CHAPTER ONE
1. INTRODUCTION AND OBJECTIVES

1.1. Introduction

Contamination is the presence of an infectious agent on a body surface; also on or in clothes, bedding, toys, mobile phones, surgical instruments, dressings, or other inanimate articles or substances including water, milk, and food (Williams and Wilkins, 2006).

Today mobile phones have become one of the most indispensable accessories of profession and social life. Microbiological standards in hygiene are necessary for a healthy life, however, practices that shift from normal standards of hygiene have been observed. These deviations result in the presence of variety of microbes on mobile phones. Researchers have shown that mobile phone could constitute a major health hazard. In 2000, World Health Organization (WHO), described the electromagnetic radiation emitted from phones and base stations has a threat to lives because, the electromagnetic radiation has been reported to alter the electric activity of the brain causing many dangerous effects. Mobile phones have also been reported to be a reservoir for microorganisms. The device can spread infectious diseases through frequent handling. Thus constituting a health hazard as tens of thousands of microbes living on each square inch of the phone (Akinyemi *et al.,* 2009; Amushan *et al.,* 2012; Auhim, 2013).

With all the achievements and benefits of the mobile phone especially public handsets, it is easy to over look the health hazard; it might pose to its many users. This is against the background that many users may not have regard for personal hygiene coupled with the location of call centers and the likely number of users per day. The constant handling of the phone by different users makes it open for arrays of microorganisms, making it a harbor and a breeding ground for microbes especially those associated with the skin. From this phone, different microorganisms may spread from user to user (Ekrakene and Igeleke, 2007; Nirupa *et al.,* 2013).

Mobile phones are one of the fastest growing technology-based industries in the world, but they are also the most fragmented industry, with several different types of mobile options that offer their own types of uses. Basic phones most commonly referred to as "cell phones" in North America and "mobiles" in most other parts of the world, tend to offer a basic operating system that allows for calling, some music capabilities and carrier-specific applications. Smart phones are non-touch screen devices that offer a robust mobile operating system, most commonly Windows Mobile, Symbian, Blackberry and Palm. Smart phones are capable of sending and receiving emails, editing documents and storing files. Pocket PC devices operate much like Smart phones, though with touch screen abilities (Johnson, 2013).

Greater the number of keys, greater would be chances of bacterial lodgment between these keys and thus greater the load on each mobile. Due to that the QWERTY mobile phone have more chance for colonization than the classical one, unless there is extra care taken of recently launched QWERTY mobile by users. The touch screen mobile had lowest percent of bacterial colonization. In India, 50 mobile phones were swabbed from healthy individuals in the community and cultured. 19 of 50 mobile phones were colonized (classical 36.3%, touch screen 28.5% and QWERTY 71.4%) with *E. coli* and coagulase negative *Staphylococcus* (Khera *et al.,* 2013).

Besides, there are no guidelines for disinfection of mobile phones that meet hospital standards. Moreover, the mobile phones are used routinely all day long and the same phones are used both inside and outside the hospital playing a possible role in spreading infections to the outside community (Badr *et al.,* 2012; Sharma *et al.,* 2014).

Studies proved that the combination of constant handling and the heat generated by the phones create a prime breeding ground for all sorts of microorganisms that are normally found on our skin. The human surface tissue (skin) is constantly in contact with environmental microorganisms and become readily colonized by certain microbial species (Trivedi *et al.,* 2011; Jagadeesan *et al.,* 2013; Shah *et al.,* 2013).

Mobile phones could be contaminated via source such as human skin or hand, phone pouch, bags, pockets, environment and food particles. These sources are links through which microorganisms colonize the phone, thus causing diseases that range from mild to chronic. Although, microorganisms isolated so far by health researchers are mostly normal flora of the source of contamination, but can cause opportunistic infections. *Escherichia coli* which are one of agents of nosocomail infection have been isolated from mobile phones of healthcare staffs. The presence of *Escherichia coli* in personal mobile phones suggests faecal contamination of these phones, which can result in community-acquired infections and disease outbreaks. Also Gram- positive bacteria e.g. *Staphylococcus aureus*, a common bacterium found on the skin and in the noses of up to 25% of healthy people and animals as normal flora can cause illnesses from pimples and boils to pneumonia and meningitis. It could be transferred into mobile phones via hand to hand or contact. The hand serves as a major vehicle of transmission of various microbes (Auhim, 2013).

Contamination of mobile phones by bacteria such as *Escherichia coli*, *Pseudomonas aeruginosa* and *Klebsiella pneumoniae*, which cause hospital infections, serve as a vehicle for the spread of nosocomial pathogens. Since the same phones are used both outside and inside of hospitals, these contaminated phones play some role in the spread of hospital infection bacteria in the community (Karabay *et al.,* 2007; Roy *et al.,* 2013).

1.2. Rationale

Today mobiles have become one of the most essential parts of the daily life. Many of users are not aware of the dangers resulting from the use of mobile phones and their role in the spread of bacterial diseases. Cell phones have been identified as one of the carriers of bacterial pathogens. Gram-negative bacteria are responsible for many diseases which include respiratory infections, enteritis and stomach disorders, meningitis, wound infections and urinary tract infections. The role of these organisms in both nosocomial and community-acquired infections has been well documented. In order to protect ourselves from this serious complication and knowledge about the level of mobile phone contamination in Sudan is essential. Moreover, by revising the literature, there is no any published study recording mobile phone contamination in Sudan.

1.3. Objectives

1.3.1. General objective

To assess Gram-negative bacteria on mobile phone in Khartoum State.

1.3.2. Specific objectives

a) To determine bacterial load on mobile phones in Khartoum State.

b) To identify Gram negative bacteria on mobile phone in Khartoum State.

c) To determine percentage of each bacterial species.