes were identified by colony characteristic, Gram's staining [15]. The distinct colonies were screened and selected on the basis of morphology, cultural characteristics by using Bergey's manual of determinative bacteriology.

Results and Discussion

The isolated colonies were then sub cultured in nutrient agar and slants in order to obtain pure cultures of all the six colonies. Six genera of bacteria were identified from positive cultures. In all, 20 swab samples of mobile phone were randomly examined, 19 bacteria isolates were identified from mobile phones were found contaminated with microbiota.

The highest prevalence of *Staphylococcus aureus* was observed in mobile phones. The research findings indicated that *S. aureus* (8 isolates), *Escherichia coli* (4 isolates), *Enterobacter* spp. (2 isolates), *Bacillus* (1 isolates), *Streptococcus* spp (1 isolates), and *Pseudomonas* spp. (3 isolates), were the main isolates frequently associated with the mobile phones (Figure1).

Showed Percentage of bacterial isolates from the samples collected from mobile phones after calculating the total percentage of each isolate, we found *Staphylococcus aureus*, *Escherichia coli*, *Enterobacter* spp, *Bacillus*, *Streptococcus* spp and *Pseudomonas* spp in the percentage of 42.10 %, 21.05 %, 10.52%, 5.26 %, 5.26 % and 15.78 % respectively (Figure 1). Environment is one of the important routes for transmission of bacteria.

The results are in accordance with the finding of [16] who observed that 99% of the phones of healthcare workers were contaminated with pathogenic micro-organisms and multi drug resistant bacteria. Mobile phone of healthcare workers in Turkey and India were contaminated with microorganism with a prevalence of 95.5 and 91.60%, respectively [17] [18].

In Nigeria, the public phones were frequently contaminated with *S. aureus*, *B. subtilis* and *Enterobacter aerogenes* and the mean bacterial viable count of these public phones was 4.93×10^6 CFU/g on nutrient agar, 2.12×10^6 CFU/g on MacConkey agar and 3.22×10^6 CFU/g on Mannitol salt agar [19].

Even in well-educated families, householders do not wash hands after going to the toilet or before eating or drinking [8] which is the predominant cause of mobile phone contamination.

The research findings indicated that the mobile phones acts as an important source of pathogenic organisms for human and can serve as vehicle for cross-transmission of microbiota. Our findings are well corroborating with the observation of other workers. Healthcare workers mobile phones in Turkey were contaminated with *Staphylococcus epidermidis*, *Staphylococcus aureus*, *Bacillus* spp. and *E. coli* [2] [17]. Also isolated *E. coli*, *Bacillus* spp. and coagulase negative *Staphylococcus* from mobile phone of health care staffs. [20] In Karabay study in Turkey, the most frequent bacteria were identified respectively as coagulase-negative Staphylococci, *Bacillus*, methicillin sensitive *Staphylococcus aureus*, *E. coli*, *Enterococcus faecalis*, *Pseudomonas fluorescens*, *K. pneumoniae*. [21]

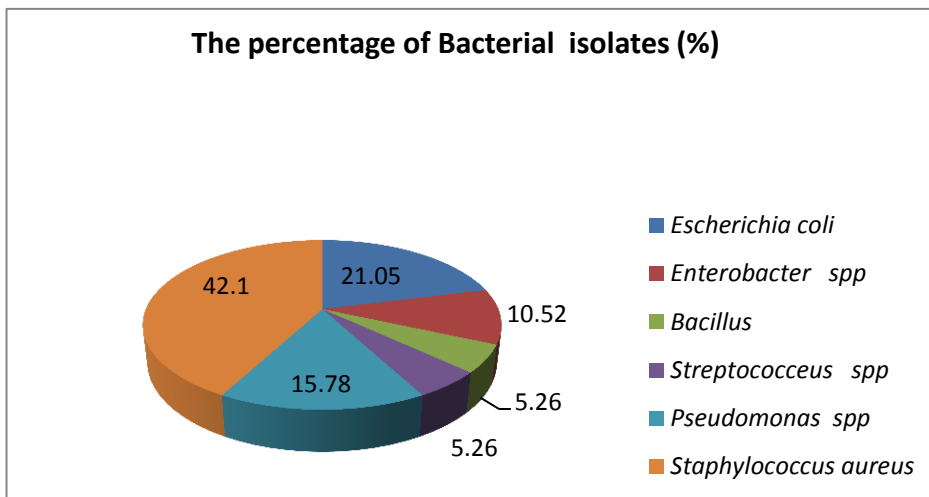


Fig (1): The percentage of Bacterial isolates from the mobile phones

The results showed that mobile phones were contaminated with different types of bacteria mentioned above. Gram positive cocci, *Streptococcus* and *Staphylococcus* spp. were identified based on morphological characteristics. Gram negative bacilli, *Escherichia coli*, *Enterobacter*, *Bacillus* and *Pseudomonas* were identified based on morphological characteristics. (Table 1). Staining helps in the identification of the organism's morphology and cell arrangement. *Escherichia coli* In Gram's staining, the morphology of the isolated bacteria exhibited Gram negative short rod arranged in single or paired and motile which was supported by several authors [22]. It is a Gram-negative, aerobic, rod-shaped bacterium with unipolar motility [23] *Pseudomonas* spp. are Rugged and opportunistic, *Pseudomonas* uses a wide range of nutritional sources as different agar media such as NA, Mackonkey, XLD, Blood agar, even very simple nutritional environments without any organic compounds. [24]

Table 1. Morphological and biochemical characteristics of Bacterial isolates from the mobile phones samples

Bacterial isolates (Species)	Gram stain	Shape	Oxid.	Cata.	Cit.	Ure.	Coag.	Nit.
<i>Escherichia coli</i>	-	Bacilli	-ve	-ve	+ve	-ve	-ve	**v.
<i>Enterobacter spp</i>	-	Bacilli	-ve	+ve	+ve	+ve	-ve	-ve
<i>Bacillus</i>	+	Bacilli	-ve	+ve	+ve	-ve	-ve	+ve
<i>Streptococcus spp</i>	+	Cocci	-ve	-ve	-ve	-ve	-ve	-ve
<i>Pseudomonas spp</i>	-	Bacilli	-ve	+ve	-ve	-ve	-ve	+ve
<i>Staphylococcus aureus</i>	+	Cocci	-ve	+ve	+ve	+ve	+ve	+ve

***Oxid:** Oxidase test, **Cata:** Catalase test, **Cit:** Citrate Utilization Test, **Ure:** Urease Test, **Coag:** Coagulase Test and **Nit:** Nitrate reduction test.



Nineteen isolates from 20 observed mobile phones belonging to the students. The highest prevalence in male was (13 isolates) and were percentage of bacteria isolated 66.66% while in female were (6 isolates) and percentage of bacteria isolated 33.33%. Also showed results Percentage of total bacteria isolated of female and male, were 31.57% and 68.42 % respectively (Table 2, 3).

Table 2. Bacteria isolated of female and male

Bacterial isolates (Species)	Female	Male
<i>Escherichia coli</i>	1	3
<i>Enterobacter</i> spp	0	2
<i>Bacillus</i>	0	1
<i>Streptococcus</i> spp	1	0
<i>Pseudomonas</i> spp	1	2
<i>Staphylococcus aureus</i>	3	5
Total	6	13

Table 3. Percentage of bacteria isolated of female and male

Bacterial isolates (Species)	Percentage %	
	female	Male
<i>Escherichia coli</i>	25	75
<i>Enterobacter</i> spp	0	100
<i>Bacillus</i>	0	100
<i>Streptococcus</i> spp	100	0
<i>Pseudomonas</i> spp	33.33	66.66
<i>Staphylococcus aureus</i>	37.5	62.5
Total Bacterial isolates	Percentage %	
	female	male
19	31.57	68.42

[25] documented hand-to-mouth transfer of microbes after handling contaminated fomites during casual activities. During every phone call the mobile phones come into close contact with strongly contaminated human body areas with hands to hands and hands to other areas (mouth, nose and ears). [26] isolated *S. aureus*, MRSA, *E. coli*, *P. aeruginosa* and *K. pneumoniae* and Coagulase negative staphylococci from mobile phones of health care workers in India. Mobile phones had 18 times more bacteria than toilet handles [27] and 16% of mobile phones were contaminated with faecal matter in U.K. [28]. Most of the mobile users frequently used their mobile phones during working in laboratories. These mobile phones carry pathogenic bacteria and opportunistic pathogens and in case they are not disinfected, they are considered as the exogenous source of nosocomial infections for patients. [29] [30]. Opportunistic pathogens such as bacteria, viruses and fungi can survive on inanimate surfaces for long periods of time and items such as watches, pens, and mobile phones are permanent

surfaces for transmission of these types of infections. [31] [32] [4]. The percentage of *E. coli* isolated from mobile phone was found 28.2% in another study, which is slightly higher than our study [3]. In previous study, the percentage of *Streptococcus spp.* and *S. aureus* from personal mobile phone was reported 1% and 19% respectively [33]. 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 [34].

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