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Bacteriological Evaluation of Keypad of Selected Atm Machines in Ilesha, Osun State

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Abstract: *ATM once contaminated becomes vehicles for the transmission of infection, such that the user may succeed in picking these pathogens after making use of the Automated Teller Machine, since there is no restriction as to who has access to the facility, and no guidelines to ensure hygienic usage. The current study focuses on assessment of bacterial contamination of ATM Keypads in Ilesha, Osun State. Sterile swab sticks were used to collect samples from three different ATM machines in Ilesha, Osun State namely: Bank A ATM located at Guaranty Trust Bank stand; Bank B ATM located at First Bank stand and Bank C ATM located at FCMB stand. Isolation, bacterial counts, biochemical characterization and sugar fermentation were carried out by standard methods. The culture media used were nutrient agar, MacConkey agar and Eosine Methylene Blue Agar (EMB). The total number of 61 bacteria isolates was obtained from three ATM machines. The highest bacteria isolates of 23 (37.70%) was found in first bank B ATM machine, follow by 20(32.79%) number of bacterial isolates recorded in GTB A ATM machine while the least number of bacterial isolates 18(29.51%) was recorded in FCMB ATM machine. Total number of seven bacterial isolates was discovered in three ATM machines examined and they are Psuedomonas sp., Enterobacter sp, Klebsiella sp, Staphylococcus sp, Streptococcus sp, Enterococcus sp, and Escherichia sp. The highest occurrence was found in Staphylococcus sp [18 (29.51%)], this was followed by 10(16.39%) recorded in Pseudomonas sp, 7(11.47%) were found in Enterobacter sp, Enterococcus sp., and Escherichia sp. The least occurrence of 6(9.84%) was observed in Klebsiella sp and Streptococcus sp respectively. The findings from this study revealed that the ATMs used in dishing out cash in selected banks in Ilesha, Osun State were grossly contaminated with different potentially virulent bacteria genera. Thus, it could be concluded that contact with ATMs in the study may result in bacterial cross contamination with associated possible health risks.*

Keywords: Bacteriological, ATM, Bacterial counts, Biochemical characterization, Sugar fermentation

1. INTRODUCTION

Inanimate items (fomites) have been proven to have a role in the transmission of human infections, either directly or indirectly, through contamination of fingers and subsequent hand-to-mouth contact (Uko *et al*., 2017). Eyes, noses, and cut or abraded skin are some of the other sources of exposure (Birteksoz Tan and Erdogdu, 2017). Many common places are shared with other individuals as part of life in society. This allows for the spread of a variety of bacteria that might cause diseases (Birteksoz Tan and Erdogdu, 2017). Restaurants, public transportation systems, parks, schools, daycare centers, health care institutions, and other community locations can bring a large number of people together and allow germs to spread.

Electronic banking (e-banking) has transformed the banking sector and continues to have a significant impact on banking relationships; e-banking is increasingly becoming more of a "must have" than a "joy to have" service. Automated Teller Machines (ATMs), Point of Sale Terminals (POS), Electronic Funds Transfer, and Telebanking are all examples of e-banking systems. The Automated Teller Machines, sometimes known as ATMs, have the most impact on the average person of all of these technologies (Adedoyin, 2019).

Commercial banks are important public institutions that are visited by a large number of people on a daily basis for financial services, and those banks provide or have developed various electronics-based modern banking systems technologies such as mobile banking, internet banking, and ATMs in order to embrace and attract more customers, and those devises, particularly ATMs, are frequently used by or shared between customers. Because of the extensive cutaneous contact by different users, the ATM machine is likely to

be contaminated with various bacteria, making these interfaces possible vehicles for the transmission of clinically significant diseases. (2019, Stanley & Kayode)

Automated Teller Machines (ATMs) are one of the most important services provided by the banking industry around the world. These services are given in specific places, either within the bank branch's territory or outside the bank branch's region (Barbosa *et al*., 2020). The transition from traditional monetary instruments such as paper and metal-based currency to "plastic money" in the form of credit and debit cards has accelerated the use of ATMs around the world as one of the fastest methods of cash dispensing.

Other names for ATMs include ATM machine, automated banking machine, cash dispenser, and regional versions derived from trademarks on ATM systems owned by specific banks. A typical ATM transaction is inserting a card into a receiving hole and following on-screen instructions by punching secret codes and orders into the metallic keypads, therefore instructing the machine as to the type of service required (Okoro *et al*., 2018). When there is no cash to 'give out,' the ATM is perceived as underperforming, so considerable resources have been expended to maintain and ensure that it has and dispenses cash as quickly as possible; hygienic, aesthetic, and environmental safety conditions have been left to the mercy of employed general cleaners (Okoro *et al*., 2018).

Most of these cleaners may lack the necessary training to distinguish between generalized and specialist cleaning; they may clean toilets with rags and clean ATMs with tables and chairs. Over time, these cleaning regimens may discolor the machine, dispose of bacteria, and distribute germs that could be transported between and inside banking facilities via ATMs (Okoro *et al*., 2018). Most ATMs are filthy, covered in dust and grime, especially after a heavy rain, and users in cities like Lagos, Port Harcourt, Kano, and Abuja may have to cover their noses to use the machines.

The Automated Teller Machine (ATM) is a self-service cash dispenser that also performs some human teller duties such as balance inquiries, bill payments, and mini statements. Debit/credit cards are used to conduct ATM transactions, allowing cardholders to access and conduct financial operations without the assistance of a teller (Adedoyin, 2019). The ATM is made up of a computer with a keypad and screen that performs operations including accessing bank accounts via the phone, a host processor, and a bank computer that authenticates data. This means that a consumer must interact physically with the machine in order to complete transactions (Adedoyin, 2019).

ATM requirements have grown in tandem with their increasing functions in financial transactions. They are utilized for more than only cash supply; they also provide services for various monetary transactions such as money transfers, stock market transactions, and bill payments. ATMs have offered a route for high human skin contact with microorganisms, which can be a source of infection and a health threat (Simon-oke, 2019). In Nigeria, ATMs are mostly found in metropolitan centers, commercial districts, and around hospitals. Hundreds of people, each with a distinct socioeconomic background and hygiene state, use ATMs on a daily basis (Simon-oke, 2019). In terms of contamination, ATM keypads on and near campuses rated alongside those in hospitals, indicating that ATM users on campus are unfamiliar with basic cleanliness measures (Simon-oke, 2019).

Microorganisms are found all over the environment and can survive or even flourish on any surface. Although the most of them are innocuous, some can be harmful, especially to persons who have a compromised immune system. Due to their widespread use and skin contact by many individuals throughout the day, especially in an overcrowded environment, ATMs are prone to be contaminated with a variety of pathogenic and non-pathogenic bacteria (Osarenmwinda and Blessing, 2020). Because there are no restrictions on who has access to the facility and no recommendations to maintain hygienic usage, once infected, ATMs become vehicles for the transfer of infection, such that the user may succeed in picking these germs after using the Automated Teller Machine (Opasola et al., 2017)

Furthermore, there are no restrictions on who gets access to the facility, and no procedures to ensure that it is used in a sanitary manner. However, microbial colonization of these steel keypads is inevitable, as it is with all surfaces, especially when most of these institutions lack a suitable cleaning schedule. Several researchers have looked into such colonization and the production of biofilms as a result (Simon-Oke, 2019). Many parameters, including the source and destination surface features, bacterial species involved, moisture levels, pressure and friction between the contact surfaces, and inoculum size on surfaces, have been demonstrated to influence bacteria transfers between surfaces.

The ATM is likely to be contaminated with a variety of bacteria as a result of extensive cutaneous contact by various users. There are no restrictions on who has access to the facility, and there are no procedures to guarantee that it is used in a sanitary manner. In addition, few or no empirical investigations on bacteriological examination of ATM keypads have been conducted in Ilesha Osun State. As a result, it is critical to analyze the level of bacterial contamination on ATM surfaces used by various persons in everyday situations in Ilesha, Osun State, in order to identify possible sources of high contamination rates.

2. METHODOLOGY

2.1. Sample Collection

Samples were collected using sterile swab sticks at three separate ATM locations in Ilesha, Osun State: Bank A ATM at Guaranty Trust Bank stand; Bank B ATM at First Bank stand; and Bank C ATM at FCMB stand. To avoid drying of the samples for microbiological analysis, single sterile swab sticks moistened with sterile distilled water were rubbed on the touch screen and buttons

inside the ATM room, then returned to their casings, labeled appropriately, and transported to the Microbiology laboratory within an hour. All of the samples were processed in the lab using established microbiological procedures under extremely tight aseptic circumstances. Nutrient agar (NA; Merck, Darmstadt, Germany) plates and double strength nutrient broth (9ml) in screw cap test tubes were also made according to manufacturer's requirements. The ATMs were sampled twice a day, every day. On each visit, the keypads were swabbed twice with a sterile cotton swab between the hours of 08:00 and 09:00 and 14:00 and 15:00 local time. The swabs were immediately dipped into nutrient broth-labeled tubes and transferred to the lab in an ice chest.

2.2 Isolation of Microorganisms

The sample-carrying swab stick was put into nutrient broth and stirred for 5 minutes before inoculations were collected and cultivated using the streak and spread plate techniques (Okoro *et al*., 2002). Each sample utilized in nutritional broth had inoculums removed aseptically in duplicates. Using a flamed wire loop, one inoculum was deposited on the surface of a firm, sterile nutritional agar plate and streaked completely. The second and third inoculums were applied on MacConkey agar and Eosine Methylene Blue Agar (EMB) surfaces, respectively. The inoculation plates were kept at 37°C for 24 to 48 hours after being injected. The plates were checked for growth on a daily basis. Following the establishment of growth, each culture plate was checked for different colonies, from which sub-cultures were prepared on fresh solid agar media and incubated as previously reported. When fresh growth appeared, they were inspected for consistency as a sign of purity. The pure cultures that resulted were used for characterisation and identification.

2.3 Characterization and Identification of Bacterial Isolates

Using morphological (colonial morphology, gram staining, and endospore staining) and biochemical properties, bacteria isolates were characterized as described by Mehmet *et al*. (2013). The isolates were identified by comparing their features to those of known taxa in manuals. In this example, Bergy's Manual of Determinative Bacteriology was employed as a guide. Isolates were thus identified and named in accordance with the manual's guidelines.

2.3.1. Cultural Characteristics

The total number of colonies on an agar plate was documented, as well as their cultural characteristics. Microbial counts were represented as colony forming units per milliliter (cfu/ml) of water samples after the total colony counts were multiplied by the dilution factor. Color, shape, edge, elevation, surface, and opacity of each bacterial isolate on the plate were observed and classified (Olutiola *et al*., 2007).

2.3.2. Biochemical characterization

2.3.2.1 Gram Staining

A smear of the test isolate was emulsified in a drop of sterile distilled water on a clean glass slide, forming a smooth suspension, air dried, heat fixed by passing the inoculated glass slide through the Bunsen burner flame for about 2-3 times, stained with the primary stain, crystal violet for 60 seconds, and then rinsed off in slow running tap water. It was then decolorized for around 5 seconds with 70% ethanol before being rinsed thoroughly with water to avoid decolorization. Finally, the smear was counter stained with safranin for 60 seconds, rinsed with water, and allowed to air dry before a drop of immersion oil was applied to the smear and viewed under a microscope with oil immersion lenses. Cells of isolates that held the purple color of the primary stain, crystal violet, were labeled as gram-positive bacteria, whereas those that were unable to retain the color of the primary stain but stained with the pink color of the counter stain were labeled as gram-negative bacteria (Fawole and Oso, 2001).

2.3.2.2 Catalase Test

Using a sterile loop, a smear was formed from the pure culture (18-24 hours old pure culture) on clean glass slides. A small portion of the bacterial colony was put to a dry, clean glass slide, along with a drop of 3 percent H_2O_2. A positive result is shown by rapid oxygen evolution within 5-10 seconds, whereas a negative result is indicated by no bubble at all (Olutiola *et al*., 2007).

2.3.2.3 Coagulase Test

On a clean glass slide, a drop of physiological saline was inserted. A sterile loop was used to aseptically attach a colony from a pure culture to a glass slide and emulsified in a drop of physiological saline to generate a thick suspension. A drop of rabbit or human plasma was gently incorporated into the suspension. There is no clumping when coagulase is positive (Olutiola *et al*., 2000).

2.3.2.4 Citrate Test

Citrate permeate, which is produced by citrate-using organisms, aids in the transport of citrate into the cell, allowing the organism to use it as its only carbon source. After 48 hours of incubation, the isolates were implanted into the test tubes' slope; a positive result was indicated by a color change from green to vivid blue (Okoro *et al*., 2017).

2.3.2.5 Indole Test

The test organism was injected aseptically into the tryptophan broth and cultured for 48 hours at 37°C. The 0.5ml of Kovac's reagent was applied to the test tubes holding the culture after incubation. On adding 0.5ml of Kovac's reagent to the indole test, a pink color indicated a positive reaction, whereas no color change indicated a negative reaction (Olutiola *et al*., 2000).

2.3.2.6 Oxidase

A colony from pure culture was smeared on a portion of the oxidase strip (Oxoid® UK) using an inoculating loop. After 10 seconds, a dark purple coloration indicates a positive result (Aryal, 2018).

2.4 Sugar fermentation

The sugar fermentation test was designed to examine if organisms could ferment sugars (Glucose, Sucrose, and Maltose) and produce acid and gas. Sugar indicator broth was made with peptone water medium containing 1% fermentable sugar and 0.01 percent phenol red. The Durham tube, which would trap the gas if it was formed, was gently reversed after each test tube received roughly ten milliliters of sugar broth. The test tubes were autoclaved and infected with a loopful of 24-hour-old test organism culture, then grown at 37°C for 2-7 days with acid and gas production monitored daily. The presence of yellow coloring indicates the formation of acid, whilst the displacement of the medium in the Durham tube indicates the production of gas (Fawole and Oso, 2004).

3. RESULT AND DISCUSSION

3.1 RESULT

3.1.1 Microbial counts of bacterial isolated

Table 1 reveals the bacterial counts of bacterial isolated from ATM keypads in Ilesha, Osun State. The nutrient agar plates had bacteria counts ranging from 1.6×10^1 to 2.4×10^2 , with highest bacterial counts of 2.4×10^2 obtained from first bank B ATM machine in the afternoon sample; this was followed by 2.1×10^2 recorded in GTB A ATM machine (Table 1). The least bacteria count of 1.6×10^1 was found in sample from FCMB ATM machine inoculated in Nutrient agar. The bacteria count obtained on MacConkey agar ranged between 2.3×10^1 and 2.3×10^2 for samples taken from the three ATM machines in the morning and afternoon. GTB A, First bank B and FMCB ATM machines had 2.8×10^1, 2.5×10^1 and 2.3×10^1 bacteria counts from the samples collected in the morning while 2.3×10^2, 2.2×10^2 and 4.7×10^1 were recorded for afternoon samples (Table 1). No growth was observed in Eosin Methylene Blue for samples collected in the morning but 2.3×10^2, 2.2×10^2 and 4.7×10^1 were recorded for samples collected in the afternoon from the three ATM machines inoculated to Eosin Methylene blue agar (Table 1).

Table 1: Bacterial counts of bacterial isolated from ATM keypads in Ilesha, Osun State

S/N	Period	(CFU/ml)	Nutrient Agar (CFU/ml)	Mac Conkey plate(CFU/ml)	Eosin Methylene blue plate(CFU/ml)
1	Morning	GTB A	3.4×10^1	2.8×10^1	-
		FBN B	1.9×10^1	2.5×10^1	-
		FCMB	1.6×10^1	2.3×10^1	-
2	Afternoon	GTB A	2.1×10^2	2.3×10^2	2.0×10^1
		FBN B	2.4×10^2	2.2×10^2	1.9×10^1
		FCMB	2.0×10^2	4.7×10^1	2.1×10^1

Bank A ATM located at GTB A = 1st Guaranty Trust Bank stand ATM machine; FBN B = First Bank stand ATM machine; FCMB = First City Monumental Bank ATM machine

3.1.2 Gram Reaction of Bacterial isolates

Bacterial isolates in group M, N, O, and S are rod-shaped and gram negative except for P, Q and R that are Gram positive cocci (Table 2). The arrangement of isolates in P, Q and R are not single but in group, all others (M, N, O and S) are single in arrangements (Table 2).

Table 2: Gram Reaction of Bacterial isolated from bacterial isolated from ATM keypads in Ilesha, Osun State

Isolates code	Postive/Negative	Shape	Arrangement
M	Negative	Rod	Single
N	Negative	Rod	Single
O	Negative	Rod	Single
P	Postive	Cocci	Group
Q	Postive	Cocci	Group
R	Postive	Cocci	Group
S	Negative	Rod	Single

3.1.3 Biochemical characteristics and Sugar fermentation

Catalase, coagulase, indole, citrate, glucose, sucrose are negative while oxidase and Maltose are positive for group M isolates. This is an indication that the isolates under this group are *Pseudomonas sp.* as determine through identification by Bergy's manual (Table 3).

Oxidase, Indole are negative for isolates in group N while Catalase, Coagulase, Citrate, glucose, sucrose and maltose are positive (Table 3). The results recorded for biochemical and sugar tests shows similarity to *Enterobacter sp*. as we have it in Bergy's manual for bacterial identification.

Group O isolates are oxidase, coagulase, Indole and citrate negative while catalase, glucose, sucrose and maltose are positive. The above stated biochemical and sugar fermentation shows that the isolates are related to properties of *Klebsiella sp.* when compared with Bergy's manual for bacterial identification (Table 3).

Group P isolates had negative Oxidase,Coagulase, Indole, Citrate, Glucose, Sucrose but catalase and maltose are positive. The above biochemical and sugar properties confirmed isolates as *Staphylococcus sp*. in reference to Bergy's manual (Table 3)

Isolates in group Q had positive catalase while Indole, citrate, oxidase, sucrose, maltose, coagulase and glucose are negative. This attributes obtained in this isolates is in similarity with Micrococcus as depicted in Bergy's manual for identifying bacteria. This implies that the isolates in group Q are *Streptococcus sp.* (Table 3)

Group R isolates had negative catalase, indole oxidase and maltose while coagulase, citrate, glucose are sucrose are positive. The above biochemical and sugar properties confirmed isolates as *Staphylococcus sp*. in reference to Bergy's manual (Table 3)

Isolate in Group S had positive catalase, indole, maltose and glucose while Oxidase, coagulase, citrate and sucrose are negative (Table 3). The result observed is similar to biochemical and sugar test of *Escherichia coli* in Bergy's manual.

Table 3: Biochemical characteristics and Sugar fermentation of bacterial isolated from ATM keypads in Ilesha, Osun State

Isolate code	Catalase	Indole	Oxidase	Citrate	Coagulase	Glucose	Sucrose	Maltose	Probable Identity
M	-	-	+	-	-	-	-	+	*Pseudomonas sp*
N	+	-	-	+	+	+	+	+	*Enterobacter sp*
O	+	-	-	-	-	+	+	+	*Klebsiella sp*
P	+	-	-	-	-	-	-	+	*Staphylococcus sp*
Q	+	-	-	-	-	-	-	-	*Streptococcus sp*
R	-	-	-	+	+	+	+	-	*Enterococcus sp*
S	+	+	-	-	-	+	-	+	*Escherchia sp.*

Key: (-) = Negative, (+) = Positive

3.1.4 Bacteria Distribution in the Various ATM Machines examined at in Ilesha, Osun State

The total number of 61 bacteria isolates was obtained from three ATM machines in Osun State. The three ATM machines examined are GTB A, First bank B and FCMB ATM machine. The highest bacteria isolates of 23 (37.70%) was found in GTB B ATM machine, follow by 20(32.79%) number of bacterial isolates recorded in GTB A ATM machine while the least number of bacterial isolates 18(29.51%) was recorded in FCMB ATM machine (Table 4). Total number of seven bacterial Isolates was discovered in three ATM machines examined and they are *Psuedomonas sp., Enterobacter sp, Klebsiella sp, Staphylococcus sp., Streptococcus sp, Enterococcus sp.,* and *Escherichia sp* (Figure 1). The highest occurrence was found in *Staphylococcus sp* [18 (29.51%)], this was followed by 10(16.39%) recorded in *Psuedomonas sp*, 7(11.47%) were found in *Enterobacter sp, Enterococcus sp.*, and *Escherichia sp*. The least occurrence of 6(9.84%) was observed in *Klebsiella sp* and *Streptococcus sp* respectively (Table 4).

Table 4: Bacterial Distribution in the Various ATM Machines Examined in Ilesha, Osun State.

S/N	Bacterial Isolates	GTB A ATM Machine	GTB B ATM Machine	FCMB ATM Machine	Number (%) Occurrence
1	*Psuedomonas sp.*	2	5	3	10(16.39)
2	*Enterobacter sp.*	4	2	1	7(11.47)
3	*Klebsiella sp.*	3	1	2	6(9.84)
4	*Staphylococcus sp.*	5	7	6	18 (29.51)
5	*Streptococcus sp.*	1	2	3	6(9.84)
6	*Enterococcus sp.*	2	4	1	7(11.47)
7	*Esherichia coli*	3	2	2	7(11.47)
	TOTAL	20(32.79%)	23(37.70%)	18(29.50%)	61(100)

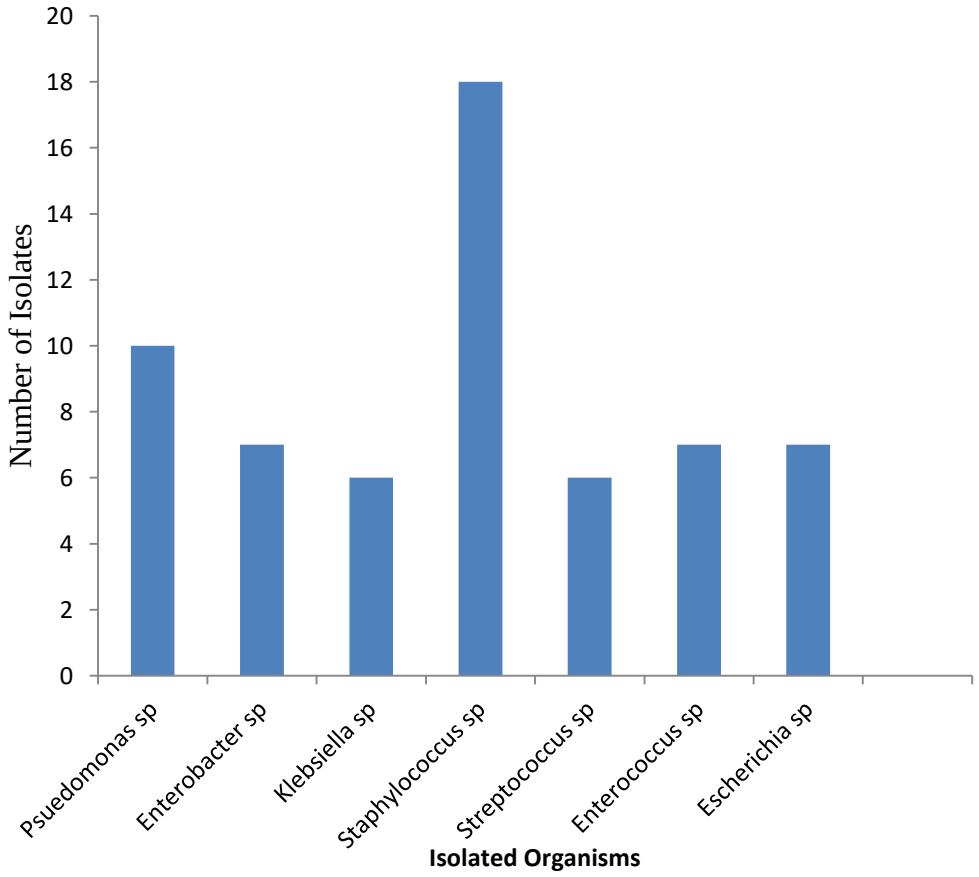

Figure 1: Bacterial Contamination of ATM machines in Ilesha, Osun State

3.2 Discussion

The outcomes of this study revealed that ATM keyboards, like other contaminated surfaces in public spaces such as telephones and door handles, can be a source of bacterial infections. Because these machines are used by so many people with varying degrees of hygiene and health standards, they can be widely implicated in absorbing, housing, and transmitting pathogenic microbes. Contaminated hands touching an ATM keypad can spread viruses to the keyboard and money, allowing infectious diseases to spread (Chairman et al., 2011). *Pseudomonas sp, Enterobacter sp, Klebsiella sp, Staphylococcus sp, Streptococcus sp, Enterococcus sp*, and *Escherichia sp* were among the pathogenic bacteria isolated during the study period. Similarly, Ya'aba *et al*. (2020) identified *E. coli, Salmonella sp., Bacillus sp., Pseudomonas sp., Staphylococcus aureus, Klebsiella sp*., and *Enterobacter sp*. from ATM keypads in Lafia Metropolis, Nasarawa State, Nigeria.

The presence of *E. coli*, *Salmonella*, and *Staphylococcus sp*. in this study is similar to that found by Malik et al. (2014), who discovered pathogenic bacteria (E. coli, Salmonella, Shigella, and Staphylococcus spp.) on all samples (external surfaces of computer keyboards and computer mice), with E. coli dominating the isolates. Another study, identical to this one, found that harmful germs were present on ATM surfaces (Oluduro *et al*., 2012). ATMs in Ebonyi state, Nigeria, tested positive for S. aureus, coagulase-negative Staphylococcus, Streptococcus spp., *Pseudomonas spp*., *Enterobacter spp*., and E.coli, similar to the current study (Onuoha and Fatokun, 2012). The findings of the current investigation are consistent with those of Abban *et al*. (2011) and Okoro Nworie *et al*. (2012), who found *Staphylococcus spp., E. coli, and Klebsiella sp*. on ATM keyboards. All studies on ATMs show that they may play a role in the spread of infectious diseases.

S. aureus was isolated from the majority of ATM keypads in this investigation, which is not surprising given that it is a well-known habitant microflora of the skin (Hardy et al., 2006) S. aureus is carried by between 20 and 40% of healthy people at any given time. Because S. aureus is the most common human staphylococcus pathogen, causing boils, abscesses, wound infections, and pneumonia, as well as the rising frequency of Methicillin Resistant Staphylococcus aureus (MRSA), the presence of this organism in most equipment should not be taken lightly. Despite the fact that it is a common skin habitant, it is frequently responsible for endocarditis and illnesses in people with limited resistance (Willey et al., 2008).

4. Conclusion

According to the findings of this investigation, the ATMs used to disburse cash in Ilesha, Osun State, were heavily contaminated with a variety of potentially dangerous bacteria types. As a result, these devices could be used to spread medically critical infections through human hands. As some reports have showed, public education is crucial when it comes to handling ready-to-eat meals after utilizing these public cash dispensing machines, as some reports have revealed gaps in the general public's knowledge of hygienic food handling techniques. It was discovered that ATMs are contaminated with bacteria that are harmful to humans and may easily be passed from one person to the next by contact with the machine, droplets from coughing and sneezing, and touching with previously contaminated hands. As a result, it's probable that interaction with ATMs in the study resulted in bacterial cross contamination, posing health hazards.

The amount of microbiological contamination can be reduced by disinfecting ATM machines and sanitizing them on a regular basis. Appropriate hygiene workouts can prevent infection from spreading. Cleaning strategies should be devised utilizing effective sanitizers to reduce the number and variety of these germs on automated teller machines, while it is obviously difficult to completely eliminate all bacteria from ATM surfaces. To limit the likelihood of spreading contagious agents, all users and operators of such machines should closely adhere to hand hygiene, cleaning, sanitizing dirty ambient surfaces, and ATM devices. It is also recommended that the general population be educated about the potential health risks connected with poor personal hygiene, and that they wash their hands regularly (disinfection/sanitization) before and after using ATMs.

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