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Research Article

**COMPARATIVE STUDY OF THE BACTERIOLOGICAL  
QUALITY OF NEW NAIRA NOTES AND SOME NIGERIA  
CURRENCIES IN CIRCULATION****Orogu J.O.<sup>1\*</sup>, Akpobire D<sup>1</sup>. and Adebisi O.O.<sup>2</sup>.**<sup>1</sup>Department of Science Laboratory Technology, Delta State Polytechnic Ozoro, Delta State, Nigeria.<sup>2</sup>Department of Microbiology, Faculty of Life Science University of Ilorin (UNILORIN), Ilorin, Nigeria.**Abstract:**

*The comparative study of the bacteriological quality of new naira notes and naira currencies in circulation was carried out with a view to access the bacteriological quality of the Nigerian currency note in Nigeria and to compare the bacteria load between mint notes and dirty notes in circulation. The naira notes comprising of all denomination were collected from different chosen occupational groups in Ozoro town (for dirty naira notes), while the mint was collected from a commercial bank in Ozoro. The notes were surveyed for bacterial contaminant using dilution method. The bacteria isolated from the notes were Escherichia coli (33.3%), Salmonella sp (50%), Streptococcus sp (50%), Staphylococcus aureus (33.3%), Proteus mirabilis (50%), Micrococcus sp (50%) and Pseudomonas aeruginosa (50%). The total bacteria count ranges from  $3.6 \times 10^4$  CFU/ML to  $9.6 \times 10^4$  CFU/ML. Lower denomination notes were more contaminated than higher denomination notes. Dirty and wrinkled notes had more contaminants than the mint notes. This study has demonstrated that naira could be a source of contamination by microbial pathogen.*

Key words: *Naira notes, Bacteriological, quality, comparative study*

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## INTRODUCTION:

Money is any object that is generally accepted in payment for goods and services, and repayment of debts [1]. The main functions of money are distinguished as; a medium of exchange, a unit of account, a store value, and occasionally in the past a standard of deferred payment. In most day to day transactions, money in form of notes and coins, pass through the hands of many people; as against exchange dependent on double coincidence of wants [2].

Various denominations of money have been minted by the Central Bank of Nigeria (CBN). They are released to the public through the commercial banks. Currently, there are eight denominations of the naira note form: N5, N10, N20, N50, N100, N200, N500, and the N1000 notes. The N5, N10, N20, N50, N100 and N200 notes are the most commonly used and are more involved in daily cash transactions. They are common especially among the populace, while the N500 and N1000 notes are commonly used among the wealthy and in corporate transactions [3].

Bacteria and viruses are the pathogens for a multitude of diseases. Both can arrive on or in the human body by contact or smear infection, caused for example, by touching a coin or a banknote. From such sources bacteria can cause diseases such as cholera or tuberculosis, while viruses can cause influenza, hepatitis B, and AIDS. The two pathogens are quite distinct from each other. Bacteria constitute a large domain of prokaryotic micro-organisms. Typically few micrometers in length, bacteria have a wide range of shapes, ranging from spheres to rods and spirals [4].

Bacteriology is the study of bacteria which is a branch of microbiology that involves the identification, classification and characterization of bacterial species [5]. There are approximately ten times as many bacterial cells in the human flora as there are human cells in the body, with large number of bacterial on the skin and as gut flora [6]. The vast majority of the bacterial on the body are rendered harmless by the protective effects of the immune system and few are beneficial. However, a few species of bacterial are pathogen and causes infectious diseases, including cholera, syphilis, anthrax, leprosy, and bubonic plague.

Bacteria's have been shown to spread from person to currency notes which is widely used as exchanges for goods commonly and routinely passed among individuals and services in most countries worldwide. Thus bacteria could be spread on the surface of currency note which are widely used as each currency is exchanged many times during the time it

circulates [7]. Currency notes therefore present a particular risk to public health, since communicable disease can spread through contact formites[8].

Although paper money is impregnated with disinfectant during production to inhibit micro-organisms, pathogens are isolated from currency notes and coins [9].

The contamination of the notes can be traced to dust, soil, water, micro flora of the body of handlers (hand skin etc), the saliva often used when counting the notes.

## Methodology

### Study area

The study area was Ozoro, the local government headquarter of Isoko North local government area of Delta State, South-south region of Nigeria.

### Sample collection

Currency samples were collected in different denominations (50, 100, 200, 500 naira). The samples were divided into two categories A and B. 'A' represents the dirty currency which were sub divided into A1; N50, A2: N100, A3: N200, A4: N500, while 'B' represents mint which were also sub divided into B1, N50, B2: N100, B3: N200,. Both were transported to the laboratory, where analysis was carried out.

### Analysis Isolation of test organisms

The samples were swabbed using sterile swab stick and serially diluted according to Cheesbrough (2005). 0.5ml of  $10^{-3}$ ,  $10^{-4}$ , and  $10^{-5}$  dilutions were transferred to twelve plates of nutrient agar. The media was prepared according to the manufacturer instruction and then used for enumeration of isolated bacteria.

The plates were incubated at 37°C for 24 hours. Purified isolates were identified according to their morphological characteristics and reactions to biochemical test.

## RESULT AND DISCUSSION:

The bacterial isolated from the currency samples were *Salmonella sp Streptococcus suis*, *Micrococcus sp*, *Proteus mirabilis*, *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Escherichia coli*.

Table 1 shows bacterial isolates that have the ability to utilize sugar as the substrate.

Table 2 shows the occurrence of bacteria isolates, number of occurrence and percentage of occurrence in different currency sample.

Table 3 shows the Heterotrophic Plate Count of bacterial isolates from different currency samples.

**Table 1: Cultural, Morphological and Biochemical Characteristics of Bacteria Isolates**

Isolates	Gram stain	Morphological characteristic	Citrate	Catalase	Indole	Glucose	Lactose	H <sub>2</sub> S	Gas
<i>Staphylococcus aureus</i>	GPC	Cocci	-	+	+	+	+	-	+
<i>Escherichia Coli</i>	GNB	Rods	-	+	+	+	+	-	+
<i>Pseudomona aeruginosa</i>	GNB	Rods	-	+	-	+	-	-	+
<i>Streptococcus suis</i>	GPC	Cocci	+	+	-	+	+	-	-
<i>Salmonella species</i>	GNB	Rods	-	+	+	+	+	-	+
<i>Micrococcus species</i>	GPC	Cocci	-	+	-	-	-	-	-

Key + = positive, - = Negative, GSB = Gram Positive Bacillus, GNB = Gram Negative Bacillus, GPC = Gram Positive cocci

**Table 2: Occurrence of bacteria isolates identified in different currency samples**

Samples	Bacteria	Percentage of Occurrence
A1	<i>Salmonella species</i>	50.0
	<i>Proteus mirabilis</i>	50.0
A2	<i>Streptococcus suis</i>	50.0
	<i>Proteus mirabilis</i>	50.0
A3	<i>Proteus mirabilis</i>	50.0
	<i>Salamonella species</i>	50.0
A4	<i>Micrococcus species</i>	50.0
	<i>Pseudomona-aeruginosa</i>	50.0
B1	<i>Micrococcus species</i>	33.3
	<i>Pseudomona-aeruginosa</i>	66.6
B2	<i>Staphylococcus aureus</i>	33.3
	<i>Micrococcus species</i>	33.3
	<i>Pseudomonas aeruginosa</i>	33.3
B3	<i>Escherichiae coli</i>	33.3
	<i>Micrococcus species</i>	33.3
	<i>Pseudomonas aeruginosa</i>	33.3

**Table 3: Total bacterial count from currency samples**

Samples	Bacteria Isolated	CFU
A1	<i>Salmonella species</i>	8.0 X 10 <sup>4</sup>
	<i>Proteus mirabilis</i>	4.8 X 10 <sup>4</sup>
A2	<i>Streptococcus suis</i>	8.4 X 10 <sup>4</sup>
	<i>Proteus mirabilis</i>	4.0 X 10 <sup>4</sup>
A3	<i>Proteus mirabilis</i>	6.0 X 10 <sup>4</sup>
	<i>Salmonella species</i>	8.8 X 10 <sup>4</sup>
A4	<i>Micrococcus species</i>	3.6 x 10 <sup>4</sup>
	<i>Pseudomonas-aeruginosa</i>	8.4 X 10 <sup>4</sup>
B1	<i>Micrococcus species</i>	9.4 x 10 <sup>4</sup>
	<i>Pseudomonas-aeruginosa</i>	4.0 x 10 <sup>4</sup>
	<i>Pseudomonas-aeruginosa</i>	4.8 x 10 <sup>4</sup>
B2	<i>Staphylococcus aureus</i>	8.6 x 10 <sup>4</sup>
	<i>Micrococcus species</i>	4.8 x 10 <sup>4</sup>
	<i>Pseudomonas aeruginosa</i>	4.0 x 10 <sup>4</sup>
B3	<i>Micrococcus species</i>	9.6 x 10 <sup>4</sup>
	<i>Pseudomonas aeruginosa</i>	4.8 x 10 <sup>4</sup>
	<i>Escherichiae coli</i>	6.0 x 10 <sup>4</sup>

**DISCUSSION:**

This study reveals that the microbiological quality of Naira currency in circulation is of high rate. The four categories of both dirty notes and mint notes that were used for the analysis were found to be contaminated with bacteria or pathogens. This confirmed that currency might be a vector playing an important role in the transmission of pathogen micro-organisms in the community according to (Michael, 2002)[9].

Table 1 shows bacterial isolates that have the ability to utilize sugar as the substrate, and it reveals their cultural, morphological and biochemical characteristics. The bacteria isolated include *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Escherichia coli*, *Streptococcus*, *Salmonella species* and *Micrococcus species*

The most common bacteria isolates identified in all the currency notes (Table 2) were *Micrococcus species* and *Pseudomonas aeruginosa*.

*Escherichia coli* have the lowest occurrence. The presence of *E. coli* in naira notes is an indication of faecal contamination from humans after toilet use and this may occur through hands of handlers [12]. All the organisms occurred at a (50%) rate. Example *Salmonella sp* (50%), *Proteus mirabilis* (50%), *Streptococcus suis* (50%), *Salmonella species* (50%), all the dirty currency notes, while in the mint currency notes all the organisms occurred at a (33.3%) rate except for *Pseudomonas* that occurred at a (66.6%) rate in the 50 naira (B1) currency note. The presence of *E.coli*, *Salmonella sp* *Pseudomonas* *Proteus mirabilis* from the test samples correlates with the findings of Awe, et al., 2010 [13] who

isolated similar isolates from some Nigerian currencies.

The total bacterial count from the currency samples (Table 3) recorded *Micrococcus* as the highest organism in mint notes (9.6 x 10<sup>4</sup>) and occurred as the lowest in dirty notes with a CFU/ml of (3.6 x 10<sup>4</sup>). While *Salmonella species* occurred highest with CFU/ml of (8.8 x 10<sup>4</sup>) in the dirty notes and was not found in the mint currency, a particular concern was the isolation of *Salmonella* from the currency, which indicated faecal contamination. This finding supports the fact that individuals who prepare food after handling contaminated currency notes have a higher risk of infecting themselves and others with food borne pathogens [14].

This study revealed that paper currency is highly contaminated with microbes and may play a role in the transmission of antibiotic resistant or potentially harmful organisms. Lower denomination notes were found to be more contaminated than the higher ones. Dirty notes had more microbial load than the mint notes.

**CONCLUSION:**

This study shows that contaminated money is public risk when associated with the simultaneous handling of food and currency may spread nosocomial infections. We have highlighted the potential for bank notes to carry bacteria, as well as their potential capacity to spread infection. The currency circulating in different places could serve as a vehicle for transmission of drug resistance. Pathogen or potential organisms and contamination could be due to unsafe handling of currency and mint notes were not contaminated. The longer a paper currency stays in

circulation the more opportunity there is for it to become contaminated.

### RECOMMENDATIONS

hygienic measures such as thorough hand washing with soap after using currency notes and ATM should be observed and the practice of keeping money in shoes and socks and under the carpet should be discouraged. Furthermore, we should avoid the use of saliva during counting of currency notes as well as desist from placing money in the mouth and biting off corners of the currency notes. Moreover ready-to-eat-food sellers should be educated to avoid possible cross contamination between currency notes and the food they sell.

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