

Short Communication

Microorganisms associated with computer keyboards and mice in a university environment

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A study was carried out to isolate and to identify microorganisms associated with computer keyboards and mice in computer centers and cyber café located in Kogi State University, Anyigba, Nigeria and its environs. Samples were collected from five different cyber café and computer centers. The samples were collected from three computer keyboards and mice in each cyber café and computer centers. The collected samples were inoculated on nutrient agar, MacConkey agar and potato dextrose agar by following standard methods. The isolates obtained were examined and identified by colonial morphology, Gram reaction and biochemical characteristics. Four bacterial and four fungal species were isolated from the samples. The bacterial isolates include *Staphylococcus aureus*, *Enterococcus* sp., *Staphylococcus epidermidis* and *Streptococcus* sp. The fungal isolates are as follows *Aspergillus* sp., *Mucor* sp., *Penicillium* sp. and *Rhizopus* sp. These microorganisms have pathogenic potential and hence their presence on such surfaces (computer keyboards and mice) may be additional reservoirs for the transmission of microorganisms and become vectors for cross-transmission of bacterial and fungal infections in the university and its environs.

Key words: Computer, microorganisms, pathogenic, surfaces, university, Nigeria.

INTRODUCTION

Computers continue to have an increased presence in almost every aspect of our occupational, recreational and residential environments. In various university environments, students have indicated 100% access to computers, 92.1% regularly use internet and 73.3% regularly use e-mail (Palmer and Bray, 2001). To accommodate the intensive use of computer technology, universities have developed multiple-user "Cyber Cafe" on campus for general student access. As the population of such facility increases, there is need to recognize that computer equipment may act as a reservoir for the transmission of potential hazardous or pathogenic

microorganisms (Hartman et al., 2004).

The ability of a computer to act as fomites has been previously documented in healthcare (Huber and Pelon, 2005) and hospital environment (Bures et al., 2000). In work place, contamination of the office environment (including the computer keyboard and mouse) with bacteria is also recognized (Hirsch, 2005). The increased availability of multiple-user computers in the university setting means that these items or equipment are handled by numerous users on a daily basis. Given that computers are not routinely disinfected, the opportunity for the transmission of contaminating microorganisms is potentially great. Our understanding of the ubiquity of microorganism in the environment is developing, but the risk or hazard of contamination posed by the computer keyboards and mice is not yet fully understood. No clear regulations or even widely recognized guidelines have been formulated on the hazard caused by computer

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components (keyboards and mice). This is not in the best interest of campus students especially that computer keyboards and mice could spread significant number of pathogens.

The objective of this work therefore is to isolate and identify microorganisms associated with computer keyboards and mice in cyber café and business centers in Kogi State University, Anyigba and its environs in Nigeria.

MATERIALS AND METHODS

A total of five cyber café were randomly selected in and around Kogi State University, Anyigba, Nigeria. In order to determine the types of microorganisms present, the keyboards and mice were sampled with a moisture sterile cotton swab. In all a total of 30 samples were taken from keyboards and mice from the cyber café. Following swab taken, each swab stick was placed back into the casing to avoid contamination and was labeled appropriately. All the samples collected were transported to the laboratory within an hour for culture and treated according to standard method (Anderson and Palombo, 2009). A variety of selective and differential microscopic methods were used for presumptive identification of contaminating microorganisms. Gram staining, microscopic examination and confirmatory biochemical tests were performed to further identify bacteria and fungi (Anderson and Palombo, 2009).

RESULTS AND DISCUSSION

Bacterial and fungal isolates from cyber café/computer centers are presented in Table 1. Previous studies have reported that computer keyboards and mice can become contaminated with pathogenic bacteria and fungi (Cozanitis et al., 1978; Rafferty and Pancoast, 1984; Ferdinandus et al., 2001; Anderson and Palombo, 2009). The present study showed that microbial contamination occur on computer surfaces located in a university setting and may reflect the multiple-user environment where the possibility of contamination by individuals who are carriers of bacteria such *Staphylococcus aureus* is greater and the isolation of viable microorganisms suggest that the species present are able to persist for a period of time on these surfaces. It is suggested that computer keyboards and mice in institutions may act as a vehicle for the transmission of pathogenic organisms (Anastasiades et al., 2009).

In this study, *S. aureus* was isolated from all the cyber café and this bacterial isolate is of medical importance as a causative agent in human diseases. It has been known to cause various pus-forming infections in humans such as boils, carbuncles, impetigo, osteomyelitis, toxic-shock syndrome (Hartman et al., 2004). On the other hand, *Staphylococcus epidermidis* which was also isolated from most of the samples is a normal habitat of the skin but can occasionally assume an opportunistic pathogenic role in causing human infection such as endocarditis (Anastasiades et al., 2009). *Aspergillus* sp. isolated from

Table 1. Microbial isolates from the cyber cafe/computer centres.

Isolates	Identified organisms	
	Bacteria	Fungi
A	<i>Staphylococcus aureus</i>	<i>Mucor</i> sp.
B	<i>Staphylococcus epidermidis</i>	<i>Penicillium</i> sp.
C	<i>Enterococcus</i> sp.	<i>Aspergillus niger</i>
D	<i>Streptococcus</i> sp.	<i>Rhizopus</i> sp.

most of the samples indicates that aspergillosis can also be spread in the cyber café through surfaces such as computer keyboards and mice. Isolation of the organisms from computer keyboards and mice is a clear indication that the aseptic procedures/methods in use at the computer centers are not effective in reducing the level of the organisms on these surfaces to an acceptable level (Buers et al., 2000).

Our findings indicate that hygienic practices in the cyber café are far below expectations which could infer that users in these cyber café are almost ignorant or less informed of the risks involved in their usage of computers and that these surfaces could act as carriers or vehicles/sources of potential pathogens. This situation calls for both private and government agents in the public health sector to awake to their responsibilities in sensitizing the public through organizing lectures, training workshops and seminars of the potential risk involved in the use of contaminated computer surfaces in the cyber café. If people are informed of the microorganisms associated with computer keyboards and mice in our cyber café, it would help in reducing the risk of cross-transmission of bacterial and fungal infections through contaminated computer surfaces and would improve hygienic practices through regular and adequate disinfection of the surfaces. Government, through the appropriate agencies, should also set standard for the cyber café operators and monitor the practices in such cyber café from time to time as this will go a long way in helping to reduce microbiological and other hazards associated with cyber café and computer centers.

We observe that the level of knowledge among the computer users in cyber café and computer centers about the possibility of microorganisms on the keyboard and mouse is very poor. Majority of the computer users do not have any perception of the unhealthy practices in cyber café and possibly not aware of the risk of contracting infection from computer keyboard and mouse through such use. In every cyber café, eating should be avoided while using the computers and hand washing hygiene practices should be encouraged and maintained and keyboard and mice should be cleaned with disinfectant at least weekly and should be covered where necessary. The process of disinfection is to reduce microbial load on the solid surfaces. Microbes are everywhere, including the air around us, it is therefore

greatly recommended that hand-washing hygiene should be adopted before and after using the computers to reduce the microbial transmission. Computer keyboards and mice should also be cleaned with alcohol or other disinfectants on a regular basis.

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