

BURDEN OF MICROBIAL CONTAMINATION OF NIGERIA NAIRA CURRENCY IN PORT HARCOURT, RIVERS STATE.

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ABSTRACT

The study was undertaken to access the burden of microbial contamination of Nigeria Naira currency in circulation in Port Harcourt, Rivers State. A total of 48 samples of Naira notes in all eight denominations of #5, #10, #20, #50, #100, #200, #500, #1000 grouped as mint, clean, dirty and tattered were investigated from Beggars, Bus Conductors, Market Women, Students, Food Vendors and Workers. Also 8 minted notes was used as control. Sterile swab stick rolled on

the money was mixed in 9ml of sterile normal saline and diluted in one-tenth stepwise to 10^{-9} . One ml of the diluted sample was mixed in molten appropriate agar and incubated at appropriate temperature. Isolates were identified by standard method and wet preparation done for parasites.

Isolated organisms were 188 and includes *E. coli*, *Klebsiella sp.*, *Staph. aureus* and *Proteus sp.* accounting for 90(50%), *T. trichiuria*, *A. lumbricoides* and Hookworm accounting for 55(29.25%) and *Aspergillus sp.*, *C. albican* and *Penicillium sp* accounting for 39(20.74%). #5 notes recorded highest viable count of $22.3 \times 10^{-5} \text{CFU/ml}^{-1}$ and #1000 note had the lowest of $10.6 \times 10^{-5} \text{CFU/ml}^{-1}$. Mile III market recorded the highest rate of 86(45.7%), while Uniport campus recorded 17(9%). The mint notes had a level of 12(6.4%), while tattered notes had the highest level of 87(46.3%). Statistically there was no significant difference in viable count of microorganisms isolated per currency ($P > 0.05$) the study has shown that Nigerian currency are contaminated with highly pathogenic microorganisms and care must be taken.

KEYWORDS: Microscopy, Microorganisms, Microbial Contamination, Fomite, Currency, Naira.

INTRODUCTION

Money serves as a medium of exchange for goods and services, means of deferred payment in economic activities and as means of settlement of debt (Beg and Fisher, 1977). In the olden days the means of exchange which gave rise to paper money had been trade by barter. Money is wanted for things it will buy (Samuelson and Nordhaus, 2002).

In Nigeria, the currency happens to be abused because of the manner it is handle. In most cases money is seen faded, torn, stapled, cello taped, squeezed and often times things written on them. Generally the contamination of naira notes are from several sources such as the atmosphere, storage, usage, handling and during production (Matur *et al*, 2008). Daily transactions have made the naira notes to pass through many hands and often placed in dirty spots giving rise to imposition of pathogens on them (Awodi *et al* 2000).

Naira is the legal tender in Nigeria. The naira note is a mixture of 75% cotton and 25% linen paper currency passes from one individual to another and as such undergoes handling by numerous hands both clean and dirty.

Contaminated currency is a potential public health hazard due to the fact that it circulates amongst people. Money is seen as a fomite since it is contaminated by microorganisms associated with unclean hands or dirty environment (Shakir *et al*, 2010). Other sources of contamination of money include skin, anal region, wounds, nasal secretions by sneezing and coughing, handling after attending to patients with unwashed hands by health personnel, body fluids from commercial sex workers, bus conductors, butchers, spraying during ceremonies and market women. All these do not only deface the money but contaminates the currency with pathogenic microorganisms. Bacteria causing different infections like pneumonia, tonsillitis, peptic ulcer, urino-genital tract infection have all been reportedly associated with money (Pope *et al* 2002).

Dust and dirt that usually accumulates on paper money contain spores of infectious agents (Oyero and Emikwe, 2006).

Parasites have been observed to contaminate naira notes from faecal origin. The parasites include the trophozoites, cyst and eggs of invading microbe like *E. histolytica*, *Gardia lamblia* etc.

Bacteria that contaminate currency notes include some strains of *Streptococcus* sp, *Staphylococcus* sp., Coliforms such as *Escherichia coli*, *Klebsiella* sp, *Proteus* sp, *Salmonella* sp and *Shigella* sp that may cause dangerous fever, diarrhea and dysentery moulds and yeast such as *Aspergillus* sp., *Candida albicans* and *Rhizopus* sp., and *penicillium* also contaminate currency notes (Basuarajappa *et al.*, 2005).

The determination of microbial contamination of naira Nigerian currency note will serve as a medium of enlightening the entire populace of the inherent risks that naira note can serve as a tool or vehicle for the transmission of harmful pathogenic organisms.

This study is aimed at estimating the extent of microbial contamination of Nigeria naira currency notes, determination of the major organisms that contaminate the currency notes and to also find whether micro-organisms are found in the new naira currency note, known as mint.

MATERIALS AND METHODS

Study area

This study was carried out in Port-Harcourt metropolis, Rivers State in Niger delta region. Port-Harcourt is the capital city of Rivers State. Port-Harcourt city has a population of well over 2million people. In the city, there is a beehive of commercial activities. The city is occupied by civil servants, traders, mechanized farmers, artisans, workers, students and oil/gas workers.

The study was carried out in four different locations namely Mile 3 market, Rumuokwuta, Rumuokoro and university of Port-Harcourt campus.

Sample collection

A total of 48 samples of naira notes in eight denominations of #5, #10, #20, #50, #100, #200, #500 and #1000 were investigated.

Two sample of each denomination were obtained from different occupation groups at strategic points. The groups and beggars, bus conductors, market women, students, food

vendors and workers. Similarly eight (8) newly minted notes from each denomination was obtained from a commercial bank and used as control. Two of the samples were collected with hand glove into a labelled sterile polythene bag and sent to the laboratory for analysis. The currency notes were grouped as mint, clean, dirty and tattered.

Enumeration of bacterial and fungi isolates

Using aseptic precaution, a swab stick was moistened in the sterile normal saline and rolled on the surface of each of the currency notes. The swab from each sample was placed in a test tube containing 9ml of sterile normal saline. This was well shaken and served as the stock. Thereafter 1ml was transferred into tubes containing 9ml of sterile saline and diluted in one – tenth stepwise up to 10^{-9} dilution. 1ml of each tube was added to 12-14ml of molten nutrient agar, MacConkey agar and sabouraud dextrose agar, mixed thoroughly and allowed to set and incubated for 24hrs at 37°C and viable count made to count the bacterial colonies while the sabouraud dextrose agar plates were incubated for 5 to 7 days and colonies counted and record as total viable fungi in the sample.

The bacterial isolates were sub-cultured on fresh nutrient agar and MacConkey agar plates and identified using gram staining technique and biochemical reactions. The fungi isolates were subcultured on fresh sabouraud dextrose agar plates and identified, macroscopically, slide culture examination using a mounted needle to a few drops of lactophenol cotton blue. (Harrigan and Mac Cance, 1990).

Microscopy

This was done by wet preparation in which few drops of the sample from tube 10^{-4} and above was placed on a clean grease free slide and observed using x10 and x40 Objective lenses for the presence of parasitic agents.

RESULT

The result obtained showed the organisms isolated to include bacteria 94(50%) made up of *Staph. aureus*, *E.coli*, *Proteus* and *Klebsilla*, parasites accounted for 55(29%) comprising *T. trichuria*, *A. lumbricoides* and hookworm and fungi account for 39(20.7) and comprising *Aspergillus*, *C. albican* and *Penicillum*. All these gave a total number of 188 organisms as shown in figure 1. Similarly #10 note harboured the highest no of 56(29.8%) organisms followed by #5 40(21.3%) while #1000 had the least of 4(6.4%). In the viable heterotrophic count, #5 note recorded the highest count of $22.3 \times 10^{-5} \text{CFU/ml}^{-1}$, followed by #10 note

$20.4 \times 10^{-5} \text{CFU/ml}^{-1}$ while #1000 note had the least microbial count of $10.6 \times 10^{-5} \text{CFU/ml}^{-1}$ as shown in table 1. Mile III market showed the highest microbial contamination of 86(45.7%), followed by Rumuokoro round about 50(26.69), Rumuokwuta 35(18.6%) while Uniport campus had the least level of contamination of 17(9.0%) as shown in table 2. on the condition of the currency note, mint note had the least level of contamination of 12(6.4%) followed by clean notes of 20(14.9%), and dirty notes had the level of 61(32.4%) while the tattered notes had the least level of contamination of 87(46.3%) as shown in Figure 2.

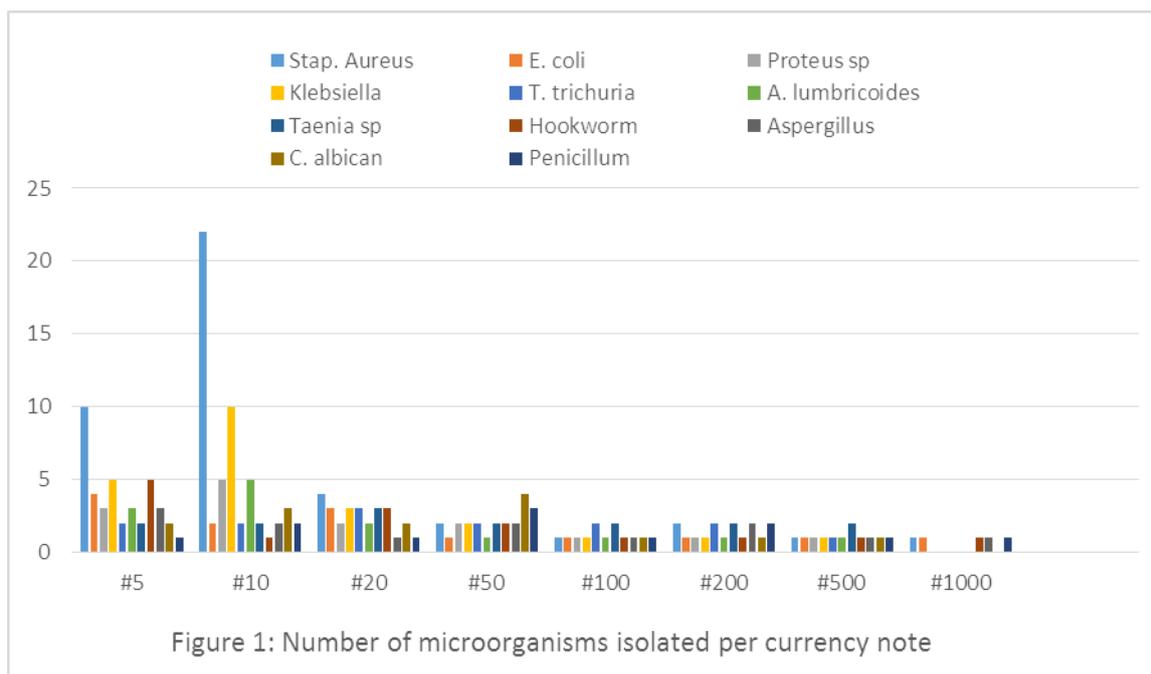
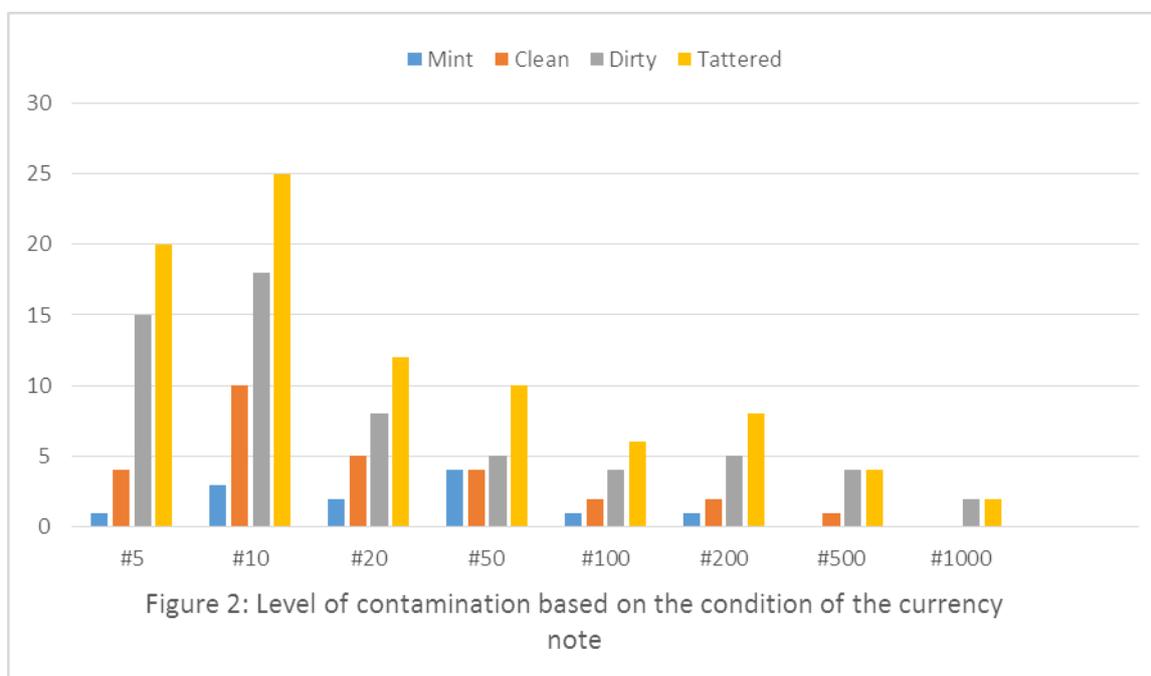


Table 1: Viable count of bacterial and fungal isolated per currency.

Microorganism	#5 Cfu/ml ⁻⁵	#10 cfu/ml ⁻⁵	#20 cfu/ml ⁻⁵	#50 cfu/ml ⁻⁵	#100 cfu/ml ⁻⁵	#200 cfu/ml ⁻⁵	#500 cfu/ml ⁻⁵	#1000 cfu/ml ⁻⁵	Total cfu/ml ⁻⁵	Mean cfu/ml ⁻⁵
<i>Staph. aureus</i>	4.0x10 ⁻⁵	2.5x10 ⁻⁵	2.9 x10 ⁻⁵	3.0 x10 ⁻⁵	2.0 x10 ⁻⁵	2.0 x10 ⁻⁵	3.7 x10 ⁻⁵	2.1 x10 ⁻⁵	22.2 x10 ⁻⁵	2.77 x10 ⁻⁵
<i>E. coli</i>	4.2x10 ⁻⁵	3.7x10 ⁻⁵	4.3 x10 ⁻⁵	2.3 x10 ⁻⁵	3.0 x10 ⁻⁵	4.0 x10 ⁻⁵	2.0 x10 ⁻⁵	2.3 x10 ⁻⁵	25.8 x10 ⁻⁵	3.2 x10 ⁻⁵
<i>Proteus sp</i>	3.9x10 ⁻⁵	4.2x10 ⁻⁵	3.2 x10 ⁻⁵	3.9 x10 ⁻⁵	2.0 x10 ⁻⁵	3.7 x10 ⁻⁵	4.0 x10 ⁻⁵	2.4 x10 ⁻⁵	27.5 x10 ⁻⁵	3.44 x10 ⁻⁵
<i>Klebsiella</i>	3.2x10 ⁻⁵	2.7 x10 ⁻⁵	4.6 x10 ⁻⁵	2.0 x10 ⁻⁵	3.3 x10 ⁻⁵	4.2 x10 ⁻⁵	3.2 x10 ⁻⁵	2.0 x10 ⁻⁵	24.6 x10 ⁻⁵	3.1 x10 ⁻⁵
<i>Aspergillus</i>	2.4x10 ⁻⁵	2.1 x10 ⁻⁵	1.5 x10 ⁻⁵	2.1 x10 ⁻⁵	1.2 x10 ⁻⁵	2.1 x10 ⁻⁵	1.1 x10 ⁻⁵	1.0 x10 ⁻⁵	13.5 x10 ⁻⁵	1.6 x10 ⁻⁵
<i>C. albican</i>	2.5x10 ⁻⁵	3.0 x10 ⁻⁵	2.1 x10 ⁻⁵	4.1 x10 ⁻⁵	1.0 x10 ⁻⁵	0.8 x10 ⁻⁵	1.0 x10 ⁻⁵	-	14.5 x10 ⁻⁵	1.8 x10 ⁻⁵
<i>Penicillum</i>	1.5x10 ⁻⁵	2.2 x10 ⁻⁵	1.8 x10 ⁻⁵	3.0 x10 ⁻⁵	1.0 x10 ⁻⁵	2.1 x10 ⁻⁵	1.0 x10 ⁻⁵	0.8 x10 ⁻⁵	13.4 x10 ⁻⁵	1.6 x10 ⁻⁵
Total	22.3x10 ⁻⁵	20.4x10 ⁻⁵	19.8 x10 ⁻⁵	20.4 x10 ⁻⁵	13.5x10 ⁻⁵	18.9 x10 ⁻⁵	16.2 x10 ⁻⁵	10.6 x10 ⁻⁵		
Mean	3.2	2.9	2.8	2.9	1.9	2.7	2.3	1.8		

Table 2: Number of microorganism in various study location.

Microorganism	Mile III (%)	Rumuokwuta (%)	Rumuokoro (%)	Uniport (%)	Total (%)
<i>Staph. aureus</i>	20	7	14	2	
<i>E. coli</i>	7	2	3	1	
<i>Proteus sp</i>	11	1	2	1	94(50)
<i>Klebsiella</i>	9	6	5	3	
Total	47(25)	16(8.5)	24(12.7)	7(3.7)	
<i>T. trichuiria</i>	5	3	5	3	
<i>A. lumbricoides</i>	8	2	3	1	55 (29.25)
<i>Taenia sp</i>	3	2	4	2	
Hookworm	6	4	3	1	
Total	22(11.7)	11(5.85)	15(7.97)	7(3.7)	
<i>Aspergillus</i>	7	2	3	-	
<i>C. albican</i>	7	2	3	1	39(20.74)
<i>Penicillium</i>	3	4	5	2	
Total	17(9.0)	8(4.25)	11(5.85)	3(1.59)	
Grand Total	86(45.7)	35(18.6)	50(26.6)	3(1.59)	
Overall Total		188(100)			



DISCUSSION

The study has revealed that most Nigerian currency notes are highly contaminated by a variety of pathogenic microorganisms. This may be due to the method of handling. This report is also similar to reports from other parts of the world. Microbial contamination of paper money is of public health concern as contaminated materials can serve as sources of transmitting disease to apparently healthy individuals. Paper money presents public health risk since communicable diseases can spread through contact with fomites as observed by Pope *et al* (2002). Even though paper money is impregnated with disinfectant, pathogens are still being isolated according to Siddigus *et al*, (2003). *Staph. aureus* appears to show high prevalence rate but for the fact that *E. coli* is also implicated points to the fact that currency notes represent reservoir of enteric pathogens. It was observed that smaller unit notes harboured more organisms than higher units, this is probably because the lower unit notes are more frequently handled by petty traders. Similarly dirty and tattered notes were more contaminated than new mints since they have been in use and often stick together with bits of sticky tape on them as observed by Siddique (2003). Money also get contaminated due to poor handling when working with food or when dressing wounds and skin lesion as found out by Hadwen *et al* (2003). Money most times get contaminated because of the practice of licking or applying saliva to the fingers while counting paper money and in most cases market women save money in their dirty brazier (self central bank) while in the market. All these are worth mentioning as they served as important potential route and means of transmission of pathogens.

CONCLUSION

To minimize the hazard associated with dirty and contaminated notes, good practice should be followed in handling money as done all over the world. The practice of arranging and keeping money in wallets should be encouraged and if possible, legislation should be put in place in this regard. As a way forward Nigerian currency notes should be disinfected and dirty and tattered money be withdrawn from circulation regularly by federal authorities. Also the importance of personal/basic hygiene in terms of hand washing after eating and after using the toilet should be made mandatory.

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