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Microbial evaluation of Naira notes in circulation in Yola metropolis, Adamawa state, Nigeria

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Abstract

The unhygienic state of most Naira currency notes in circulation in most markets in Yola metropolis of Adamawa State necessitate this research, to evaluate the microbial loads on these notes. Naira currency notes (N) of all denominations were randomly collected from traders in the markets. The mean average bacterial count on the notes was between 1.44 x 10^3 cfu/ml to 7.60 x 10^2 cfu/ml, while fungal counts ranged between 2.57 x 10^3 cfu/ml to 1.00 x 10^2 cfu/ml. The lowest and highest bacterial and fungal counts were found in the N1000.00 and N5.00 notes respectively. The bacterial genera isolated were *Staphylococcus* species, *Klebsiella* species, *Pseudomonas* species and *Escherichia coli* while *Aspergillus* species, *Fusarium* species, *Penicillium* species and *Mucor* species genera were isolated.

Keywords: Bacteria, fungi, Naira notes, contamination

1. Introduction

Microorganisms are known to spread by air, water, food, soil. Paper currency notes which are transferred from one individual to another are known to carry bacteria on their surfaces and are responsible for transmitting them (Hosen, 2006) According to Central Bank of Nigeria, CBN, (1958) the expected life span of the naira notes is 24 months but the mishandling reduces this to less than six months. This abused naira notes denotes the currency, which had been fairly long (not more than 24 months) in circulation, mishandles structurally, disfigured, literally mutilated and for the most of time, they are dirty (Jolaoso, 1981).

Incidentally, abused naira notes were reported as vehicles of bacterial, mold, parasitic infections and agents of cross contamination (Itoda, 2001). Survival of various microorganisms on paper currency indicates that this could represent a potential cause of sporadic cases of food borne illness and represent an often overlooked enteric diseases reservoir (Barry, 2002). These routes of transmission are of great importance in the health of many populations in developing countries where the frequency of infection is general indication of local hygiene and environmental sanitation levels (Cooper, 1991).

The possibility that currency notes might act as for the transmission of potential pathogenic microorganisms was suggested in 1970s (Abram and Waterman, 1972). Papers currency is widely exchanged for goods and services in countries worldwide. The possibility that paper currency might act as environmental vehicles for the transmission of potential pathogenic microorganisms was suggested in 1970s (Abram and Waterman, 1972). Paper currency is widely exchanged for goods and services in countries worldwide. All this trade is in hard currency, with lower denomination notes receiving the most handling because they are exchanged many times (Gadsby, 1998).

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Paper currency provides a large surface area as a breeding ground for pathogens (Podhajny, 2004).Studies from other parts of the world have shown that bank notes revealed the presence of high load of germs, which could cause tuberculosis, meningitis pneumonia, tonsillitis, peptic ulcer, urinary tract infection, gastro intestinal infection and lung disease. Therefore, this research work was carried out to evaluate enumerate, characterize and identify microbial isolates from spent naira currency notes spent in Yola, Adamawa State.

2. Materials and methods

2.1 Sample collection

A total of forty (40) pieces of different available denominations of naira notes were randomly collected from artisans in Yola market. These artisans include fish and meat sellers, vegetable sellers, sachet water hawkers and food vendors. Fresh new mint of naira notes were collected from a commercial bank to serve as control. The samples were aseptically collected from the artisans, placed in sterile nylon and then wrapped in sterile aluminum foil paper and were immediately transferred to the laboratory for analysis (Baker and Silverton, 1985).

2.2 Isolation of microorganisms

Each naira note was soaked in 10 ml sterile distilled water and was vigorously shaken for about 15 mins. The sterile distilled water used for soaking was the serially diluted into 10^{-1} to 10^{-3}. 1.0 ml of 10^{-1} dilution was then inoculated by pour plating method unto sterile plates containing Nutrient Agar and by spreading method on Sabroud Dextrose Agar. The plates containing Nutrient agar were incubated at 37 ^{O}C for 24 h while plates containing Sabroud Dextrose Agar were incubated at room temperature (28 ^{O}C to 32 ^{O}C) for 3 – 5 days. Pure bacterial and fungal isolates were obtained by sub-culturing unto Nutrient and Sabroud Dextrose Agar.

2.3 Morphological and biochemical characterization of bacterial and fungal isolates

The bacterial isolates were subjected to Gram's staining and biochemical tests using methods described by Cheesbrough (2000) while lactophenol cotton blue stain was used for the fungal isolates.

3. Results and Discussion

The results showed that different species of bacteria and fungi were present on the surfaces of different used naira denominations used for transactions among artisans in the main market of Yola, Adamawa State (Table 1, 2 and 3).The results in Table 1 showed that used Naira notes among artisans in Yola market are reservoir of both bacteria and fungi. However, the control samples of Naira currency did not have any organism isolated from them. This is similar to earlier report (Kawo *et al*., 2009). The lower denominations N5, N20 and N50 have higher bacterial and fungal loads that ranged from 9.60 x 10^2 cfu/ml to 1.44 x 10^3 cfu/ml for bacteria and 2.14 x 10^2 cfu/ml to 2.57 x 10^3 cfu/ml for fungi. The ranges obtained were lower compared to the report by Kawo *et al*., (2009). However, a high load of 3.57 x 10^3 cfu/ml was observed on N100 notes. The higher denominations N200, N500 and N1000 Naira notes have lower microbial loads that ranged from 1.00 x 10^3 cfu/ml to 7.60 x 10^2 cfu/ml for bacteria and 1.00 x 10^2 cfu/ml to 1.16 x 10^2 cfu/ml for fungi. This has also been observed earlier by Kawo *et al*. (2009) and Uraku *et al*. (2012). The reason for the high load observed in lower denomination could be attributed to the frequency at which they have been used among individuals than the higher denominations (Igumbor, 2007). This has also been reported by Awe *et al*. (2010).

Table 1. Bacterial and fungal counts on used Naira notes

Denomination (naira)	No. of samples	Mean value of bacterial count (cfu/ml)	Mean value of fungal count (cfu/ml)
1000	5	7.6×10^2	1.00×10^2
500	5	8.20×10^2	1.02×10^2
200	5	1.00×10^3	1.16×10^2
100	5	1.48×10^3	3.57×10^3
50	5	9.00×10^2	1.28×10^2
20	5	9.60×10^2	2.00×10^2
10	5	1.16×10^3	2.14×10^2
5	5	1.44×10^3	2.57×10^3

The cultural, morphological and biochemical properties of the isolates showed that the following bacteria were isolated *Staphylococcus aureus*, *Pseudomonas* species, *Klebsiella* species and *Escherichia coli* (Table 2) while the fungal isolates belong to the genera *Aspergillus*, *Mucor*, *Penicillium* and *Fusarium* (Table 3). The bacterial species *E. coli* and *S. aureus* and fungal species of *Mucor*, *Aspergillus* and *Penicillium* have been reported as some of the microbial contaminants isolated from Naira notes (Ememuor *et al*., 2012). Genera *Klebsiella* and *Pseudomonas* have been isolated and reported (Yazah *et al*., 2012, Oyero and Emikpe, 2007). The study showed that the poor handling of currency notes such as keeping them in stockings, brassieres by individuals and bad habit of putting saliva at the finger tips to counting, failure to wash hands after visiting toilet and touching of Naira notes with dirty hands could be responsible for the microbial contamination observed with the Naira notes.

Table 2. Morphological and biochemical characteristics of bacteria

		Gram's stain	Citrate	Catalase	Coagulase	Oxidase	Indole	Hydrogen sulphide	Gas production	Probable organism
1	Smooth, circular milky colonies on Nutrient agar	Positive and cocci in shape	Positive	Positive	Positive	Negative	Negative	Negative	Negative	*S. aureus*
2	Pale coloured colonies on MacConkey agar	Negative and rod	Negative	Negative	Negative	Positive	Negative	Negative	Positive	*Pseudomonas* sp.
3	Smooth round yellow colonies	Positive and cocci in shape	Positive	Positive	Negative	Negative	Negative	Negative	Negative	*S. aureus*
4	Mucoid pink colonies on MacConkey agar	Negative and rod	Positive	Negative	Negative	Negative	Negative	Negative	Positive	*Klebsiella* sp.
5	Smooth pink colonies on MacConkey agar	Negative and rod	Negative	Negative	Negative	Negative	Positive	Positive	Negative	*E.coli*

The biochemical characteristics showed that the *S. aureus* were positive to citrate, catalase and coagulase tests except for some certain strain that were negative for coagulase. The remaining isolates were negative for coagulase production (Table 2). *Pseudomonas* species was positive to oxidase test and gas production but negative to citrate, catalase, coagulase, indole and H_2S production tests. *E coli* was negative to all biochemical tests carried out except for indole and H_2S production.

Table 3. Morphological and morphological characteristics of the fungal isolates

	Colony appearance	Morphology	Probable organism
1	White colonies which changed to black	Non septate, multinulcleate with conidia	*Aspergillus* sp.
2	White colonies which changed to grey	Non septate, hypea with round columella	*Mucor* sp.
3	Blue to green culture on Sabroud Dextrose agar	Sepate hyphae with conidiophore brush-like conidia	*Penicillium* sp.
4	Pink colour and luzzy colonies	Sepate hyphae with conidia on the conidiophores	*Fusarium* sp

4. Conclusion

The study has shown that used Naira notes that overstayed in circulation are vehicles that transmit microbial load among the people. Therefore, there is need for sensitization of the public on proper handling and storage of Naira currency notes that will reduce transmission of pathogens. Moreover, Central Bank of Nigeria should endeavour to withdraw from circulation Naira notes that have torn and overused.

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