

Full Length Research Paper

# Microbial contamination of currency counting machines and counting room environment in selected commercial banks

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A study was carried out to isolate and identify microorganisms associated with currency counting machines and counting room environment in four commercial banks operating in Anyigba, Kogi State, Nigeria. Samples were collected from currency counting machines and counting room environment in four commercial banks operating in Anyigba, Kogi State, Nigeria. The samples were processed by using standard methods and the results revealed that sixteen (48.5%), of the thirty-three samples analyzed were contaminated by bacteria and fungi. About 70% of all the currency counting machines from the four banks were contaminated with bacteria and 25% with fungi and most of the organisms were isolated from the currency counting machines while currency counting rooms had a fewer isolates or none in some cases. Six different bacterial species were isolated: *Salmonella typhi*, *Staphylococcus* sp., *Escherichia coli*, *Streptococcus* sp., *Streptococcus pyogenes*, *Enterococcus* sp., *Proteus* sp. and four genera of fungi were isolated: *Aspergillus* sp., *Mucor* sp., *Rhizopus* sp. and *Penicillium* sp. The identified microorganisms have pathogenic potential and hence their presence on such surfaces could serve as a source of cross-transmission of bacterial and fungal infections in the banks and the general community.

**Key words:** Microorganisms, currency, counting machines, banks, potential pathogens.

## INTRODUCTION

Contamination of different objects by potential pathogenic microorganisms is of public health importance as contaminated materials can be possible sources of transmission of such pathogens. Items that are passed from hand to hand are of considerable likelihood to be contaminated with disease-causing microorganisms especially if handled with unclean hands or kept in dirty or contaminated surroundings. Paper money especially in

the Nigerian environment presents a particular risk to public health since communicable diseases can be spread through contact with fomites (Hosen et al., 2002; Xu et al., 2005; Basavuvapappa and Suresh, 2005; Ogbu and Uneke, 2007; Lalonde, 2007; Umeh et al., 2007). Microbial contamination of naira notes could also be from several sources, it could be from the counting machine, atmosphere, during storage, usage, handling or production (Awodi et al., 2000). Daily transactions have made the naira to pass through many hands and pathogens become imposed on them before they are finally deposited in banks (Umeh et al., 2007). Ogo et al. (2004) also reported that the source of contamination could be as a result of poor or negative money handling

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practices like spraying during ceremonies where such notes may be trampled upon when they fall on the ground.

The possibility that currency notes might act as environmental vehicles for the transmission of potential pathogenic microorganisms was suggested in 1970s (Abrams and Waterman, 1972). Paper currency is widely exchanged for goods and services in countries worldwide. It is used for every type of commerce, from buying milk at a local store to trafficking in sex and drugs and paper currency provides a large surface area as a breeding ground for pathogens (Podhajny, 2004).

Parasites that have been observed to be contaminants of the naira notes are mainly of faecal origin (Awodi et al., 2000). When hands used in cleaning up the anus after passing out faeces are not properly washed and are used to touch the naira note in anyway, the tendency is contamination with the trophozoite of the developed parasite, eggs, cysts or even the oocyst. Other attitudes such as the wetting of hands or fingers with saliva or use of contaminated water to lubricate the hand in counting paper money could lead to possible transfer of parasites and bacteria from such medium to the notes and finally gets to the bank (Ameh and Balogun, 1997). The occurrence of the heavy load of microorganisms on currency notes can constitute a potential health hazard to users. It has been suggested that humans keep strict adherence to hygienic practices before handling food and water after contact with currency notes and counting machines (Prasai et al., 2008). Microbes are ubiquitous, hence their ability to contaminate objects such as currency counting machines and also naira notes. Ordinarily, the exposure of naira notes to the atmosphere could even bring about contamination depending on the environment in question (Ameh and Balogun, 1997; Umeh et al., 2007). Money on which pathogenic microorganisms might survive represents an often overlooked reservoir for enteric disease (Michael, 2002). In most parts of the developed world, there is a popular belief that the simultaneous handling of food and money contributes to the incidence of food-related public health incidents (Food Science Australia, 2000).

### Rationale and aim of the study

The Nigerian currency became an issue of concern particularly in recent times when the Central Bank of Nigeria (CBN) embarked on a nationwide enlightenment campaign aimed at educating the public on the proper ways of handling the naira notes. Since the isolation of bacterial and fungal species from naira notes in Zaria (Ameh and Balogun, 1997) and the effect of parasitic and bacterial species on man, it has become necessary for thorough investigations to be carried out to determine the safety of the naira notes and their counting machines.

This study assessed microbial contamination of currency counting machines and room environment in

selected commercial banks in Anyigba Metropolis of Kogi State and the possible health risks it may pose to banks and the general community.

## MATERIALS AND METHODS

### Study area and sample collection

The study area comprised the currency counting machines and the currency counting rooms of 4 banks in Anyigba metropolis, Kogi State, Nigeria. Samples were collected from counting machines per bank using sterile swab sticks. The swab stick was removed aseptically, soaked in the sterile water and the rollers and teeth of the currency counting machines per bank were swabbed using the sterile swab sticks. The swabs were placed back in the casing before being placed in sterile polyethene bags, sealed and immediately transported to the laboratory for analysis. Media plates containing nutrient agar, MacConkey agar and potato dextrose agar were also exposed in the counting rooms for 15 min and taken to the laboratory of the Department of Microbiology, Kogi State University for analyses.

### Inoculation of samples

All samples collected from the banks were immediately taken to the laboratory. The swabs were directly inoculated on MacConkey, nutrient agar and potato dextrose agar media using streak method in duplicates. The pair of inoculated plates were incubated at 35 to 37°C for 24 h (bacteria) and fungi (PDA plates) at room temperature for 24 to 72 h. The plates were then examined for bacterial and fungal growth.

### Isolation of bacterial and fungal colonies

Mixed cultures observed on MacConkey agar, nutrient agar and potato dextrose agar media were isolated on fresh agar plates containing same kind of media in order to grow discrete colonies. The organism picked from the mixed culture was streaked according to a pattern that gradually thinned out the organism population and separated the cells spatially for effective identification and the plates were incubated at 37°C for 24 h for bacteria and at room temperature for fungi. The colonies found on each fresh plate were observed and recorded. These isolates were identified on the basis of their cultural, morphological and biochemical characteristics (Cheesbrough, 2000).

## RESULTS AND DISCUSSION

Sixteen (48.5%), of the thirty-three samples analyzed were contaminated by bacteria and fungi. About 70% of all the currency counting machines from the four banks were contaminated with bacteria and 25% with fungi and most of the organisms were isolated from the currency counting machines while currency counting rooms had a fewer isolates or none in some cases. Six different bacterial species were isolated: *S. typhi*, *Staphylococcus aureus*, *E. coli*, *Streptococcus* sp., *Enterococcus* sp., *S. pyogenes*, *Proteus* sp. and four genera of fungi were isolated: *Aspergillus* sp., *Mucor* sp., *Rhizopus* sp. and *Penicillium* sp. Table 1 shows the microbial isolates from

**Table 1.** Microbial isolates from currency counting machines and the counting rooms.

Isolates	Identified organisms	
	Bacteria	Fungi
A	<i>Salmonella typhi</i>	<i>Mucor sp.</i>
B	<i>Escherichia coli</i>	<i>Penicillium sp.</i>
C	<i>Streptococcus sp.</i>	<i>Aspergillus niger</i>
D	<i>Enterococcus sp.</i>	<i>Rhizopus sp.</i>
E	<i>Staphylococcus aureus</i>	
F	<i>Proteus sp.</i>	

currency counting machines and the counting rooms.

The result obtained in this study showed that currency counting machines and currency counting rooms in banks within Anyigba metropolis, Kogi State are contaminated with different bacterial and fungal organisms. Our finding is consistent with other studies done elsewhere in Nigeria (Ameh and Balogun, 1997; Ogo et al., 2004).

The cultural, morphological and biochemical properties of the isolates showed that they belonged to the following bacterial genera namely; *Salmonella*, *Staphylococcus*, *Streptococcus*, *Enterobacter*, *E. coli* and *Proteus* while the fungal genera; *Mucor*, *Rhizopus*, *Aspergillus* and *Penicillium*. These microorganisms could have come in contact with money through soil, clothing, food or hands of users before being taken to the bank. Some of these organisms are potential disease-causing agents. For example, *Staphylococcus* species have been known to be responsible for food poisoning, *S. pyogenes* for a variety of diseases such as respiratory tract infections, rheumatic fever and endocarditis, *E. coli* is responsible for urinary tract infections and intestinal tract diseases (Food and Agricultural Organization, 1979; Turk et al., 1983; Adesiyun, 1984).

The fungal isolates could produce elaborate mycotoxins in foods which are dangerous to humans and other animals' health (Grundy and Grundy, 1974; FAO, 1979). In addition, the findings of this work further suggest that dirty currency could host harmful micro-organisms which are also deposited on currency counting machines and the counting rooms' environment thereby posing risk to customers and bankers alike.

In Nigeria, cash transactions are used more frequently than credit cards, travelers, cheques and money orders. The habit of keeping money in bags, pockets, wallets, brassier, local pots and table covers is common among the majority of Nigerians and the outcome of this study may be a reflection of such practices.

## CONCLUSION AND RECOMMENDATION

The present study has shown that currency counting machines and the currency counting rooms of banks are contaminated with various microbial species, which may

be a direct reflection on the level of contamination of the currency through cash transactions in the community.

The occurrence of different species of microorganisms on the counting machines and currency counting rooms can constitute a potential health hazard to users. It is therefore advised that money be handled in a manner that does not get contaminated with dirt, disease-causing agents or become unduly mutilated. To help control the spread of these pathogens, it is recommended that the Central Bank of Nigeria (CBN) should enforce laws on unethical handling of the naira notes and ensure periodic withdrawal of dirty notes from the circulation.

Regular disinfection of currency deposited in banks with ultraviolet light or formalin vapors is suggested. From the results of the study, it is instructive also that hands should be washed thoroughly before and after handling naira notes as a mark of personal hygiene.

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