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Research Article

Assessment of Surface Bacteria on Keyboards, Mobile Phones and Floors in the University of Port Harcourt

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ABSTRACT

Contamination of different surfaces by bacteria has contributed to various illnesses. This study was carried out to assess the bacteria on floors, keyboards and phones in the University of Port Harcourt. The results show heterotrophic counts on keyboard samples ranged from 1.0 - 5.5× 10^6cfu/ml, bacteria count in floors sampled ranged from 1.6 – 6.1x10^6cfu/ml, while bacteria counts on mobile phones surfaces ranged from 1.3 – 9.9×10^6cfu/ml. There was no significant difference ($p > 0.05$) within the bacteria counts observed in the different samples. Bacteria isolated were identified as *Staphylococcus* sp, *Bacillus* sp, *Escherichia coli, Klebsiella* sp, *Enterococcus* sp, *Enterobacter* sp, *Pseudomonas* sp and *Streptococcus* sp. *Staphylococcus* sp was the most occurring bacterium in the keyboard samples and *Bacillus* sp was the most occurring bacterium on the floor and phones sampled. The results shows a high occurrence of potentially pathogenic bacteria on these surfaces which may contribute to the disease burden in the society.Regular cleaning and disinfection of these surfaces is recommended to greatly reduce the occurrence of diseases due to surface contamination by bacteria.

Keyword: Surface; contamination; bacteria; diseases

INTRODUCTION

Bacteria and other microorganism are ubiquitous in nature and have been the main agents in contamination of surfaces, leading to transmission of diseases. The use of computers and mobile phones continues to increase daily in almost every aspect of academic, occupational, recreational and residential environments. In various university environments, more than 80 % have access to computers, 92.1% regularly use internet [1], with 100 % of the students and staff of the university environment having at least one mobile phone. Computers and phones may act as a reservoirfor the transmission of potential hazardousor pathogenic microorganisms [2]. The ability of a computers and phones to actas fomites has been previously documented [3]. A study by Ulger et al. reported that mobile phones can be sources of nosocomial infections [4]. Given that computers are mostly used by multiple persons and are not routinely disinfected, the opportunity for the transmission of contaminating microorganisms is potentially great [5]. Sanitary conditions in public places have always been a major problem. The environment significantly influences multiple factors in the chain of infection.

Although microbiologically contaminated surfaces including floors can serve as reservoirs for pathogens and contribute to the transmission of infections [6]. The present study was aimed at investigating the bacterial contamination of computer keyboards, mobile phones and floors in the University of Port Harcourt, Rivers state, Nigeria.

METHODOLOGY

Sample Collection

Swabs sticks were moistened with sterile peptone water. The moistened swabs were briefly wiped firmly over 1cm^{3}surfaces of the keyboard and mobile phone and 1 m^3 surface of the floors. A total of thirty (30) samples were collected for this study. Ten keyboards, mobile phones and floors were sampled for this study.

Microbiological Analysis

A ten-fold serial dilution was appropriately carried out on all swab samples, 0.1ml of the dilutions were plated using the pour plate method. Enumeration of total bacteria count was done plate count agar (PCA). Coliform counts were done using eosin methylene blue agar (EMBA). Staphylococcal counts were done using mannitol salt agar (MSA). All cultures were incubated at 37^{O}C for 24 h.

Identification of Isolates

Distinct looking colonies were sub-cultured and the pure isolates were stored on nutrient agar slants at 4^{O}C for further confirmatory tests which included IMVIC test, carbohydrate utilization, and reaction on TSI, gelatin liquefaction, nitrate reduction, urease production and motility, The bacteria lisolates were identified by comparing their characteristics with those of known taxa, as described [7].

Statistical Analysis

One-way analysis of variance (ANOVA) was used to determine significant differences ($p < 0.05$) between the groups measured at a 95% confidence level. The data was entered and analyzed using SPSS (statistical package for social sciences) version 17.0.

RESULTS AND DISCUSSION

Table 1.0 shows the heterotrophic bacteria counts observed in the samples. Heterotrophic bacteria count in keyboard samples ranged from 1.0 – 5.5 x 10^6, bacteria count in floors sampled ranged from 1.6 – 6.1 x 10^6, while bacteria counts in mobile phones ranged from 1.3 – 9.9 x 10^6. There was no significant difference ($p > 0.05$) within the bacteria counts observed in the different samples. The results are consistent with the findings of Al-Ghamdi [8], and Kawo [9] which reported mean bacteria counts of 4.8 x 10^6 and 8.8 x 10^6 in computer keyboards and mobile phones respectively. This may be attributed to the frequency of use the keyboards and exposure of the phones to other surfaces [10]. The heterotrophic bacteria count observed on floor samples were similar to the findings of Ajayi [11], which reported a mean bacteria count 6.5 x 10^6. This may be attributed to the activities in the area, number of persons constantly walking and the frequency of cleaning the floors.

Table 1: Bacteria counts of samples

S/NO	Bacteria count (10^6 CFU/ml)		
	Keyboards	Floors	Mobile phones
1	1.0	1.6	9.9
2	4.5	1.9	2.3
3	2.2	4.0	1.3
4	1.7	1.9	2.1
5	5.5	5.5	2.1
6	1.5	3.8	1.8
7	1.3	2.4	2.0
8	2.9	3.5	5.3
9	2.3	4.6	3.8
10	5.5	6.1	1.4

Staphylococcus sp was the most occurring bacterium in the keyboard samples (42.5%) followed by *Bacillus* sp (31.5%), *Streptococcus* sp and *Escherichia coli* (8.7% each), while *Enterococcus* sp and *Klebsiella* sp were the least occurring bacteria (4.3%) as shown in Fig 1.0,

the isolated bacteria are consistent with those isolated in a similar studies by Kausar [5] and Al-Ghamdi [8] which reported that *Staphylococcus* sp was the most occurring bacterium in keyboards and computers sampled. The occurrence of these bacteria may be attributed to the frequency of use by various individuals and the exposure to aerosols and dusts [8].

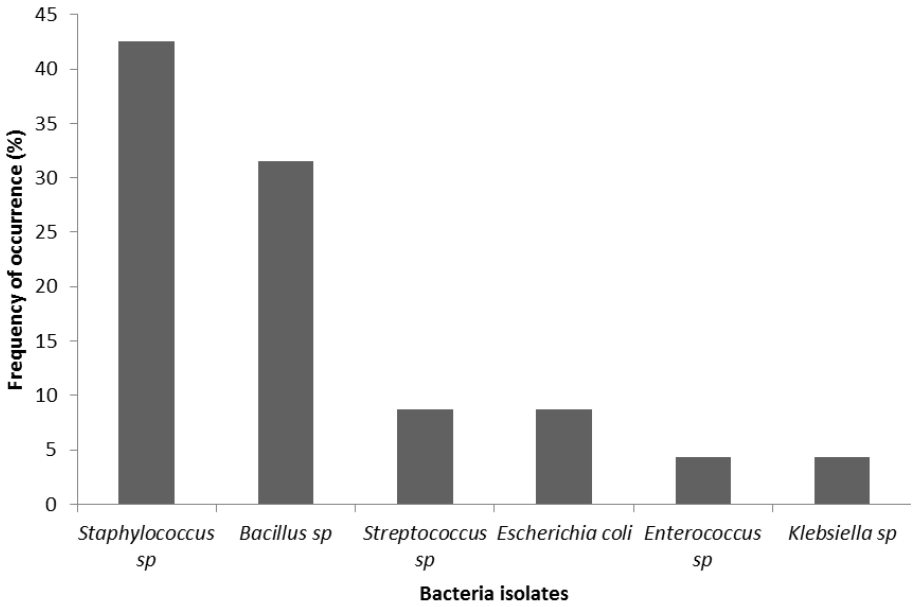

Fig 1: Occurence of bacteria isolates in the keyboard samp

Bacillus sp was the most occurring bacterium in floor samples (41.6%), followed by *Staphylococcus* sp (29.2%), *Escherichia coli* (16.7%), *Klebsiella* sp (8.3%) and *Enterobacter* sp (4.2%) as shown in Fig 2.0 This is slightly different from the findings of Kawo [9], which reported that *Staphylococcus* sp was the most abundant bacterium in the floors sampled. The high occurrence of *Bacillus* sp may be attributed to the exposure of foot wears to various soil samples of the individuals from different locations [11]. These organisms may cause illnesses when they come in contact with broken skin surfaces of individuals. Spores formed by *Bacillus* sp may be inhaled and could cause illnesses in individuals [12].

Fig 3.0 shows the occurrence of the bacteria isolated in the phones sampled, *Bacillus* sp was the most occurring bacterium (45%), followed by *Staphylococcus* sp (30%), *Escherichia coli* (15%) and the least occurring bacterium was *Pseudomonas* sp (10%). The bacteria isolated are consistent with the findings of Kawo [9] The frequency of use and exposure of mobile phones to environmental surfaces including the hands and skins of users could determine the degree of contamination of these phones by bacteria [10]. A combination of constant handling and heat generation provides a favorable breeding ground for microbes that are normally found on our skin. This could lead to a high potential of contamination of the cell phones [12].

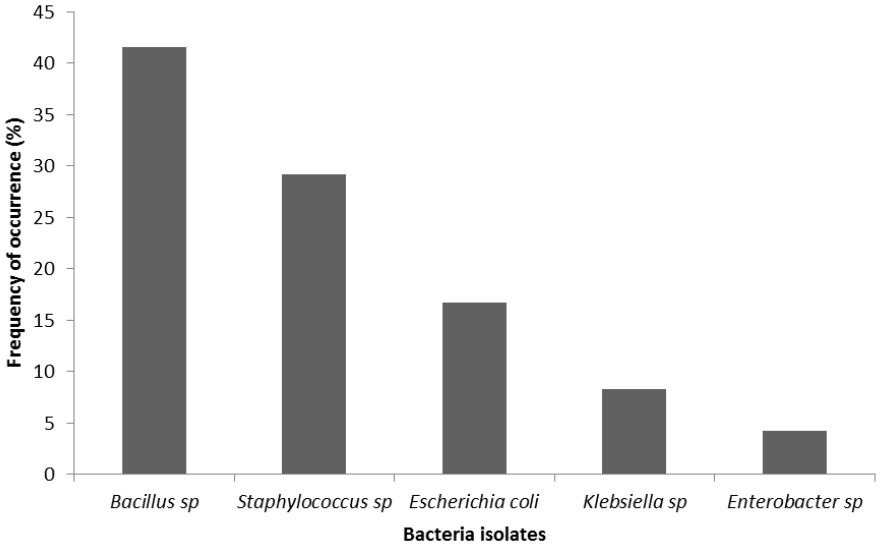

Fig 2: Occurrence of bacteria isolates in floor samples

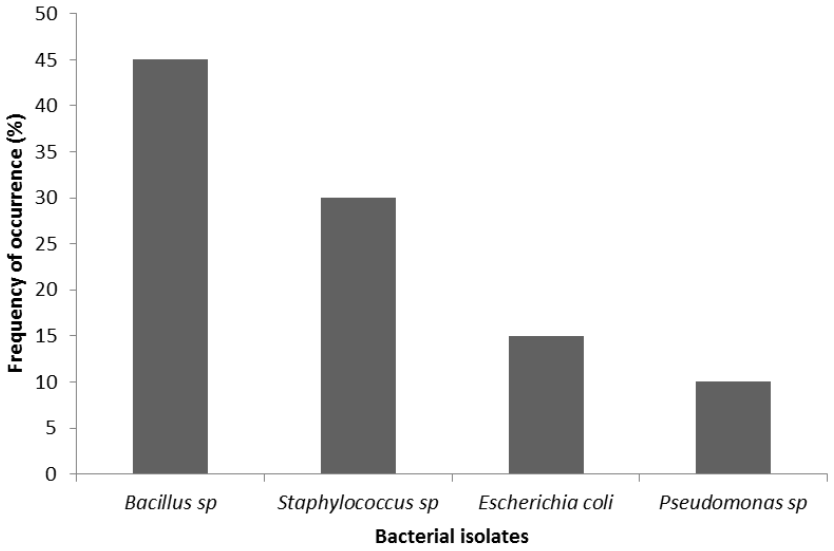

Fig 3: Occurrence of bacteria isolates in phone samples

CONCLUSION

The bacteria count observed in the samples exceed the WHO recommended limits for contact surfaces (1.20 x 10^6cfu/ml). This may be attributed to the frequency of usage of the keyboards and phones, with little attention to disinfection of these surfaces. Occurrence of bacteria such as *Escherichia coli, Klebsiella* sp and *Enterococcus* sp could potentially lead to illnesses especially when they come in contact with immuno-compromised individuals. The study shows it is imperative for the regular cleaning and disinfection of floors, keyboard and phone surfaces. It is also recommended that individuals maintain good personal hygiene to prevent successful contamination by these surface bacteria.

CONFLICT OF INTEREST STATEMENT

The authors declare that they have no conflict of interests.

REFERENCES

1. Palmer SR, Bray SL. Longitudinal study of computer usage in flexible engineering education. Australian J Edu Tech 2001; 17: 313-314.

2. Hartman B, Benson M, Junger A. Computer keyboard and mouse as a reservoir of pathogen in an intensive care unit. J Clin Monit Comp 2004; 18: 7-12.
3. Huber JS, Pelon W. Low cost screening for microbial contamination in aerosols generated in a dental office. Gen Dent 2005; 53: 270-271.
4. Ulger F, Esen S, Dilek A, Yanik K, Gunaydin M. Leblebicioglu H. Are we aware how contaminated our mobile phones with nosocomial pathogens? Annals Clin Microbiol Antimicrob 2009; 8: 7.
5. Kausar M., Nabiha N. Study of bacteria on computers mice and keyboards. Int J Curr Microbiol. App Sci 2014; 3(4): 813-823.
6. Jarvis WR. The inanimate environment. In, Bennett JV, Brachman PS, eds. Hospital infections, 5th ed, Philadelphia, PA, Lippincott-Raven, 2007; p 275.
7. Cheesbrough M. District Laboratory Practice in Tropical Countries Part 1 2nd ed. Cambridge, UK: Cambridge University Press; 2005.
8. Al-Ghamdi AK, Abdelmalek SMA, Ashshi AM, Faidah H, Shukri H, Jiman-Fatani AA. Bacterial contamination of computer keyboards and mice, elevator buttons and shopping carts. Afr J Microbiol Res 2011; 5(23): 3998-4003.
9. Kawo AH, Dabai YU, Manga SB, Garba GJ. Prevalence and public health implications of the bacterial load of environmental surfaces of some Secondary Schools in Sokoto, North-western Nigeria. Int Res J Microbiol 2012; 3(5): 186-190.
10. Mohammed A, Kawo AH, Yusha'u M. Bacteriology of GSM cell phones. J Res Biosci 2006; 2(1): 47-50.
11. Ajayi A, Ekozien MI. Sensitivity Profile of Bacterial Flora Isolated From Bathroom. Elite Res J Biotech Microbiol 2014; 2(1): 1-3.
12. Brady RR, Wasson A, String I, Mc-Allister C, Damani NN. Is your phone bugged?: The incidence of bacteria known to cause nosocomial infection in health care workers mobile phones. J Hosp Infec 2006; 62:123–125.

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