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BACTERIAL LOAD OF THE SURFACE OF SOME SELECTED AUTOMATED TELLER MACHINES (ATMs) IN KANO METROPOLIS, NIGERIA

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ABSTRACT

An Automated Teller Machine (ATM), also known as Automated Banking Machine (ABM) or cash machine and several other names, is a computerized telecommunication device that provides access to financial transactions in a public space without the need for a cashier or other intermediaries. The Automatic Teller Machine (ATM) has been widely used due to its convenience but also serves as a source of bacterial contamination. The aim of this work was to determine the bacterial load of surfaces of selected ATMs in Kano metropolis. Swab samples were collected from four (4) selected areas and ten (10) different study sites. The samples were collected using swabbing technique and standard plate count was employed for the enumeration of bacterial counts. The mean bacterial counts ranged between the lowest count of 1.20 x 10^2 cfu/cm^2 and the highest count of 1.78 x 10^2 cfu/cm^2 and the mean count of individual machine ranged from 1.70 x 10^1 cfu/cm^2 upto 6.00 x 10^1 cfu/cm^2. All the ATMs were found to be contaminated. It could thus be concluded that the ATMs studied present a very great risk factor for cross contamination. The general public should therefore be enlightened on the possible health hazards associated with such items like ATMs and thus advised for strict personal hygiene and regular washing of hands before and after contact with ATMs so as to reduce the possible transfer of bacterial diseases and/or infections.

Keywords: Automated Teller Machines (ATMs), Bacteria, Contamination, Kano metropolis.

INTRODUCTION

An Automated Teller Machine (ATM), also known as Automated Banking Machine (ABM) or cash machine and by several other names, is a computerized telecommunication device that provides the clients of a financial institution with access to financial transactions in a public space without the need for a cashier or other intermediaries. According to Sharma and Rathore (2012), ATM is an electronic unattended banking outlet, which allows customers to complete basic banking transactions without a direct branch interaction or a branch representative or teller. It is connected to a data system and related equipment and activated by a bank customer to obtain cash withdrawals amongst other services such as cell-phone recharge and inter- account transfer. The ATM comprises a computer with a keypad and screen to perform tasks to access bank accounts through telephone networking, a host processor, and a bank computer to authenticate data. Electronic banking is an offshoot of Information and Communication Technology (ICT), which is a major driver for improved quality of life, economic growth and development in the countries of the world (Anwana, 2010; Okoro *et al.,* 2018). It provides the classic and current means of e-banking. E-banking systems evolved technologies such as Automated Teller Machines (ATMs), Point of Sales Terminals (POS), Electronic Funds Transfer and Tele-banking, among others. Out of all these technologies, the ATMs have the most significant impact on the common man (Folorunsho *et al*., 2010). The wide acceptance of e-banking technology has created new environmental challenges on the use of electronics and technological devices due to its convenience. Thus, provides an avenue for high human dermal contact since customer must be in physical interaction with the machine to carry out transactions, which could be a source of contamination, infection and health hazards to man (Sribenjalux *et al.,* 2011; Sharma and Rathore, 2012; Okoro *et al.,* 2018). In addition, contamination of environmental objects and surfaces is a common phenomenon. Neel (2012) stated that the contamination of objects by potential pathogens of microbial origin is of public health importance as contaminated materials can become possible sources of disease/infection transmission.

The ATM machine is therefore likely to be contaminated with various microorganisms due to their vast contact by multiple users (Onuoha and Fatokun, 2014). This study was therefore carried out to determine the bacterial load of some selected ATMs in Kano metropolis, north-western Nigeria. This was a view to suggesting ways for the prevention and control of diseases and/or infections associated with bacterial contamination of ATMs.

MATERIALS AND METHODS

Sample Collection Sites

The study areas selected were four (4), which comprised of Aminu Kano Teaching Hospital, AKTH (Site A1), Zaria road (Sites B1 and B2), Bello Road (Sites CI, C2 and C3), Murtala Muhammad way (Sites D1, D2, D3 and D4) making ten (10) sample collection sites. The samples were obtained for four consecutive weeks making a total of 40 samples. The samples were collected from the ATM by aseptic swabbing technique. A swab stick was carefully unsealed and pre-moistened with sterile normal saline by dipping the tip of the swab stick into the container of normal saline. The pre-moistened swab stick was rubbed onto the surface of the machine. The cover of the swab stick was immediately replaced and taken to the laboratory for further analysis (Nwankwo and Offiah, 2016). On reaching the laboratory, plates of freshly-prepared nutrient agar (oxoid) were made and streaking method (inoculation) was employed (in close proximity of Bunsen flame with all safety measures) as described by Cheesbrough (2005). The culture plates were done in duplicates and incubated at 37^0C for 24 hours, after which distinct colonies formed were noted, counted, recorded and expressed as colony forming unit per centimeter square (cfu/cm^2).

RESULTS

From this study, all the ATMs were found to be contaminated with the overall mean bacterial count of 1.53 x 10^3 cfu/cm^2 as shown in Table 1. The mean count of individual machine ranges from 1.70 x 10^1 cfu/cm^2 upto 6.00 x 10^1cfu/cm^2. The mean total of study site AI (Aminu Kano Teaching Hospital was 1.78 x $10^{2,}$ for BI (Zaria Road 1) was 1.50 x 10^2, B2 (Zaria Road 2) was 1.72 x 10^2, C1 (Bello Road 1) was 1.37 x 10^2, C2 (Bello Road 2) was 1.49 x 10^2, C3 (Bello Road 3) was 1.42 x 10^2 , D1 (Murtala Muhammad way 1) was 1.56 x 10^2, D2 (Murtala Muhammad Way 2) was 1.64 x 10^2, D3 (Murtala Muhammad Way 3) was 1.20 x 10^2, D4 (Murtala Muhammad Way 4) was 1.60 x 10^2.

Table 1: Mean bacterial load of the 10 different areas of Kano metropolis

Sample Collection Sites	Bacterial Counts (cfu/cm^2) Sample 1	Sample 2	Sample 3	Sample 4	Mean Total
AI	3.90 x 10^1 ±0.28	3.60 x 10^1±0.70	4.30 x 10^1 ±0.42	6.00 x 10^1 ±0.28	1.78 x 10^2 ±0.42
B1	3.60 x 10^1± 0.14	4.70 x 10^1 ± 0.56	4.20 x 10^1 ±0.14	2.80 x 10^1 ±0.28	1.50 x 10^2 ±0.28
B2	4.30 x 10^1 ± 0.28	5.00 x 10^1 ± 0.70	3.80 x 10^1 ±0.42	4.10 x 10^1 ±0.14	1.72 x 10^2 ± 0.28
C1	3.30 x 10^1 ± 0.28	5.80 x 10^1 ± 0.14	2.90 x 10^1 ±0.56	1.70 x 10^1 ±0.00	1.37 x 10^2 ±0.56
C2	3.70 x 10^1 ± 0.71	4.90 x 10^1 ± 0.28	4.10 x 10^1 ±0.00	2.20 x 10^1 ±0.56	1.49 x 10^2 ±0.56
C3	4.40 x 10^1 ± 0.14	3.90 x 10^1 ± 0.14	3.00 x 10^1 ±0.42	2.90 x 10^1 ±0.56	1.42 x 10^2 ± 0.16
D1	2.90 x 10^1 ± 0.14	4.70 x 10^1 ± 0.90	4.90 x 10^1 ±0.14	3.10 x 10^1 ±0.28	1.56 x 10^2 ±0.45
D2	5.00 x 10^1 ±0.56	2.80 x 10^1 ± 0.84	5.30 x 10^1 ±0.42	3.30 x 10^1 ±0.42	1.64 x 10^2 ±0,34
D3	3.80 x 10^1 ±0.00	1.80 x 10^1 ±0.84	3.50 x 10^1 ±0.14	2.90 x 10^1 ±0.28	1.20 x 10^2 ±0.00
D4	4.30 x 10^1 ± 0.14	3.60 x 10^1 ± 0.42	4.70 x 10^1 ±0.28	3.40 x 10^1 ±0.12	1.60 x 10^2 ±0.71
Mean Total	3.92 x 10^2 0.28	4.08 x 10^2 ± 0.56	4.07 x 10^2 ±0.56	3.24 x 10^2 ±0.24	1.53 x 10^3 ±0.84

Key:
AI (Aminu Kano Teaching Hospital), BI (Zaria Road 1), B2 (Zaria Road 2), C1 (Bello Road 1), C2 (Bello Road 2), C3 (Bello Road 3), D1 (Murtala Muhammad way 1), D2 (Murtala Muhammad Way 2), D3 (Murtala Muhammad Way 3), D4 (Murtala Muhammad Way 4).

The percentage bacterial count of 10 different areas of Kano metropolis was obtained using the mean total of each study site as presented in figure 1.

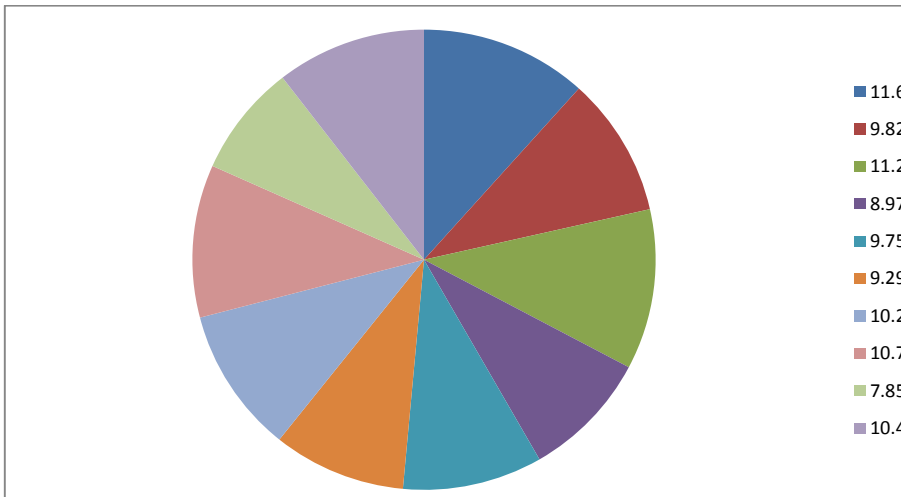

Figure 1: Percentage bacterial count of 10 different areas of Kano metropolis

DISCUSSION

The presence of bacteria on inanimate objects has been reported by earlier investigators (Famurewa and David, 2009; Gholamreza *et al.,* 2009; Sribenjalux, 2011; Nwankwo and Offiah, 2016; Okoro *et al.,* 2018; Uko *et al.,* 2017). The study site (Site A1) in this study with the highest contaminated ATM was found inside Aminu Kano Teaching Hospital (AKTH), with a bacterial count of 1.78 x10^2 cfu/cm^2. On the other hand, the ATM with the least bacterial count was found at Murtala Muhammad Way (Site D3), which had 1.20 x 10^2 cfu/cm^2. The high bacterial count obtained in Site A1 could be due to the health personnel using the machine in such area while wearing their laboratory coats and/or carrying materials such as papers, pens, etc from inside the hospital environments (laboratory, wards, etc) while patients and visitors equally were in continuous use of the machine in the hospital premises. Thus, germs (including bacteria) could be transferred to both the ATMs and the hands of the users. Other sources of the ATMs contamination could be from droplets during coughing, sneezing and touching with previously contaminated hands or placement on surfaces by the customers (Sharma and Sumbali, 2014; Saeed and Rasheed, 2011).

In the case of Site D3 with the lowest bacterial count, the machine was inside a bank branch and they were of multiple numbers, as such, the users have options to use amongst the machines available. This, among other reasons, could be why the least bacterial contamination observed in this study. This is in agreement with Nwankwo and Offiah (2016) who reported that ATMs with more customers than the others showed both a wider spectrum of bacterial types and higher degree of contamination. In addition, since the Site D3 was in the City Centre, the machine was generally used by enlightened people that take some precautions while using public devices by punching the machine with car keys, pens and any other objects, which might have not been allowed direct contact with hands.

CONCLUSION AND RECOMMENDATION

Bacteria could be suspended in the air or airborne particles and eventually settle onto a fomite such as ATM. From the results of this study, the mean bacterial counts ranged between the lowest count of 1.20 x 10^2cfu/cm^2 and the highest count of 1.78 x 10^2cfu/cm^2 and the mean count of individual machine ranges from 1.70 x 10^1 cfu/cm^2 upto 6.00 x 10^1cfu/cm^2. It was noted that the ATMs are contaminated with bacteria that are of medical importance and could be easily transferred from one person to another via contact with the machine, from droplets during coughing, sneezing and touching with previously contaminated hands. Thus, it could be concluded that contact with ATMs in the study sits may result in bacterial cross contamination with associated possible health risks. Therefore, it is recommended that the general public be enlightened on the possible health hazard associated with poor personal hygiene and hence should ensure regular and proper washing (disinfection/sanitization) of hands before and after contact with ATMs.

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