Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

J E Z S Journal of Entomology and Zoology Studies

E-ISSN: 2320-7078
P-ISSN: 2349-6800
www.entomoljournal.com
JEZS 2020; 8(3): 1192-1195

Received: 22-03-2020
Accepted: 24-04-2020

Pushpa Sharma
Department of Vetrinary Microbiology and Biotechnology, CVAS, RAJUVAS-Rajasthan University of Veterinary and Animal Sciences, Bikaner, Rajasthan, India

BN Shringi
Department of Vetrinary Microbiology and Biotechnology, CVAS, RAJUVAS-Rajasthan University of Veterinary and Animal Sciences, Bikaner, Rajasthan, India

RK Sharma
Department of Vetrinary Microbiology and Biotechnology, CVAS, RAJUVAS-Rajasthan University of Veterinary and Animal Sciences, Bikaner, Rajasthan, India

Corresponding Author:
Pushpa Sharma
Department of Vetrinary Microbiology and Biotechnology, CVAS, RAJUVAS-Rajasthan University of Veterinary and Animal Sciences, Bikaner, Rajasthan, India

A study on bacterial flora on the finger printing scanners of the biometric devices at a CVAS, RAJUVAS, Bikaner

Pushpa Sharma, BN Shringi and RK Sharma

Abstract
Biometric devices (BDs) are the integral component of the present-day lifestyle, and their use has grown beyond imagination and more commonly used in both the public and private sectors to record attendance. The BDs recognize the person by fingerprint capturing in which physical contact occurs between the skin and the surface of the device. The BDs become the source of transmission of the microorganisms from one person to another when successive persons align their fingers on the device. Many studies conducted in different settings shows that they are the main source to transfer the pathogenic microorganisms. In this study the various microbial flora on the surface of BDs installed in Rajasthan University of Veterinary and Animal Sciences, Bikaner were studied. The aim of the study was to assess the risk of transmission of pathogenic micro-organisms through fingerprinting devices by isolating the microbial flora which may be present in the Biometric devices and also assess the bacterial load on fingerprint scanners (FPS) of BDs revealed the presence of 0.23×10^3 to 3.52×10^3 colony-forming units of bacteria per cm^2 of FPS. The wet swabs were used to collect the sample from the surface of the biometric fingerprinting device. The collected swabs were inoculated in the Nutrient agar plate, Blood agar plate and Mac Conkey agar plate and incubated overnight at 37° C for the isolation of bacteria. The bacterial isolates were identified by performing Gram staining and biochemical reactions. The antibiotic sensitivity testing was done for the isolated pathogens. Out of the total 20 samples collected from the surface of the biometric fingerprinting devices, 16 (80%) samples were culture positive. Coagulase negative Staphylococcus species (CONS) was the commonest organism to be isolated 15 (75%), followed by Gram positive bacilli 15 (43.7%) and Gram negative bacilli of 16 (75%) among all the positive cultures. The Gram positive and negative bacilli isolated were *Enterobacter* spp., *Aeromonas* spp., *Bacillus* spp., *Streptococcal* spp., *Klebsiella* spp., *Pseudomonas* spp.

Keywords: Biometric devices, bacterial transmission, *Aeromonas*, Escherichia coli, *Klebsiella pneumonia*

Introduction
Biometric devices (BDs) are the integral component of the present-day lifestyle, and their use has grown beyond imagination. Biometrics is essentially ready for mass application, as the success of the Indian Aadhaar programme demonstrates. Launched in 2010 by the Unique Identification Authority of India (https://uidai.gov.in/), the goal of the programme is to provide all 1.2 billion Indian citizens with a unique 12-digit number linked to biometric features to serve as an identification system "devoid of any classification of caste, creed, religion and geography".

Nowadays Biometric fingerprint identification is expanding in all sectors. Biometric authentication systems are becoming increasingly common. Though their use offers important advantages to governmental agencies, business, and consumers, the widespread use of biometric technology has the potential for serious negative consequences.

The BDs recognize the person by fingerprint capturing in which physical contact occurs between the skin and the surface of the device. Many persons successively align their fingers on the same surface of the hardware devices. This activity may lead to the transmission of various microorganisms from this environmental devices to humans. This may increase the risk of transmission of infection when these devices are used by health care workers, science researchers, animal handlers whose hands are more prone to carriage of microorganisms including pathogens [1-3]. It is important to note that the skin surface acts as the habitat of a microbial flora, predominately consisting of gram-positive bacteria.

Temperature, humidity, and skin physiology all play a role in maintaining the skin micro flora [4]. According to healthcare infection transmission, transfer of microbes through an inanimate objects applies to indirect contact transmission, and the involved objects are termed as fomites [3]. Many microorganisms may be present in clean hands and most of them remain viable in the hands for more than 20 minutes and can also survive for a longer time on an inanimate objects. Studies have shown that human pathogens can be transmitted between nonliving objects by direct hand contact [5].

We presently studied the presence of various microbial flora on the surface of BDs installed in Rajasthan University of Veterinary and Animal Sciences, Bikaner and the risk of transfer of microorganisms through these fingerprinting devices.

Materials and Methods

All biometric devices used by staff of this University were included in this study. One biometric device is installed on all entry gates of office and laboratory buildings, to clock entry and exit timings and there is no provision for regular disinfection of the device.

Sample Collection

Sampling was done from 20 BDs installed at different places to clock in and out times for employees of Rajasthan University of Veterinary and Animal Sciences, Bikaner. All samples were collected between 10:30 am to 11 am and 5:15 pm after the last scan on the machine. Sterile wet cotton swabs with saline were rubbed on the scanners in all directions avoiding any other contamination. All the swab samples were collected on the same day on 19th August 2019 and transferred to the laboratory within 20 min in sterile containers at ambient temperature.

Processing of Swab samples

The collected swabs were immediately transferred to individual sterile tubes containing normal saline solution (NSS). Swabs in NSS were swirled on a vortex shaker for five minutes and then swabs were inoculated in Nutrient Agar, blood agar and Mac Conkey agar plate for the isolation of the bacteria if present. Remaining NSS were serially diluted and bacterial load was determined using pour plate method [6], in triplicate for each dilution. The count of bacteria was expressed as colony forming-units (CFUs) per square cm. Isolated different types of colonies (three or more of each type) from each plate were picked up and identified using growth, staining, morphological, cultural and biochemical characteristics [7, 8].

Results & Discussion

The total number of collected swabs from the biometric surface of the fingerprinting device was 20. Based on the use of the biometric fingerprinting devices by the people, the samples were grouped into three. Those devices in the college block (3) were used to record attendance of students, doctors and administrative staff, while those in high risky areas (5) are used by Professors, Doctors, Researchers and animal healthcare workers for the purpose of access to certain areas. The devices in other departments (12) were used to record attendance of Professors and other staffs. Table 1 shows the samples collected sites and the number of growth yielded sites.

Among the 3 samples collected from the devices used only by the University staff and students, 2 (66%) yielded growth, of which 1 (50%) were coagulase negative Staphylococcus spp and Gram positive bacilli and the remaining 1 (50%) was Gram negative bacilli. Among 12 samples collected from the devices used commonly by both Professors and other staffs of departments, 9 (75%) yielded growth, 8 (99%) were coagulase negative *Staphylococcus* spp. and both Gram positive and negative bacilli & cocci and the remaining 1 (1%) was a Gram negative bacilli. The samples which were collected from the devices used by the Professors, researchers, other staffs and health care workers were 5. Among them all 5 (100%) yielded growth of almost all type of bacteria like they yielded coagulase negative *Staphylococcus* spp., *E. coli*, and other Gram positive bacilli and Gram negative bacilli. This is shown in Figure 1.

CONS was isolated from 15 (75%) of the 20 samples which yielded growth and 3 (15%) were of them were methicillin resistant and the rest were methicillin sensitive. The Gram negative bacilli isolated were *E. coli*, *Enterobacter* spp., *Acinetobacter* spp. and *Aeromonas* spp., *Streptococci* spp. *Bacillus* spp., *Enterococcus* spp., *Enterobacter*, *Klebsiella*., *Streptococcus*, *Pseudomonas*. Most commonly 12(75%) isolated Gram negative bacteria was *E. coli*. Among these isolates some strains were sensitive while some were resistant to all the commonly used antibiotics.

Table 1: Sites of sample collection

S. No.	Sample Collection Sites	Number of Samples	Number Yielding Growth
1.	Administrative block	3	2 (66%)
2.	High risky areas	5	5 (100%)
3.	Others departments	12	9 (75%)
4.	Total	20	16 (80%)

Table 2: Bacterial load on fingerprint scanners of biometric devices (BDs) installed in RAJUVAS- Rajasthan University of Veterinary and Animal Sciences, Bikaner, for biometric attendance of employees, types of bacteria detected

Use of BDs	Colony forming units (cfu) per cm^2 of the BDs fingerprint scanner	Bacteria identified, number of isolates
1.a	$0.63\pm0.13 \times 10^3$	*S. aureus*, *B. thuringiensis*
1.b	$3.02\pm0.13 \times 10^3$	*E. coli* *S. haemolyticus*
2.a	$3.33\pm0.26 \times 10^3$ $3.52\pm0.06 \times 10^3$ $1.53\pm0.15 \times 10^3$	*S. aureus*, *E. coli* *S. haemolyticus* *Ec. faecalis*, *B. thuringiensis* *K. pneumonia* *En. Agglomerans* *St. milleri* *P.aeruginosa*
2.b	$0.63\pm0.13 \times 10^3$ $0.83\pm0.05 \times 10^3$	*S. aureus*, *E. coli* *S. haemolyticus* *B. thuringiensis* *St. milleri* *A. media*
2.c	$1.21\pm0.13 \times 10^3$ $0.73\pm0.07 \times 10^3$	*S. aureus*, *E. coli* *S. haemolyticus* *Ec. faecalis*, *En. Agglomerans* *A. media*
2.d	$0.75\pm0.13 \times 10^3$ $3.00\pm0.13 \times 10^3$	*S. aureus*, *E. coli* *S. haemolyticus* *Ec. faecalis*, *St. milleri* *B. thuringiensis*
2.e	$3.00\pm0.13 \times 10^3$	*S. aureus*, *E. coli* *S. haemolyticus* *K. pneumonia*
3.a	$2.71\pm0.19 \times 10^3$	*S. aureus*, *E. coli* *S. haemolyticus*
3.b	$0.88\pm0.13 \times 10^3$	*S. aureus*, *B. thuringiensis*
3.c	$2.71\pm0.19 \times 10^3$	*S. aureus*, *E. coli* *B. thuringiensis* *En. Agglomerans*
3.d	$0.88\pm0.13 \times 10^3$	*S. aureus*, *E. coli* *S. haemolyticus*
3.e	$0.75\pm0.13 \times 10^3$ $2.71\pm0.19 \times 10^3$	*S. aureus*, *E. coli* *S. haemolyticus* *A. media* *K. pneumonia*
3.f	$0.73\pm0.07 \times 10^3$	*S. aureus*, *E. coli* *S. haemolyticus*
3.g	$0.83\pm0.27 \times 10^3$	*S. aureus*, *En. Agglomerans*
3.h	$0.79\pm0.13 \times 10^3$ $0.23\pm0.07 \times 10^3$	*S. aureus*, *B. thuringiensis* *En. Agglomerans* *S. haemolyticus*
3.i	$1.21\pm0.11 \times 10^3$	*S. aureus*, *E. coli* *A. media*

A., Aeromonas; *B., Bacillus*; *E., Escherichia*; *Ec., Enterococcus*; *En., Enterobacter*; *K., Klebsiella*; *S., Staphylococcus*; *St., Streptococcus*; *P., Pseudomonas.*

Use of BDs, 1 Administrative block, of >99 people; 2 high risky area, of >50 people; 3 other departments, of 50-100 people.

The overall culture positivity rate of all the samples taken from the various biomedical devices was 80%. Christine R. Blomeke *et al*., (2007) studied the survivability and transferability of these organisms from biometric devices and reported that after organisms have been located onto the surfaces of the fingerprinting devices majority of them are transferred in the first 10 minutes.

The bacterial load on FPS ranged from 0.23×10^3 to 3.52×10^3 cfu per cm^2 (Table 2).

Among the 16 of culture positive swabs 93% were CONS, 43.7% were Gram positive bacilli and 75% were Gram negative bacilli. Among the 15 isolates of CONS 15% were methicillin resistant. In a study conducted by Jacobs *et al*., on BDs in a VISA collecting office isolation rate of *Staphylococcus aureus* was 18.5% while that of Gram-negative bacteria was 75.1% [9]. A study done by Isaac *et al*., showed coagulase-negative *Staphylococcus* species growth from 25 keyboards [10]. Another study conducted in a tertiary care hospital on the mobile phones of health care personnel, 65% were CONS and *Staphylococcus aureus* was the commonest pathogen to be isolated followed by Gram negative bacilli like *E. coli*, *Pseudomonas* spp., *Acinetobacter* spp., etc. All the above findings show that all these inanimate objects and devices definitely harbor pathogenic and other bacteria on them and may become the source of infection depending on their location and in their own way serve to transmit them.

Conclusions

The study concludes that the bio-metric finger printing devices are more prone to be transmitting the microorganisms through inanimate objects from one person to another. These biometric finger print scanners may harbor a variety of pathogenic and drug resistant bacteria. Thus those who are susceptible host, may acquire infection. This risk can be reduce by implementation of simple infection control measures. Thus the persons who are undergoing immunosuppressive therapy, chemotherapy, recovering from organ transplants, and or suffering from immune disorders may be advised to avoid Biometric attendance on public places, or should use properly disinfected devices or should use sanitizer after use of BD or any alternative touch less devices should be installed.

Acknowledgements

Authors are thankful to the staff of RAJUVAS and all intern students of 2019 batch of RAUVAS for assisting in collection and testing of samples.

References

1. Scientific Advisory Board of the International Scientific Forum on Home Hygiene. Hygiene procedures in the home and their effectiveness: a review of the scientific evidence base, 2006.
2. Centers for Disease Control and Prevention. 2002. Guideline for hand hygiene in health-care settings: recommendations of the healthcare infection control practices advisory committee and the HICPAC/SHEA/APIC/IDSA hand hygiene task force. MMWR Recomm Rep., 51:1-45.
3. Centers for Disease Control and Prevention. 2003. Guidelines for environmental infection control in health-care facilities: recommendations of CDC and the Healthcare Infection Control Practices Advisory Committee (HICPAC). MMWR Morb. Mortal Wkly. Rep., 52:1-48.
4. McBride M, Duncan W, Knox J. The Environment and the Microbial Ecology of Human Skin. Applied and Environmental Microbiology. 1977; 33(3):603-608.
5. Reynolds KA, Watt PM, Boone SA, Gerba CP. Occurrence of bacteria and biochemical markers on public surfaces [Electronic version]. International Journal of Environmental Health Research. 2005; 15(3):225-234.
6. Sanders ER. Aseptic laboratory techniques: plating methods. J Vis Exp, (63): e3064. Singh BR, 2009. Labtop for Microbiology Laboratory. Lambert Academic Publishing; Germany. 2012, 86.
7. Carter GR. Diagnostic Procedures in Veterinary Bacteriology and Mycology. 5th Ed. Elsevier Inc., Springfield. 1990, 620.
8. Nirupa S, Bhabuvignesh RN, Jeya M. Can mobile phones act as vehicles transmitting Nosocomial infections. Int. J. Pharm. Bio Sci, 2013, 859-64.
9. Biometric fingerprinting for visa application device and procedure are risk factors for infection transmission. J. Travel Med, 15(5), 335-43.
10. Brues S, Fishbain JT, Uyehara CFT *et al*. Computer keyboards and faucet handles as reservoirs of nosocomial pathogensin the intensive care unit. Am. J Infect. Control. 2000; 8:465-70.
11. Isaacs D, Daley A, Dalton D. Swabbing computers in search of nosocomial bacteria. Ped. Infect. Dis. J., 17: 53310.1097/00006454-199806000-00025.Carter, M.J. 2005. Enterically infecting viruses: pathogenicity, transmission and significance for food and waterborne infection. J Appl. Microbiol., 1998; 98:1354-1380.
12. BioCote, 2019. How long can microbes like bacteria survive on hard surfaces? https://www.biocote.com/blog/how-long-can-microbes-like-bacteria-survive-hard-surfaces/ (Accessed on April 17, 2019).
13. Christine R, Bloomeke, Stephen J, Elliotte *et al*. Bacterial surviablity and transferability on Biometric devices. 1-4244-1129-7/ IEEE. 2007, 80-84.
14. Nirupa S, Gayathri V, Priyadarshini Shanmugam. A Study on Bacterial Flora on the Finger printing Surface of the Biometric Devices at a Tertiary Care Hospital. Int. J. Curr. Microbiol. App. Sci. 2016; 5(9):441-446.
15. Singh BR, Vinodhkumar OR, Sinha DK, Agri H. Bacteria on fingerprint scanners of Biometric Attendance Machines. Microbiol Res Int. 2019; 7(4):31-39