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Bacterial contamination of computer keyboards and Mice used in some banks in Benghazi, Libya

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Abstract*: This study was performed to isolate and identify of bacterial contamination on the computer keyboards and mice surfaces in ten banks in Benghazi city-Libya. This study included collecting 300 samples, 30sample from each bank, from the surfaces of keyboards and mice, from all of the bacterial species in this study were identified by Biochemical tests, API test and Phoenix 100.Six pathogenic bacteria species have been identified: gram positive bacillus ,staphylococcus coagulase negative, E.coli, klebsillaoxytoca and Acinetobacter baumannii species was isolated only from the all banks. Most of the bacterial species dominate and which identify was Gram positive bacillus in all of the banks included in this study, on both from the surface of keyboard and mouse. This study showed that .the total percent of bacterial contamination was 97.35%.The percent of bacterial contamination of computers keyboards and mouse's respectively were 67.3% , 51% , 8.33% , 4.33% , and .33% gram positive bacillus ,Staphylococcus coagulase negative, E.coli, Klebsillaoxytocaand Acinetobacter baumanniit 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 vector for cross-transmission of bacterial infection in the banks and its environment.*

Keywords:*Computer keyboard, computer mice, Bacterial contamination, Banks*

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I. Introduction:

Computer hardware has been implicated as a potential reservoir for infectious agents of increasing concern, however, is the role of keyboards in the non-hospital environment as pathogen reservoirs. It follows that the ubiquitous sharing of public computers by a broad user base might facilitate increased transmission and prevalence of pathogenic microorganisms throughout the community. Inadequately performed hand hygiene and non-disinfected Surfaces are two reasons why the keys and mice-buttons of laptops could be sources of microbial contamination resulting consequently in indirect transmission of potential pathogens and nosocomial infections .(Donatus and Eucharia,2013)Computers continue to have an increased presence in almost every aspect of our occupational, recreational, and residential environments whilst the contribution of hands contaminated with pathogenic and non-pathogenic microorganisms to the spread of infectious disease has been recognized for many years. Numerous studies have indicated that computer keyboards and mice can become contaminated with pathogenic bacteria it is perhaps not unexpected that such microorganisms would contaminate these common work surfaces. However, the present study showed that microbial contamination also occurs on computer mice and keyboard located in some banks in Benghazi. A particularly interesting finding was that multi- user computer had significantly more numbers of microorganisms as well as greater numbers of potentially pathogenic species. However, this may simply reflect the multiple- user environment where the likelihood of contamination by individuals who are carriers of bacteria such as staphylococcus sp. (Aweet al,2013).The contribution of hands contaminated with pathogenic microorganisms to the spread of infectious diseases has been recognized for many years. The prevalence of bacterial infections in humans is increasing and has been shown to result in part from the non- hospital setting to the community and vice versa. It has been realized that one main cause of bacterial contamination of computer keyboards and mice in non-hospital setting is through eating while working with the computer in the office or browsing the internet with the computer. As a result, some food crumbs and spills can wind up on and between the keyboard keys and on the mice buttons. Given that computers are not routinely disinfected, the opportunity for the transmission of contaminating microorganism is potentially great. (Tagoeet al2010) Thus this research seeks to investigate what kinds of microorganisms especially bacteria that contaminate keyboards and mice in some banks in Benghazi, Libya. (Anderson et al, D2009).

Computer and its accessories such as keyboards and mices have been implicated in most cases as agent of infection transmission both in the community and in the non-hospital's environment. Computers are being

increasingly used in our life and keyboards and mice are also a source of potentially lethal bacteria, viruses and infections between users. Computers are ubiquitous in different units of medical settings, for instance, in laboratory where investigations are accessed, radiologic findings are viewed, and computerized physician order entry is performed as well as record departments. Not only in the health sector, has the computer got application, but also in various other sectors of the economy. This suggests the possibilities of the public contacting some of the infectious diseases that had been identified with CK. (Awoleye*et al*,2012).

II. Materials and Methods:

The surfaces of 300 computer keyboards and mice of male and female in 10 banks in Benghazi had collected. The samples were randomly selected for this study. This was performing during opening hours featuring normal staff traffic at the banks. The single sterile swab stick was moisted with sterile saline solution and moved over the surfaces were tested (keyboard and mice). The swab sticks were immediately transported to the laboratory. All swabs were inoculated in broth media and incubated in the incubator for 24 hours after that were cultured in (Maconkey, Blood Agar). Gram-positive and Gram-negative bacteria were identified

as per standard microbiological procedures. Bacterial colonies were differentiated based on the colony morphology and color, Gram staining, hemolysis patterns, catalase and coagulase test [for Staphylococci], and catalase and oxidase testsforGram-negative bacteria, and by phoenix Suitable biochemical tests were donefor further identification of the bacterial isolates. Antibioticsusceptibility test was done for pathogenic strains by phoenix 100.

III. Results and Discussion:

In this study table (1) showedthe most isolated bacteria from computer keyboard and computer mice was Gram positive *bacilliusspp* was 74% and 60.66%, respectively.similar to Al Ghamdi (2011) study in Saudi Arabia showed that the percent of Gram positive *bacilliusspp* isolated from computer keyboard and computer mice was 58% and 60%, respectively. Also,this study found the prevalence Rate of colonization of *Staphylococcus coagulase* Negative spp found in Lower rate compared with Gram positive *bacilliusspp* reach to 12%, and 22% of computer keyboard and mice respectively.in contrast study Chimezie*et al* (2013) found that the percent of Staphylococcus coagulase Negative spp of CK was 43.3%, and CM was 40.9%.However*E.coli*was isolated reach to 7.33% of CK, and9.33 % of CM in contrast to Eltablawy and Elhifnawi (2009) study in Cairo Egypt found that the percent of *E.coli* was 4.2% of CK,and 0% of CK.*Acinetobacter baumannii* was reported reach to 0.76% of CK, and 0% of CM similar to Srikanth et al (2009) study in Chennai, India found that the percent of *Acinetobacter baumannii* was 0% in both CK,and CM.*Acinetobacter*can cause a variety of diseases, ranging from *pneumonia* to blood or wound infections. *Acinetobacter*may also "colonize" or live in a patient without causing infection.*Klebsiella Oxytoca* was reported at 5.33% of CK, and 3.33% of CM lower to Srikanth et al (2009) study in Chennai, India found that the percent of *Klebsiella Oxytoca* was 13% in both CK,and CM.Pathogenicity Frequent cause of nosocomial urinary and pulmonary infections; wound infections secondary infection in lungs of patients with chronic pulmonary disease .For the non-growth result reported 2.88% in both CK, and CM similar to Engelhar(2008) found that the percent of the non-growth was near to 2% in both CK, and CM.

Table (2) showed the total percent of bacteria in all 10 banks.

Bacterial swab Total percent	Numbers of bacteria	%
Gram positive Bacillus spp	202	67.3%
Escherichia coli	25	8.33%
Staphylococcus coagulase Negative	51	17%
Klebsiella spp	13	4.33%
Acinetobacter baumannii	1	.33%
Non growth	8	2.66%
Total	**300**	**100%**

Distribution of isolation bacteria from all banks:

This study showed that both Gram positive bacteria and Gram-negative bacteria was found in all banks table (2) showed the total percent of Gram-positive*Bacillus* 76% in Al Wahda Bank, ALRouwaisat,Al Saharee Bank, Alberka,and Al Tejarawa Al Tanmia Bank. Al Fuwaihat bankfollowed by 73.34% at al Jamhuriaa bank, twenty street and Al Tejareemyedan al baladea Bank,63.70% at Al Tejarawa Al Tanmia Bank. Al Hadayek,60% at Al Jamhureia Bank. Al Hadayek,50% at Alwahda bank, 46.70% Al Wahda Bank, Omer Al Mukhtar Steer,and 0%Al SahareeBank, AlFuwaihat.

E. coli was the highest in Jamhuriaa bank, twenty street, followed by 10% inAl Wahda Bank, Omer Al Mukhtar Steer.20% in Al Jamhureia Bank. Al Hadayek,6.70% Al Wahda Bank, twenty street,Al SahareeBank, Alberka,and Al TejaraWa Al Tanmia Bank. Al Hadayek,3.34%Al TejaraWa Al Tanmia Bank. Al Fuwaihat,and Al Tejareemyedan al baladea Bank,and 0%Al Wahda BankAl Rouwaisat.

Staphylococcus coagulase Negative reported 30% in AlWahda Bank,and Al Wahda Bank, Omer Al Mukhtar,26.70% in Al TejaraWa Al Tanmia Bank. Al Hadayek,20% Al Tejareemyedan al baladea Bank,13%Al Jamhureia Bank Al Hadayek Al Wahda Bank,AlRouwaisat,and Al Saharee Bank, Alberka,10%Jamhuriaa bank, twenty street,6.67%in AlTejaraWa Al Tanmia Bank. Al Fuwaihat,and 3.34% in Al SahareeBank .

*Klebsellaoxycota*was 0% in Jamhuriaa bank, twenty street,Al Saharee Bank, Alberka,Al Saharee Bank,and Al Tejareemyedan al baladea Bank.3.34% reported in Al Jamhureia Bank. Al Hadayek,and Al TejaraWa Al Tanmia Bank. Al Hadayek.6.70% in Al Wahda Bank AlWahda Bank,and Al Wahda Bank, Omer Al Mukhtar,and 10%in Al Wahda Bank,AlRouwaisat.

Acinetobacter baumannii 3.34%just found in Al Jamhureia Bank Al Hadayek,Finally, the non-growth reportedhighest percent 6.70%in Al Wahda Bank Al Wahda Bank, Omer Al Mukhtar,3.34%Jamhuriaa bank, twenty street,Al Saharee Bank, Alberka,Al Saharee Bank FH,AlTanmia Bank. Al Fuwaihat,andAl Saharee Bank, AlberkaFuwaihat.

Table(2) Distribution of isolation bacteria from all banks:

BACTERIA	1	2	3	4	5	6	7	8	9	10
Bacillus gram positive spp	60%	63.70%	46.70%	73.34%	76%%	76%	76%	76%	73.34%	50%
Eschericha Coli spp	20%	6.70%	10%	3.34%	3.34%	67.6%	6.67%	0%	13.34%	6.70%
Staphylococcucs Coagulase negative	13.34%	26.70%	30%	20%	6.67%	13.34%	13.34%	13.30%	10%	30%
Klebsiella spp	3.34%	3.34%	6.70%	0%	10%	0%	0%	10%	0%	6.70%
Acinetobacter spp	3.34%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Non-growth	-	-	6.70%	-	3.34%	3.34%	3.34%	-	3.34%	6.70%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

1-Jamhoria Bank-Al Hadayek
2-Bank of Commerce&Development-Al Hadayek.
3-Wahda Bank-Omer Al Mukhtar Street.
4-National Commerce Bank-Maydan Al Baladeah.
5-Bank of Commerce&Development-Al Fuwaihat.
6-Shara Bank-Al Fuwaihat.
7-Shara Bank-Alberka.
8-Wahda Bank-Al Ruwaisaat.
9-Jamhoria Bank-20 Street.
10- Wahda Bank-Main Branch.

E.coli it was resistance to Ampicillin,Amoxicillin,Nitrofurantoin, however was sensitiveto Amikacin,Ceftriaxone,Amikacin, Ceftriaxone ,Nitrofurantoin, Imipenem , Meropenem ,Cefepim, Colistin, Tigecycline, Eratapenem,this result agree with (Turkia 2010),also the Klebsiella was sensitive to Amoxicillin ,Amikacin , Imipenem , Meropenem ,Cefepim, Colistin, Tigecycline, Eratapenem. However, the Klebsiella was resistance to Ampicillin,Ceftriaxone,Nitrofurantoin.For the Acinetobacter was sensitive to Amikacin,Ceftriaxone,Imipenem,Meropenem, Cefepim, Colistin, Tigecycline, Eratapenem.in the same manner was resistance to Ampicillin, Amoxicillin,Nitrofurantoinnear to (Gutmann *et al*.,1990), (Al-yaseri ,1995),(Rolston *et al*., 1996).reported the similar result for *E.coli*, *Klebsiella*, *Aceinetobacter*. Reported the

isolated bacteria*E.coli,Acinetobacter* were resistance to Amoxicillin , Amikacin , Imipenem , Meropenem ,Cefepim.

The Gram positive bacteria *B.cerus*,was sensitive Ampicillin, Amoxicillin, Teicoplanin. Tetracycline, similar to (Eltablaeay,and Elhifnawai2009). however, it was resistance to Rafmpin in contrast with (Uzoigwe And Wokoma2011) reported sensitive to Rafmpin.

Also,*staphylococcus epidermis* reported the sensitivity to AmpicillinAmoxicillin,Teicoplanin,Tetracycline,Nitrofurantoin,SulphamethoxazoleRafmpin,Vancomycin,Cipro floxacin, Imepenem, Gentamycin, in contrast with (Gomes et al 2012) reported Staphylococcus epidermis was resistance to Rafmpin,Gentamycin.

IV. Conclusions

Computers keyboards and mice should be disinfected daily or when visibly soiled or if they become contaminated with food materials. Clean a computer's keyboard and mice with a disinfecting wipe before someone else uses that keyboard and mice. Regular clean of your keyboard and mice is quite simple to do and could prevent your computer becoming a health hazard. Users should unplug Keyboards and turned before wiping surfaces with a dampsoft lint-free cloth or germicide.

Further research shouldbe undertaken to investigate more types of different bacteria that could be associated withshopping trolleys and elevators buttons because these are other significant sources of contamination.

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