

ASSESSMENT OF BACTERIOLOGICAL QUALITY OF NAIRA NOTES IN CIRCULATION IN AFIKPO METROPOLIS

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ABSTRACT

*The bacteriological quality of eight denominations of naira notes (₦5, ₦10, N20, N50, ₦100, N200, ₦500 and ₦1000) from taxi driver, students and fish sellers in circulation in Afikpo was determined. The collected samples were each soaked in 50ml distilled water, thereafter 10-fold serial dilution was performed up to 10^{-3} . By pour plate method, 10^{-2} aliquot was seeded onto prepared MacConkey and nutrient agars plates for coliform and aerobic bacteria isolations respectively and incubated for 24hours at 37°C . Results showed that ₦5 had the highest aerobic count of $3.0 \times 10^2 \text{ cfu/ml}$ followed by ₦20 ($24 \times 10^2 \text{ cfu/ml}$) with the least colony forming unit per milliliter (cfu/ml) of 10×10^2 from ₦1000. Coliform plate count also indicates higher contaminants with ₦5 having $2.7 \times 10^2 \text{ cfu}^{-1}$ followed by ₦10 ($2.3 \times 10^2 \text{ cfu}^{-1}$) while N1000 also had the least with $7 \times 10^2 \text{ cfu}^{-1}$ respectively. The eight denominations yielded many genera of bacteria, with ₦5 note having the highest microbial contamination while the least came from ₦1000. Bacteria isolates included pathogenic organisms like *Proteus mirabilis*, *S. aureus*, *Enterobactersp.*, *Salmonella sp.*, *Pseudomonas sp.* and *Klesiella pneumonia*. Based on the findings, the researchers recommend that: money should be carefully handled/stored as it may be a vehicle for the spread of diseases.*

Key Word: Bacteriological, Quality, Naira Note

INTRODUCTION

Money is a legal tender that is generally accepted as a medium of exchange. According to Mishkin (2007), money is any item or verifiable record that is generally accepted as payment for goods and services and repayment of debts in a particular country or socio-economic context, or is easily converted to such a form. *Money assumes many forms one of which is Fiduciary Money* which paper money is an example. The term paper money applies to bank notes and government notes which pass freely from hand to hand as a medium of exchange.

The contamination of currency notes could be from several sources, atmosphere during storage, usage, handling or production (cf. Awodiet *al.*, 2001; Bhatet *al.* (2010). Daily transactions have made currency notes to pass through many hands and pathogens become imposed on them (cf. Maturet *al.*, 2010). Ogoet *al.* (2004) also reported that naira note hardly last for more than one year owing to poor or negative money handling practices like spraying during ceremonies where such note may be trampled upon when they fall on the ground (cf. Awei et *al.*, 2010).

Paper currency provides a large surface area as breeding ground for pathogenic microorganisms and their ability to contaminate objects such as currency notes is very prevalent. Ordinarily, the exposure of currency notes to the atmosphere could even bring contamination depending on the environment in question (cf. Podhajny, 2004; Ameh and Balogun, 1997). When hands are used in cleaning up the anus after passing out faeces and are not properly washed and are used to touch currency notes in any way, the tendency of contamination is high. Other attitudes according to Awei et *al.*, (2010), such as wetting of fingers with saliva or unclean water to lubricate the fingers in counting

money, could lead to possible transfer of microorganism from such medium to the notes and vice versa. The habit of wetting of fingers with saliva or the use of contaminated water as lubricant for fingers during the money counting, can lead to the transfer of bacteria and parasitic ova or cysts to currency notes and coins (cf. Ameh and Balogun, 1997). Even the currencies used in public transport system were also reported to be contaminated with pathogens (cf. Lamichhane *et al.*, 2009).

Money on which pathogenic microorganisms might survive represents an overlooked reservoir for enteric diseases (cf. Michaels, 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 incidence (cf. FSA 2000). Over the last two decades data indicating that simultaneous handling of food and money as a cause of sporadic food-borne illness causes have accumulated from studies of the microbial status and survival of pathogens on coins and currency notes (cf. New *et al.*, 1989; Oktay, 1992).

However, pathogenic microbes, if present on the hands, can be transferred from cashiers and salesman to the general public via currency notes and coins (cf. Igumbor *et al.*, 2007). Adegoke and Okoh in 2011 noted that improper handling of money in hospitals also plays an important role in the contamination of currency notes and coins with pathogenic microbes. Similarly, simultaneous handling of food and money by waiters or vendors can have serious consequences as the food they serve is ready to eat and does not require any further heating.

Afshan and Saira (2015) concluded that paper currency offers a larger surface area as a propagation medium for pathogens. Microorganisms as noted by El-Din and Hassan (2005) may

endure on it for longer periods of time. A large number of microbes can be found accumulated on older paper notes. At the same time, material of currency notes also plays an important role in bacterial attachment (cf. Hübner *et al.*, 2011). Moreover, the storage of currency note and coins in polythene, cotton and leather bags increases the microbial load. This is because of humid and dark conditions present in these bags, which ultimately favour the growth and propagation of the microorganisms (cf. Barolia *et al.*, 2011).

It was in realization of these conditions upon which money is subjected and its ageless accessibility (i.e. old and young including infants) that prompted this research so as to assess the bacteriological quality of naira notes in circulation within Afikpo metropolis with a view of creating awareness on the dangers inherent on its abuse.

MATERIALS AND METHOD

Sample Collection

Ten (10) pieces of each of the eight denominations of the naira notes (N5, N10, N20, N50, N100, N200, N500 and N1000 naira notes) were collected aseptically in sterile bags, according to their denominations, from volunteers who included taxi drivers, students and fish sellers and taken to the laboratory for microbiological analysis.

MICROBIOLOGICAL ANALYSIS

Sample Preparation

Each of the currency notes were immersed in a 50ml distilled water and allowed to stand for some time after which, 1ml aliquot of the solution was used in the preparation of 10-fold serial dilution up to 10^{-2} .

Media Preparation

All media (MacConkey agar and Nutrient agar) employed in this study were prepared based on manufacturer's instruction and autoclave at 121°C for 15 minutes.

Media Inoculation

By the spread plate method, 0.1ml aliquot of the 10^{-2} diluents was inoculated unto the solidified MacConkey and Nutrient agar plates and incubated for 24 hours at 37°C for the viable aerobic and coliform enumerations.

IDENTIFICATION OF THE ISOLATES

Isolates were identified based on the cultural, morphological and biochemical characteristics. The biochemical parameters employed were Oxidase Test, Catalase Test, mannose, lactose, sucrose, glucose and maltose fermentation, Motility Test, Indoleproduction, Voges -Proskauer (V-P) tests.

RESULTS

Result of the microbial analysis of the eight denominations in circulation in Afikpo North L.G.A. showed that they were contaminated with one kind of microorganisms or the others.

Table 1: Total viable and coliform count of bacteria isolates.

The viable count shows that N5 has the highest contaminants of 3.0×10^2 cfu/g with the least coming from N1000 note with a count of 1.0×10^2 cfu/g. The total coliform count also revealed that N5 recorded 2.7×10^2 cfu/g with the least contaminant found in N1000 with coliform count of 7×10^2 cfu/g (table 1).

Denomination (N)	Aerobic count cfu/gcfu/g	Coliform count
5	3.0×10^2	2.7×10^2
10	2.1×10^2	2.3×10^2
20	2.4×10^2	2.0×10^2
50	1.9×10^2	1.5×10^2
100	1.7×10^2	2.0×10^2
200	1.3×10^2	1.0×10^2
500	1.8×10^2	1.3×10^2
1000	1.0×10^2	7.0×10^2

TABLE 2: Biochemical characteristics of bacteria isolates.
The biochemical analysis of the isolates revealed the recovery of *Staphylococcus aureus*, *Enterobacter* sp., *Salmonella* sp., *Pseudomonas* specie. *Proteus mirabilis* and *Klesiella pneumonia* (table 2)

Catalase	coagulase	gram	citrate	indole	motility	oxidase	mannlac	Isolated organism.	
+	+	+	+	-	-	-	+		
+	+	-	-	-	+	+	+	APAPAPAPS	<i>aureus</i>
+	+	-	-	-	+	+	+	AGPAGP	<i>Enterobacter</i>
									sp.
+	-	-	-	+	+	ND	OO	GP	AGP AGPSalmonella
									sp.
+	-	-	+	+	-	OO	OO	AP	APPseudomonas
									sp.
----	-	+	+	+	++	+			<i>Klesiella</i>
									<i>pneumonia</i>
+++	+	-+	-ND	-	-	+	+		<i>+Proteus</i>
									<i>mirabilis</i>

Key: + = Positive Reaction, - = Negative Reaction

Mann = mannose, lac = lactose, suc = sucrose, glu = glucose, mal = maltose

DISCUSSION

Analysis of the total viable count shows that N5 had the highest aerobic count of 3.0×10^2 cfu/g followed by N20 with cfu/g of 2.4×10^2 , N10, N50, N500, N100, N200 and N1000 with the corresponding colony forming units (cfug⁻¹) of 2.1×10^2 , 1.9×10^2 , 1.8×10^2 , 1.7×10^2 , 1.3×10^2 , 1.0×10^2 respectively. The coliform plate count indicates higher contaminants with N5 having 27×10^2 cfug⁻¹ followed by 10, N20 and N100, N50, N500, N200, N1000 with plates counts of 2.3×10^2 cfug⁻¹, 2.0×10^2 cfug⁻¹, 1.5×10^2 cfug⁻¹, 1.3×10^2 cfug⁻¹, 1.0×10^2 cfug⁻¹ and 7.0×10^2 cfug⁻¹ respectively (Table 1).

The morphological and biochemical characteristics of the isolates shows the recovery of six genera of bacteria namely *Staphylococcus aureus*, *Enterobacter spp.*, *Salmonella spp.*, *Pseudomonas specie*, *Proteus mirabilis* and *Klesiella pneumonia* (table 2).

The high viable and coliform counts discovered N5 (3.0×10^2 cfu/ml and 2.7×10^2 cfu/ml respectively) in this present study varies greatly with the result of Yakubu, *et al.*, (2014) who recorded 13 cfu/g on N5. The high presence of coliform and aerobic bacteria on the N5 note must not be unconnected with the fact that it is readily available in the hands of the young and old, sane and insane and the ease with which it could be seen in the environment. Awodiet *al*(2001) and Bhat *et al.* (2010) lend weight to this view when in their separate works noted that the contamination of currency notes could be from several sources, atmosphere during storage, usage, handling or production.

The contamination of currency notes must equally not be unconnected with the passing of these notes from one hand to another and also the fact that the hygienic status of many of the handlers of currency notes is too poor thereby making contamination of the currency note inevitable. This observation is supported by the remark of Maturet *al.* (2010) as they noted that daily transactions have made currency notes to pass through many hands and pathogens become imposed on them. Ogoet *al.* (2004); Aweiet *al.* (2010) learnt their voices to in support of this position when they noted in their separate reports that naira note hardly last for more than one year owing to poor or negative money handling practices like spraying during ceremonies where such note may be trampled upon when they fall on the ground. In buttressing this fact further, Ameh and Balogun (1997) opined that when hands are used in cleaning up the anus after passing out faeces and are not properly washed and are used to touch currency notes in any way, the tendency of contamination is high. Aweiet *al.* (2010) noted that other attitudes such as wetting of fingers with saliva or unclean water to lubricate the fingers in counting money could lead to possible transfer of microorganism from such medium to the notes and vice versa. This fact was further buttressed by Ameh and Balogun in 1997 when they opined that the habit of wetting of fingers with saliva or the use of contaminated water as lubricant for fingers during the money counting, can lead to the transfer of bacteria and parasitic ova or cysts to currency notes and coins.

With the recovery of these organisms in this present study, there is no doubt that there may be the possibility of food – borne disease as a result of handing money and food at the same time. This position is in agreement with the view of FSA (2000) when they noted that 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 illnesses.

The organisms recovered from this notes are known to be of medical health importance. Craig (1997) upholds this view when he noted that pathogenic microorganism found on money e.g. bacteria such as *Staphylococcus* spp, *Escherichia coli*, *Pseudomonas aerogenosa*, *Proteus mirabilis* are responsible for large number of diseases of man.

S. aureus recovered in this present study calls for caution in the use of currency notes. Pope *et al.* (2005) noted this when *S. aureus* a non-spore former survive for a long time outside a living host. Janardan *et al.* recognized this when he averred that it causes minor skin infection like pimples, impetigo, boils to life-threatening diseases like pneumonia, osteomyelitis, endocarditis.

Klebsiella spp. is a virulent organism that has been associated with community acquired infections such as pneumonia. *E. coli* as recovered in this work is seen as an indicator of poor hygiene among users of the naira notes.

Pseudomonas spp. is pathogenic in immunio compromised individuals. The organisms as asserted by Yakubu *et al.* (2014) attaches itself to and colonies the mucus membrane or skin, invade locally and produce systemic disease (wounds and meningitis).

CONCLUSION

The study assessed the bacteriological quality of eight different denominations of naira notes in circulation in Afikpo metropolis. The monies were collected from taxi drivers, students and fish sellers. The samples were analyzed using

standard microbiological techniques. The analysis revealed that naira notes could be a vehicle for the transmission of diseases to humans, as bacteria of medical importance were isolated from them.

RECOMMENDATION

This work has revealed that the currency notes are contaminated with many genera of pathogenic bacteria. The rate of contamination of the naira notes could be reduced if certain measures are observed. These include:

- 1) there is need for the handlers of money to be careful on the way and manner they handle and store it as it may be a vehicle for the spreading of diseases;
- 2) children should be discouraged from holding money, as they may put it inside their mouth thereby giving the microbes easy access into their body to initiate disease;
- 3) people should be discouraged from using their spittle to wet their hands during the time they are counting money, as this is one of the easiest ways of contaminating the currency notes; and
- 4) there should be stiffer penalties meted on those that spread money during occasions, as this is one of the easy ways of contaminating the currency notes.

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