

ISOLATION OF ANTIBIOTIC RESISTANT BACTERIA FROM THE
HANDPHONES OF MALE AND FEMALE USERS IN INTI INTERNATIONAL
UNIVERSITY

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ABSTRACT

The current most indispensable accessories of humans is the mobile phone. Despite their vast benefits, mobile phones are undoubtedly a good reservoir for bacterial transmission due to its heavy usage. This makes mobile phones excellent tools to transmit bacteria including antibiotic resistant bacteria. Thus, the objectives of this study were to isolate antibiotic-resistant bacteria from the mobile phones of male and female users in INTI International University and to preliminarily compare the pattern of distribution of antibiotic-resistant bacteria between the gender using the chi square test. Twenty-six touch screen mobile phones samples were collected from the students and lecturers of INTI International University by rubbing the screens aseptically using sterile cotton swabs. The samples were cultured onto nutrient agar to obtain pure cultures. All the isolates were subjected to confirmatory tests as well as the antibiotic susceptibility test. The antibiotic susceptibility was determined using the Clinical and Laboratory Standards Institute, 2017. A total of 53 pure culture isolates were obtained from the touch screen mobile phones, where, 48 isolates were gram-positive and the remaining 5 were gram-negative bacteria. The genera of the isolates were predicted based on the results obtained from the confirmatory tests and were confirmed with the Bergey's manual. According to the results, the possible genera of the isolates that had been isolated from the touch screen mobile phone samples were *Enterobacter sp*, *Staphylococcus epidermidis*, *Staphylococcus aureus*, *Micrococcus sp*, *Propionibacterium sp* and *Bacillus licheniformis*. Out of the 48 gram-positive, 24 isolates were resistant to at least one type of antibiotics. Apart from that, 14 isolates were resistant to cefoxitin, 18 were susceptible but the susceptibility of the other 16 isolates could not be determined. However, all the gram-negative bacteria were susceptible to all three antibiotics, namely, tetracycline, amikacin and erythromycin. The chi square tests indicated that there are no significant differences in the number of antibiotic-resistant bacteria isolated from male and female users but this can be better determined from a larger sample size.

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LIST OF ABBREVIATIONS

μg	Microgram
μL	Microliter
A	Amikacin
ASPs	Antimicrobial Stewardship Programs
<i>B.licheniformis</i>	<i>Bacillus licheniformis</i>
$^{\circ}\text{C}$	Degree celcius
CFU/MI	Colony forming units/millilitre
CLSI	Clinical and Laboratory Standards Institute
Cm	Centimetre
CO_2	Carbon dioxide
DA	Clindamycin
df	Degree of Freedom
E	Erythromycin
<i>E. coli</i>	<i>Escherichia coli</i>
Etc	Et cetera
FOX	Cefoxitin
H_0	Null hypothesis
H_1	Alternative hypothesis
H_2O	Water
H_2O_2	Hydrogen peroxide
HAIs	Healthcare-Associated Infections
HGT	Horizontal Gene Transfer

KZ	Cephazolin
MDR	Multidrug-resistant
MH	Mueller Hinton
Mm	Millimetre
MR	Methyl red
MRSA	Methicillin-resistant <i>Staphylococcus aureus</i>
MRVP	Methyl Red Voges Proskauer
MSA	Mannitol Salt Agar
Nm	Nanometre
<i>P. aeruginosa</i>	<i>Pseudomonas aeruginosa</i>
<i>P. vulgaris</i>	<i>Proteus vulgaris</i>
rpm	Revolution per minute
<i>S. aureus</i>	<i>Staphylococcus aureus</i>
<i>S. epidermis</i>	<i>Staphylococcus epidermis</i>
<i>S. Pneumoniae</i>	<i>Streptococcus pneumonia</i>
<i>S. typhimurium</i>	<i>Salmonella typhimurium</i>
TE	Tetracycline
TSI	Triple Sugar Iron
v/v	Volume/volume
VP	Voges-prokauer
VRE	Vancomycin-resistant enterococci
χ^2	Chi Square

CHAPTER 1

INTRODUCTION

The current and one of the most crucial accessories of most humans is the mobile phones (Tagoe, Gyande & Ansah, 2011). Mobile phone users are estimated to reach 4.77 billion by the end 2017 (Number of mobile, 2015). Mobile phones are widely used because of their importance and assistance in the daily lives of humans. Mobile phones provide additional services, such as email, text messaging service, as well as other services (Tagoe et al., 2011).

Despite the benefits, handphones have setbacks which are often neglected by users. These setbacks affect the health of the users (Ibrahim, Akenroye, Opawale & Osabiya, 2013). Mobile phones are known as fomites, objects that contain microorganisms obtained from the environment (Bhoonderowa, Gookool & Biranjia, 2014). The microbes on the mobile phones are able to survive and breed due to the high temperature and humid conditions provided by the phones (Srikanth, Rajaram, Sudharsanam, Lakshmanan, Umamaheswari & Kalyani, 2009). Thus, a mobile phone can easily transmit microbes including antibiotic resistant bacteria to others and to the environment (Elmanama, Hassona, Marouf, Alshaer & Ghanima, 2015). This is possible because mobile phones come in contact with the microbes found on the skin and other body parts of the users (Rawia, Hatem & Nabil, 2012). Some of the resistant bacteria that have been isolated from mobile phones are *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Staphylococcus epidermidis*, *Bacillus subtilis* and *Enterobacter aerogenes* (Amira, 2010). Therefore, in order to prevent the transmission of antibiotic resistant bacteria among the public, appropriate personal hygiene and disinfection of the contaminated surfaces should be followed (Chang, III, Byeong & Sang, 2013).

Previous study has shown that, more gram positive bacteria were isolated from the mobile phones compared to gram negative bacteria. Also, a higher number of bacteria had been isolated from the male users compared to the female users (Elmanama et al., 2015). This could be due to the hygiene factors and cosmetic

(Elmanama et al., 2015). This could be due to the hygiene factors and cosmetic products used by the female users that have antimicrobial agents which reduces the bacterial load on the skin that could possibly transfer the bacteria onto the phone. To date, very limited studies have been done to compare overall resistant bacteria loads on the mobile phones of female and male users.

Therefore, the objective of this study was to isolate antibiotic-resistant bacteria from the mobile phones of male and female users in INTI International University and to preliminarily compare the pattern of distribution of antibiotic-resistant bacteria using chi square test. By knowing the types of resistance, we may be able to somehow predict the types of antibiotics that are commonly used within this community as we all know that the higher the prescription, the higher the chances of bacteria gaining resistance towards antibiotics. Also, knowing the overall percentage or load of bacteria by gender may provide a deeper insight why the load is higher in a certain gender compared to another (if any).

CHAPTER 2

LITERATURE REVIEW

2.1 ANTIBIOTICS

An antibiotic is a chemical that kills or inhibit the growth of the bacteria. They are often used to prevent or treat bacterial infection since 1940s, and are a strong tool in the clinical management of bacterial diseases (Sengupta, Chattopadhyay & Grossart, 2013). The Scottish physician-scientist, Alexander Fleming, was the first person to discover antibiotic which was penicillin. More than a million lives have been saved ever since the initial discovery and use of antibiotics (Tan & Tatsumura, 2015).

Antibiotics are also important in preventing or treating infections in patients who are undergoing chemotherapy or experiencing chronic infections due to organ transplants, joint replacement and cardiac surgeries. Antibiotics also help to prolong the life span of humans by changing the outcomes of bacterial infection. For instance, the average life span of a person who lived in U.S. in 1920, were 56.4 years old, whereas, the average lifespan of the people who live in U.S. today is almost 80 years (Ventola, 2015). On top of that, antibiotics have also contributed to the decrease of mortality and morbidity caused by the poor sanitation in developing countries (Ventola, 2015).

Currently antibiotics are produced via semi-synthetic route which involves the hydrolysis of natural antibiotics followed by the amidation of natural or modified antibiotic nuclei with different donor chains of carboxylic acyl (Volpato, Rodrigues & Fernandez, 2010). Phenethicillin was the first semi-synthetic penicillin used in clinical practice followed by ampicillin, amoxicillin, oxacillin, cloxacillin, nafcillin, ticarcillin, carbenicillin, flucloxacillin, and methicillin (Rolinson, 1998). Semi-synthetic antibiotics were produced to increase the absorption, excretion and protein-binding of the antibiotic along with the decreased allergic reactions and intrinsic activity of the semi synthetic antibiotics (Kalant, 1965). But the main reason for this is because bacteria were becoming resistant to the natural antibiotics.