

BUGS IN ATM AND THEIR CONTROL

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ABSTRACT

Microbes contaminate various environmental sources and humans always have a tendency to get into contact with them. In the human body, the hands are the organs that are highly involved in picking up microbes from animate and inanimate objects with reference to the instrumentation process in the banking sector automatic teller machine (ATM) have become an important component of life. Many users access the ATM so the chances of microbial population contaminating the ATM too is high. Many drug -resistant pathogens are found to be transmitted through various parts of the ATM and the as the cleanliness of the ATM room are very bad the situation becomes even worse in transmitting the pathogens.

Therefore, investigation of the bacterial load of these devices may be valuable to increase our awareness about the possible transmission ways of pathogens in public

For a long time, plants have been an important source of natural products for human health and many products from plants have been prepared for the control of the pathogens so in this regard. The present study was undertaken specifically to investigate the role of aqueous extracts of *M. oleifera* Lam. leaves as a potential antimicrobial agent against some human pathogenic bacteria isolated from ATM *Moringa Oleifera* has been used extensively in traditional medicine for the treatment of several ailments, promotes digestion, skin diseases, diarrhea, as stimulant in paralytic afflictions.

KEYWORDS: Automated Teller Machines, MDR Strains, *Moringa Oleifera*

Article History

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INTRODUCTION

Bacteria are ubiquitous organisms among the creatures that exist everywhere in the environment which able to grow on any surface. Contamination of environmental objects and surfaces is a common phenomenon. Human beings have a marked tendency to pick up microorganisms from environmental objects, and especially the hand has been shown to play a role in the transmission of organisms. Continuous development and expansion of urbanization with increasing rate of population, and also limited times, cause people to use new developments in electronic banking which named Automated Teller Machines (ATMs). Today, the widespread use of electronic technologies as a source of health system contamination is considered. The ATM machine is likely to be contaminated with various microorganisms due to their vast contact with multiple users. There is no restriction as to who has access to the facility and no guideline to ensure hygienic usage. But like all surfaces, microbial colonization of these metallic keypads is imminent, particularly when there are no proper

cleaning regimens in place for most of these facilities. (Whitehead *et al.*, 2006) An Automated Teller Machine (ATM) is a computerized telecommunications device that enables the clients of a financial institution to perform financial transactions without the need for a cashier, human clerk or bank teller. ATMs are known by various other names including ATM machine, automated banking machines, cash dispenser and various regional variants derived from trademarks on ATM systems held by particular banks (Rasiah *et al.*, 2010). The automated Teller machine is the most widely used form of computer-driven public technology (Hone *et al.*, 2008) with an estimated over 2.4 million units in use (ATMIA 2011) since their invention and use in the late 1960's. A typical usage of the ATM machine involves slotting a card into a recipient hole and following on-screen instructions, by punching the keys of the metallic keypads to enter secret codes and commands; thus instructing the machine as to kind of service one requires (ATMIA 2011). Bank ATMs are the essential requirements of our social life. They are frequently localized in city centers, trade areas, and around the hospitals. Hundreds of people whose socio-economic levels and hygienic status are quite different with each other use ATMs daily. Customers contact with their hand the surfaces of key-pad and/or screen of these devices. However, there is limited data about their status for microbial colonization. Therefore, investigation of the bacterial load of these devices may be valuable to increase our awareness about the possible transmission ways of pathogens in public.

Pathogens spread among people with direct contact (physical contact, touching, eating contaminated food, inhalation, kissing etc with the infected person and indirect contact using objects such as towels, door, the knob, cup etc handled by an infected person). In the healthcare settings, certain infection control measures have been established to reduce microbial transmission in these ways (Mathai *et al.*, 2010) Currently, such measurements have been adopted for the community because of the large outbreaks that emerged in the recent years. In a meta analysis, (Larson *et al.*, 2006) stated that improving the hand hygiene is an important strategy that may significantly reduce the spread of respiratory tract pathogens in the public, after vaccination and education practices.

Non-porous surfaces such as taps, telephones, doorknobs, etc., facilitate a surface for the transmission of pathogenic microorganisms. The residence of pathogens like *Staphylococcus epidermidis*, *Staphylococcus aureus*, *Staphylococcus alpha haemolyticus*, *Enterococcus faecalis*, *Bacillus subtilis*, *Corynebacterium*, *Pseudomonas aeruginosa*, *Escherichia coli* and *Acinetobacter calcoaceticus* were found on the surface of public telephone booths since they are constantly utilized by the users and also observed in the door knobs, the mouthpiece, and keypad of mobile phones and computer (Jerkovic *et al.*, 2013).

Microbes develop resistance to available antibiotics due to its irrational use and they started to spread via horizontal gene transfer. The bacteria show reluctant toward antibiotic is increasing with each passing year (Levy *et al.*, 1998). Beta-lactamases produced by these pathogenic microbes to overcome the activity of the beta-lactam group of antibiotics pose the greatest resistance ability even to last resort to antibiotics including carbapenems. Some microbes have progressed resistance to multiple drugs and are known as multiple drug resistance (MDR). MDR permits disease-causing microbes to resist antimicrobials, which are targeted at eliminating the microbes (Siegel *et al.*, 2006). The antibiotic-resistant pathogens widened worldwide and strains, which pose resistant to four or more frontline antibiotics called extremely drug-resistant have found recently (Shah *et al.*, 2007). Totally drug-resistant strains have also been reported in later years (Velayati *et al.*, 2009). Recently, it has been noticed that the automatic teller machine (ATM) also serve as a mediator for the transmission of diseases by vast dermal contact with the key panel (Nworie *et al.*, 2012). Several works have been reported to analyze the microbial contamination on the screens and metallic keypads on ATMs. There is a possibility that the ATMs may be contaminated with MDR strains of bacteria, however,

very few works have been reported on the same. Hence, the aim of this study was to find out the prevalence of MDR strains on the touch screen of ATMs

The increasing prevalence of multi-drug resistant strains of bacteria and the recent appearance of strains with reduced susceptibility to antibiotics, raised the specter of 'untreatable' bacterial infections and adds urgency to the search for new infection-fighting strategies (Rojas *et al.*, 2006). For a long time, plants have been an important source of natural products for human health. The antimicrobial properties of plants have been investigated by a number of studies worldwide and many of them have been used as therapeutic alternatives because of their antimicrobial properties (Adriana *et al.*, 2007). The practice of complementary and alternative medicine is now on the increase in developing countries in response to World Health Organization directives culminating in several pre-clinical and clinical studies that have provided the scientific basis for the efficacy of many plants used in folk medicine to treat infections. (Dilhuydy and Patients., 2003).

It is therefore very necessary that the search for newer antibiotic sources be a continuous process. Plants are the cheapest and safer alternative sources of antimicrobials (Doughari *et al.*, 2007). *Moringa oleifera* Lam. is the most widely cultivated species of a monogeneric family, the Moringaceae that is native to the sub-Himalayan tracts of India, Pakistan, Bangladesh and Afghanistan (Fahey, 2005) which is widely used for a treating bacterial infection, fungal infection, antiinflammation, sexually-transmitted diseases, malnutrition, and diarrhea. the present study was undertaken specifically to investigate the role of aqueous extracts of *M. oleifera* Lam. leaves as a potential antimicrobial agent against some human pathogenic bacteria isolated from atm *Moringa Oleifera* has been used extensively in traditional medicine for the treatment of several ailments, promotes digestion, skin diseases, diarrhea, as stimulant in paralytic afflictions, epilepsy and hysteria (Farooq *et al.*, 2011). Various parts of the plant have been shown to be useful, such as the roots have been experimentally shown to have anti-inflammatory action (Shareef *et al.*, 2006) the leaves, stem bark and seeds have been reported to have therapeutic properties (Anwar and Rashid, 2007).

In 2015 a study was done by R. Bagyalakshmi, department of microbiology, Sri. Lakshmi Narayana institute of medical science, massoud, puducherry. The prevalence of microbiological contamination and the antibiotic resistance pattern in automated teller machine. In this present study, we have to isolate and which aimed at identifying the microorganism present in automated teller machines in and around of Coimbatore and to design a cheap herbal handed wash to control the spread of the organisms

MATERIALS AND METHODS

Sample Collection

During September 2017 to December 2017 a total of 40 swabs of the ATMs, parts like the metallic key pads, door handles, screen, card insert area, money outlet area were collected. All the swab samples were collected from different ATMs located in various parts of Coimbatore, which was very near to the public places. The ATMs chosen were, HDFC (Peela media), KVB (Meena estate), Indian bank (Esso bunk), a bank of India (pulikulam), icici bank (Lakshmi mill), Punjabi national bank (hopes), Indian overseas bank (Citra), IDBI (Gandhipuram)

Collection of Samples

Sterile swab which was aseptically prepared was dipped in peptone broth and was taken to the sample collecting areas and using aseptic technique. The separate swab stick moistened with peptone broth was moving over the surface of

the metallic keypads, door handles, screen, card insert area, money outlet and then inserted into the labelled peptone broth and agitated for a few minutes and transported to the lab and was processed within one hour.

ISOLATION, IDENTIFICATION AND CONFIRM OF THE PATHOGENS ASSOCIATED WITH ATMs

Primary Isolation

The swab containing peptone broth, which was transported to the lab. It was plated onto Mcconkey agar, Mannitol salt agar, and Nutrient agar to isolate the organism residing in the different part of ATMs.

Identification of the Isolates

Based on the size, colour and colony morphology on Mcconkey agar, Mannitol salt agar and Nutrient agar the identification was done

Identification of Colonies from MacConkey Agar, Mannitol Salt Agar and Nutrient Agar Plates

The colonies were sub cultured onto Nutrient agar slats after 24 hours of incubation the colonies were identified by Grams staining.

Confirmation of Isolates

When the swabs obtained from the door handle and keypad of HDFC ATM, KVB ATM, INDIAN BANK ATM, BOI ATM, ICICI ATM was plated onto Nutrient agar, MacConkey and Mannitol salt agar plates after 24 hours of incubation colonies were found. These colonies were subjected to identification by Gram staining and standard biochemical test based on Bergey's manual systemic bacteria.

ANTIBIOGRAM OF THE ISOLATES

All the isolates were subjected to the Kirby Bauer disc diffusion assay with the following antibiotics Nalidixic acid (30mcg), Ampicillin (10mcg), Cephataxmo (30mcg), Novobiocin (30), Amphoteicin (100) and Cetriaxone. Sub cultured in nutrient broth tubes of their turbidity was adjusted to 0.5% McFarland standard and they were used for swabbing the Muller Hinton Agar plates on which the antibiogram was to be done

PREPARATION OF HERBAL HAND WASH

Collection and Authentication of Moringa Material

The fresh leaves of Moringa oleifera were collected from TNAU and was identified and authenticated by a botanist at the biological science department

ASSESSING ANTIMICROBIAL ACTIVITY OF MORINGA LEAF EXTRACT

Preparation of Moringa Leaf Powder

The leaves were dried in shade and crushed using sterile technique to obtain the leaf powder. It was preserved by packing it in an aseptic plastic container this powder was further used to extract preparation

Aqueous Extract Preparation

20 gm of the powdered leaf was weighed and transferred into 1 liter beaker. 150 ml of distilled water was added to the powder and allowed to stand for 48 hours.

This was then heated on a water bath at 60⁰c evaporation takes place it was then filtered using what man filter paper.

Anti bacterial Assay of Moringa Leaf Powder Against the Pathogens (Isolated from ATM s)

The anti bacterial activity of the aqueous extract of *Moringa oleifera* dried leaf powder were individually tested against the isolates *in vitro* test was then carried out by disc diffusion method. A swab of the isolates was done at the Muller Hinton agar plate and then wells were cut in the Muller Hinton agar plate and 1.5µl, 2.5µl, 5µl and 10 µl of the leaf extract was added into the well and incubated at 37⁰C for 24 hours tetracyclin as control.

RESULTS AND DISCUSSIONS

Identification of Organism from Different Parts of ATM

The result of the study showed a high level of bacterial contamination of the surface of metallic keypads, door handles and screen of ATMs. Apart from the quantity of bacteria, the type of microorganism present on a surface is also an important determinant of whether an infection will occur or not. Seventeen bacterial isolates were obtained from the samples collected from the seven ATM out of eight ATMs tabulated in (Table No:1) In ICICI ATM there were no isolates in any part.

The seventeen isolates were identified by Gram staining, biochemical tests were done based on Bergey's manual systemic bacteriology. A previous study showed the prominent presence of *staphylococcus species*, *E coli* and the presence of *Salmonella* and *Shigella* are minimal. However, they constituted more impact on human health as disease causing pathogen, the samples collected from ATM steel pads, touchscreen in a different area, *Shigella* was found in the ATM at a shopping mall. (p, Arulazhakan *et al.*, 2014). The result of the present study was correlated with something to discussed with the previous study, the *Staphylococcus* and *E coli* were found in the present study, but *Salmonella* and *Shigella* was not found in the present study.

ANTIBIOGRAM OF THE ORGANISMS ISOLATED FROM ATM

All the confirmed organism were subjected to the antibiotic sensitivity assay Kirby- bauer disc diffusion method with 6 different antibiotics

All the isolates showed completely resistant to amphotericin (100mcg) and *staphylococcus aureus* resistants to all antibiotics.

E.coli was found to be intermediate resistant to Cephataximo (30mcg) and sensitive to ampicillin (10mcg) *Pseudomonas* was sensitive to ampicillin (10mcg) and *klebsiella* intermediate sensitive to Cephataximo (30mcg),

A previous study susceptibility pattern of the isolates to some prescribed antibiotic show that *S. aureus* and CNS showed the highest susceptibility (25% and 18.75%, respectively) to the applied antibiotics, while all the other bacteria showed varied degrees of resistance to the antibiotics tested (stanley chukwudozie onuoha *et al.*, 2014). The present study was discordant with the previous study, here the all isolates showed the complete resistant to a particular antibiotic (amphoterecin 100mcg), the *Staphylococcus aureus* was resistant to ampicillin 10mcg in both studies. *E coli* and *pseudomonas* was found to be sensitive to ampicillin 10mcg in the present study, it was discordant with the previous study that shows the *E coli* and *Pseudomonas* was found to be resistant to ampicillin.

The Antimicrobial Activity of the Aqueous Extract of Moringa Oleifera Leaf

The antimicrobial activity of the aqueous extract of *moringa oleifera* with concentration 10 µl, 5µl, 2.5µl and 1.5µl was done against the highly resistant 4 different isolates *E.coli*, *staphylococcus aureus*, *klebsiella*, *Pseudomonas* and the results revealed that the organism was found to be sensitive to the extract. The zone of inhibition of *Moringa oleifera* leaf extract against the organisms in different concentration at 10 µl, *E.coli* was 12mm, *Staphylococcus aureus* was 13mm, *Klebsiella* was 11mm, *Pseudomonas* was 12mm at 5µl *E.coli* was 8mm, *Staphylococcus aureus* was 7 mm, *Klebsiella* was 7mm, *Pseudomonas* was 9 mm.

A previous study shows that all organisms were unaffected by the aqueous extracts with no zones of inhibition observed compared with the control antibiotic which was effective on the 3 organisms, with zones of inhibition of 18mm, 20mm, and 13mm for *E coli*, *Shigella flexneri* and *salmonella typhi* respectively (Lar p, et al., 2011). this was completely discordant with the result of the present study, it shows the aqueous extract of the moringa oleifera leaf with concentration 10µl, 5µl, were found to be sensitive against the isolates.

Hand Wash Preparation

Application of 10µl aqueous extract of Moringa oleifera leaf was found to be highly efficient against the isolates

In this study, Moringa oleifera has been described to have antibacterial activity against some human bacterial pathogens like, (*E.coli*, *Pseudomonas*, *Klebsiella*, *Staphylococcus aureus*). There is an evidence supporting the effect of this plant as an antibacterial agent so it can be tested as a hand washing product. So this extract was used to prepare a herbal hand wash in which the components were (water, cocamido propyl hydroxy sultaine, olive oil, SDS 1.5)

All the components used to design the hand wash was checked for the antibacterial activity against the isolates using the well diffusion method on Muller Hinton Agar, the concentration of herbal hand wash components was (water 2ml, cocamido propyl hydroxy sultaine 1ml, olive oil 1ml, SDS 1ml)

The result obtained showed that there was no zone, indicating that the components in the hand wash do not have an effect on the isolates and only the leaf extract was effective against the isolates as there zone formation, so the formulation can be used as an effective herbal hand wash against the pathogens isolated from ATM's

Table 1: The Samples Collected from Different Parts of Eight ATM s

Sl.No	Automated Teller Machine	Parts	Place
1	K.V.B	A)Door handle b) screen c) keypad d) card insert area e) money outlet	Meena estate
2	H.D.F.C	a) Door handle b) screen c) keypad d) card insert area e) money outlet	Peelamedu
3	INDIAN BANK	a) Door handle b) screen c) keypad d) card insert area e) money outlet	Esso Bunk

4	I.C.I.C.I	a) Door handle b) screen c) keypad d) card insert area e) money outlet	Lakshmi Mill
5	I.D.B.I	a) Door handle b) screen c) keypad d) card insert area e) money outlet	Gandhipuram
6	I.O.B	a) Door handle b) screen c) keypad d) card insert area e) money outlet	Citra
7	PUNJAB NATIONAL BANK	a) Door handle b) screen c) keypad d) card insert area e) money outlet	Hopes
8	BANK OF INDIA	a) Door handle b) screen c) keypad d) card insert area e) money outlet	Pulikulam

CONCLUSIONS

This study confirmed the presence of bacterial contamination on the ATM screen, door handle, and keypad. The isolated organisms were *Staphylococcus aureus*, *E.coli*, *Klbsiella* and *Pseudomonas* the result of antibiotic test showed, All the isolates showed completely resistant to amphotericin (100mcg) And *Staphylococcus aureus* resistant to all antibiotics.

E.coli was found to be intermediate resistant to Cephataximo (30mcg) and sensitive to ampicillin (10mcg) *Pseudomonas* was sensitive to ampicillin (10mcg) and *Klbsiella* intermediate sensitive to Cephataximo (30mcg). In this study, *moringa oleifera* has been described to have antibacterial activity against some human bacterial pathogen like (*E.coli*, *Pseudomonas*, *Klebsiella*, *Staphylococcus aureus*). There is an evidence supporting the effect of this plant as an antibacterial agent. So it can be tested as hand wash product, and This extract was used to prepare a herbal handwash, This cheap herbal handwash helps to control the bacterial contamination in ATM's

REFERENCES

1. Anwar, F, Rashid, U., *Physico-chemical characteristics of Moringa oleifera seeds and seed oil from a wild provenance of Pakistan. Pakistan Journal of Botany*, 2007. 39: (5): 1443-1453.
2. Adriana, B., A.N.M. Almodóvar¹, C.T. Pereira¹, and T.A. Mariângela., *Antimicrobial efficacy of Curcuma zedoaria extract as assessed by linear regression compared with commercial mouthrinses. Braz. J. Microbiol.* 38:440-445.2006
3. Dillhuydy, J.M., *Patients attraction to complementary and alternative medicine (CAM): a reality which physicians can neither ignore nor deny. Bull. Cancer.* 90:623-628. 2003.

4. Ghosh, P. P., and Sabyasachi Pattnaik. "Multi-Factor authentication in relation to secured payment systems in ATM's."
5. Doughari, J.H., A.M. El-mahmood, and S. Manzara., *Studies on the antibacterial activity of root extracts of Carica papaya L. Afri. J. Microbiol. Res.* 037- 041. 2007.
6. Farooq, F, Rai, M., Tiwari, v.,Khan, A. A., *Medicinal properties of Moringa o Leifera: An overview of promising healer. Journal of Medicinal Plants Research*, 6: (27): 4368-4374.2012.
7. Fahey, J.W., *Moringa oleifera: A review of the medical evidence for its nutritional, therapeutic, and prophylactic properties. Trees for Life Journal.*1:5. 2005.
8. Hone, K.S., Graham, R., Maguire, M.C., Baber, C and Johnson, G.I., *Speech Technology for Automatic Teller Machines: an investigation of user attitude and performance. Ergonomics*, 41 (7): 962-981. 2008.
9. Jerkovic- Mujkic A, Besta R, Memisevic S., *Bacterial contamination of public telephones in the downtown area of Sarajevo. Afr J Microbial Res* 2013;(17);1664-7.
10. Larson EL., *preventing viral upper respiratory infections in households. Public Health Nurs.* 24(1);48-59.2006
11. Levy SB., *The challenge of antibiotic resistance. Sci Am* 1998;278(3):46-53.
12. Mathai E, Allegranzi B, Kilpatrick C, Pittet D., *Prevention and control of health-care associated infections through improved hand hygiene. Indian J. Med. Microbiol.* 28(2):100-106. 2010.
13. Sankhyan, N. I. D. H. I., et al. "Determination and comparison of Vitamin C content from Moringa oleifera by different methods." *International Journal of Agriculture Science and Research* 3.2 (2013): 67-70.
14. Nworie O, Mercy M, Chukwudi A, Oko I, Chukwudum SO, Agah VM., *Antibiogram of bacteria isolated from automated teller machines within abakaliki metropolis. Am J Infect Dis* 2012;8(4):168-74
15. Rasiah, D., *ATM Risk Management and Controls. Eur. d. Econ. Finance Admin. Sci.*, 1: 161-171. 2010.
16. Rojas,J.J., *Screening for antimicrobialactivity of ten medicinal plants used in Colombian folkloric medicine: A possible alternative in the treatment of non-nosocomial infections. BMC Compliment Altern. Med.* 6:2. 2006.
17. Shah NS, Wright A, Bai GH, Barrera L, Boulahbal F, Martín-Casabona., *Worldwide emergence of extensively drug-resistant tuberculosis. Emerg Infect Dis* 2007;13(3):380-7.
18. Siegel JD, Rhinehart E, Jackson M, Chiarello L., *Management of Multi drug Resistant Organisms In Healthcare settings.*135(3),2006.
19. Velayati AA, Masjedi MR, Farnia P, Tabarsi P, Ghanavi J, Ziazarifi AH., *Emergence of new forms of totally drug-resistant tuberculosis bacilli: super extensively drug-resistant tuberculosis or totally drug-resistant strains in Iran. Chest*, 2009;136(2):420-5.
20. Whitehead, K. A., Verrand. J., *The effect of surface topography on the retention of Microorganisms. Food and Bioproducts Processing*, 84 (4): 256-259. 2006
21. PATEL, NIVEDITA, et al. "Phytochemical analysis and antibacterial activity of moringa oleifera." *International Journal of Medicine and Pharmaceutical Sciences* (2014): 27-34.