



Full Length Research Article

THE BACTERIAL BURDEN OF COMPUTER KEYBOARDS IN CYBER CAFES LOCATED IN AND AROUND RIVERS STATE UNIVERSITY OF SCIENCE AND TECHNOLOGY, PORT HARCOURT

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ABSTRACT

The prevalence of bacteria on computer keyboards in cyber cafes situated in and around Rivers State University of Science and Technology, Port Harcourt, Nigeria was investigated. A total of 200 computer keyboards were examined by culture methods for the presence of bacteria. Out of the 200 computer keyboards, 40 each were taken from the 4 cyber cafes including the university Information and Communication Centre (ICT). The numbers examined were: FCB 36(18.0%) had bacteria growth, SPC 20(10.0%), BB 30(15.0%), RGBC 34(17.0%), ICT-RSUST 30(15.0%) respectively. From the results, 58(36.6%) had 1-5 counts, 78(52.6%) had counts from 6-10 counts and 13(8.6%) had counts ranging from 10 and above colonies. The overall percentage occurrences of isolated bacteria were: coagulase-negative Staphylococci 116(55.8%), Staphylococcus aureus 42 (20.2%), Bacillus spp. 24(11.5%) and Escherichia coli 26(12.5%). Overall prevalence of bacteria from the cyber cafes were FCB 78(37.5%), SPC 38(18.2%), BB 28(13.4%), RGBC 30(14.4%) and ICT-RSUST 34(16.3%). FCB had the highest prevalence of bacteria and coagulase-negative Staphylococci were highest in percentage occurrences.

Key words: Computer keyboard, Fomites, Transmission, Pathogens.

INTRODUCTION

Computer has continued to have an increasing presence in almost every aspect of our occupational, recreational and residential environments. In various universities and environments, students have indicated 100% access to regular use of e-mail to accommodate the computer technology (Palmer and Bay, 2001). Universities have developed multiple cyber cafes on campuses for students. As the population that uses such facilities increases, there are needs to recognize that computer may serve as reservoir for the transmission of potential pathogenic microorganisms (Elsick, 2006). The ability of computer to act as fomite had been documented in health care and hospital environments (Huber and Pelon, 2005). Computer keyboards and mouse as agents harbouring bacteria had been recognized (Hirsch, 2006). The oldest and most widely accepted keyboard layout is the "Qwerty keyboards" with random distribution of characters requiring more fingers involvement on the keyboard (Rutala *et al.*, 2006). An internet cafés are places which provide internet access to the public for fee and usually provided snacks and drinks, hence the name "café". Studies in hospital setting had reported that microbial contamination of computer interface surfaces were so prevalent that various microbes had been isolated from more than 50% of keyboards of hospital computers (Raynold *et al.*, 2005). The contributions of human hands, contaminated with pathogenic microbes in the spread of infections are

increasing, therefore the investigation of computer keyboards as fomites and additional reservoir for transmission of microbes and vectors for cross transmission is necessary.

MATERIALS AND METHODS

Study Area

Rivers State University of Science and Technology, Port Harcourt was chosen as a premier University of Science and Technology with population of over 16,000 students in the institution. The student submit term-papers and assignments online, check e-mails and browse for educational materials at low price in cyber cafes in and around the University.

Collection of Samples

Each computer keyboard from various cyber cafes was swabbed with a sterile swab stick by gently swabbing the surfaces of the keyboard. The swab stick was tightly corked and taken to the laboratory immediately for culture.

Preparation of Media

MacConkey and Nutrient agar (Oxoid, UK) were reconstituted and prepared according to the manufacturer's instructions. Blood (7%) was added to nutrient agar at about 47°C, mixed properly before pouring and the solidified agar plates were stored for subsequent uses at 4°C.

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Cultivation of Samples

Each sample was inoculated unto already prepared Blood and MacConkey agar plates, starting with blood agar. The inoculated agar plates were streaked out with sterile wire loop and the plates were incubated for 18 – 24hour at 37⁰C. After which, the plates were examined for growth and the plates with growth were selected for necessary identification of the isolates.

Identification of isolated bacteria

The identification of isolates was carried out using cultural characteristics, Gram’s stain, catalase, motility, indole and citrate tests according to Cheesbrough, 2002.

Statistical Analysis

Statistical analysis was done using chi-square. p < 0.05 values were accepted as significant.

RESULTS

The percentage isolation rate from each of the cyber cafes were: FCB 36(24.0%), SPC 20(13.3%), BB 30(20.0%), RGB 34(22.6%) and ICT-RSUST 30(20%) respectively. The highest isolation rate was from FCB as shown in Table 1. There was no significant difference in isolation rate at P < 0.05 among the cyber cafes. The results of colonial counts on agar plates showed that 58(36.6%) had counts from 1- 5 colonies, 78(52.6%) had 6 - 10 colonies and 13(52.6%) had counts 11- 15 colonies respectively. Most plates had colony counts between 6 to 10 colonies as shown on Table 2.

The result of percentage occurrences of isolated bacteria on computer keyboards were: coagulase negative *Staphylococci* 116(55.8%), *Staphylococcus aureus* 42(20.2%), *Bacillus spp.* 24(11.5%) and *Escherichia coli* 26(12.5%) respectively. The percentage prevalence of isolated bacteria from the cyber cafes were FDB 78(37.5%), SPC 38(18.2%), BB 28(13.4%), RGBC 30(14.4%) and ICT-RSUST 34(16.3%) respectively.

DISCUSSION

The loads of bacteria on computer keyboards from the cyber cafes may be directly related to how often customers patronize these cyber cafes (usage). The more often the computer keyboards were used by different persons, the higher their microbial burden. The hygienic levels maintained by persons using the computer keyboards may contribute to the load of bacteria deposited on them. An attractive factor for costumers in some cyber cafes is the availability of snacks and drinks, although it was noted that food crumbs and spills can wind up on and between keyboards, mouse buttons and knowing that computers are not routinely disinfected; the opportunity for transmission of contaminating microbes are potentially high (Elablawy and Elhifnawi 2009; Aderson and Palonbero, 2009). There was no significant difference (p < 0.05) in isolation rate of bacteria from the different cyber cafes.

A total of 150(75.0%) of culture plates had isolates from computer keyboards. The bacterial load might be small compared to the number of microbes estimated to cause infection in an individual. These bacteria may be transmitted into a suitable medium e.g. food etc. where they can multiply and cause infection, knowing that they have short generation time.

Table 1. Percentage isolation rate from different cyber cafes

Cyber café	No. Examined	Percentage positive
First Computer Base (FCB)	n = 40	36(18.0%)
Students Parliament Centre (SPC)	n = 40	20(10.0%)
Big Boss (BB)	n = 40	30(15.0%)
Royal Gold Business Centre (RGBC)	n = 40	34(17.0%)
ICT – RSUST	n = 40	30(15.0%)
TOTAL	200	150(75.0%)

Number in parenthesis= percentages

Table 2. Colony Forming Units of isolates from computer keyboards

Colonial counts on agar plates-cfu	FCB	SPC	BB	RGBC	ICT-RSUST	TOTAL
0	4	20	10	6	10	50(25)
1- 5	12	7	13	16	10	58(29)
6- 10	21	10	15	15	18	78(39)
10 – 15	3	3	2	3	2	13(6.5)
Total	36(18)	20(10)	30(15)	34(17)	30(15)	150(75)

Numbers in parenthesis=percentages

Table 3. Percentage occurrences of isolated bacteria from computer keyboards

Isolated bacteria	FCB	SPC	BB	RGBC	ICT-RSUST	TOTAL%
Coagulase negative <i>Staphylococci</i>	40(51.2)	24(63.1)	16(57.1)	20(66.6)	16(47.1)	116(55.8)
<i>Staphylococcus aureus</i>	20(25.6)	10(26.3)	8(28.5)	0(0.00)	4(11.7)	42(20.2)
<i>Bacillus spp.</i>	10(12.5)	0(0.00)	4(14.2)	2(6.6)	8(23.5)	24(11.5)
<i>Escherichia coli</i>	8(10.2)	4(10.5)	0(0.00)	8(26.6)	6(17.6)	26(12.5)
Total	78(37.5)	38(18.2)	28(13.4)	30(14.4)	34(16.3)	208

This load in an immune-compromised individual (with defective immunity) may cause infection. This might show that computer keyboards could transmit bacteria as observed by other workers (Elis, 2005; Huber and Pelon, 2005). From the results of percentage occurrences of isolated bacteria from computer keyboards, coagulase-negative *Staphylococci* were most prevalent. Coagulase-negative *Staphylococci* and *Staphylococcus aureus* are normal flora of humans, carried on the hands, nostril, other parts of the body and even clothes. Their persistent presence may be as a result of human contact with the computers, especially the keyboards that frequently interact with the fingers. In cyber cafes *Staphylococci* species rank highest in numbers. It was noted by (Kassem *et al.*, 2007) that *Staphylococci* are the most prevalent, with percentage occurrence of 70.8%. *Staphylococci* is associated with diverse human infections ranging from UTI, wound infections, boils, toxic shock syndrome, respiratory tract, food poisoning etc. Most *Staphylococci* of human origin interact daily with various chemicals used as body creams, pomade, medicated soaps, germicides, powder, disinfectants, deodorants and others. Some may contain sub-inhibitory concentrations of one or more of these chemicals, antibiotics of the same family etc. These may trigger resistant plasmid genes to be developed in the bacterium that encounter them.

This may have made most *Staphylococci* of human origin to develop resistance to some antimicrobial agents because they were encountered daily in sub-inhibitory concentrations on humans. Kassen *et al.*, (2007), also noted that 70.0% of computer keyboards in use are contaminated with antibiotic-resistant *Staphylococci* species. *Staphylococcus aureus* is implicated in food poisoning hence it is of public health concern in cyber cafes. *Bacillus* was 11.5% in occurrence, *Bacillus* species are spore bearers, mostly found in soil and dust in the environment. The agitation of dust during sweeping and cleaning may be a sure source of contamination. The ability of the spore to withstand heat and chemical disinfectants moderately is an added advantage to their longer persistence on computer keyboards (Brookes *et al.*, 2007).

Escherichia coli are 12.5% percent in occurrence, the presence of *E. coli* clearly indicates fecal contamination of the computer keyboards. *E. coli* is the most prevalent aerobic organism (about 80.0%) in human and animal intestinal tract. Both *E. coli* and *Bacillus cereus* species are associated with the infections of gastrointestinal tract and produce toxins. The presence of *E. coli* is pointer to the possible presence of other enteric pathogens, which calls for public health attention. In similar study carried out in Vom, Plateau State, Nigeria, (Obinna *et al.*, 2012) isolated *Bacillus spp.*, *E. coli*, *Staphylococcus aureus*, coagulase-negative *Staphylococci*, *Streptococci spp.* and *Diphtheroids* on computer keyboards and mouse. In another work on examination of computer keyboards and mouse in Abakiliki, Ebonyi State, Nigeria, (Anyim *et al.*, 2013) isolated *Staphylococcus spp.*, *E. coli*, *Bacillus spp.* and *Pseudomonas spp.* In Lokoja, Kogi State, Nigeria, (Awe *et al.*, 2013) isolated *Staphylococcus spp.*, *Streptococci spp.*, *Bacillus spp.*, *Micrococcus spp.*, *Klebsiella spp.*, *Salmonella spp.* and *E. coli*.

These findings clearly show that fomites may play an important role in transmission of some diseases (Feied, 2004), and they could be transmitted through direct contact with body secretions, fluids, contact with soiled hands, aerosolized infective droplets and activities such as talking, sneezing, coughing, vomiting, hand shaking etc. (Goldman, 2000, Reeynold *et al.*, 2005).

Conclusions

Without hesitation, fomites such as computer keyboards are implicated as mediums for possible transmission of pathogenic microbial agents.

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