Influence of Job Occupation on the Bacterial Contamination of Currency Notes in Circulation

Askira M. Umoru[1], Muhammad M. Ibrahim[2], Isyaka M. Tom[3], Jidda B. Umar[4], Abdullahi Aliyu[5]

[*1]Department of Medical Laboratory Science, University of Maiduguri, Nigeria
[2]Department of Microbiology University of Maiduguri, Nigeria
[3]Department of Medical Microbiology, University of Maiduguri, Nigeria
[4]Department of Medical Microbiology, University of Maiduguri Teaching Hospital, Nigeria
[5]Department of Biological Sciences, Abubakar Tafawa Balewa University, Nigeria

Correspondence author's email: mnistyle [AT] yahoo.com

_____

ABSTRACT--- *Analysis of the role played by different job occupations in relation to bacterial contamination of currency notes in circulation was conducted at the University of Maiduguri main campus from March 2014 to April 2014. The study was aimed at identifying the extent of contamination of the notes in circulation, and to determine if job occupation has an influence in the bacterial contamination of currency notes, which serve as a medium of exchange. A total of 108 samples of the Nigerian currency note (Naira: N) of the following denominations; N5, N10, N20, N50, N100 and N200, were randomly collected from six (6) occupational groups namely: Fish/Meat sellers, Restaurant operators, Traders, Taxi drivers, Students and Banks. Samples were processed for bacterial isolation. 29 out of 108 samples yielded bacterial growth which gives a total recovery rate of 27%. Currency note with the highest contamination was N50 (24.1%), followed by N10 (17.2%), N100 (17.2%), N200 (17.2%), N20 (14%) and N5 (10.3%). Organisms isolated from the currency notes in descending order of prevalence include Staphylococcus spp (24.1%), Streptococcus spp (24.1%), Escherichia coli (17.2%), Klebsiella spp (13.8%), Enterobacter spp (10.3%), Pseudomonas spp (3.45%), Coliform bacteria (3.45%), and Candida spp (3.45%). Occupational group with the highest currency note contamination rate was Restaurant operators (31%), followed by Traders (24%), Fish/Meat sellers (21%), Taxi drivers (14%), Bank (7%) and Students (3%). N50 note collected from restaurant operators recorded the highest contamination rate of 14%. A significant relationship has been observed between occupation and level of contamination. We advocate that proper standards of hygiene should be observed to avoid contamination, and onward transmission of these pathogens.*

Keywords--- Contamination, Currency, Occupation, Nigeria.
_____

1. INTRODUCTION

Paper currency serves as a means of exchange for goods and services in most countries worldwide. It is usually present in various denominations with the lower denominations most often involved in retail business transactions, as such, being the most circulated. The constant circulation of currency notes from one individual to another may lead to deformation, discoloration or damage to the currency notes. But one important effect of such circulation is the risk of transmission of potentially pathogenic bacteria across a population.

The possibility that currency notes might act as environmental intermediary for the transmission of potentially pathogenic micro-organisms had been established 4 decades ago (Abrams and Waterman 1972). The ability of micro-organisms to survive on paper currency and coins indicates that this could represent a potential cause of sporadic cases of food borne illness and represents an often overlooked enteric disease reservoir (Barry 2002). Micro-organisms may be transmitted directly through hand-to-hand contact, or indirectly via food or inanimate objects. These routes of transmission are of public health importance, most especially in developing countries, where the frequency of infection is a general indication of local hygiene and environmental sanitation.

Without established standards of hygiene, human occupational activities, especially those that involve immediate exchange of goods/services with currency notes could introduce the risk of bacterial transmission from one individual (buyer) to another (seller). Although paper money is impregnated with disinfectants to limit the growth of bacteria, potentially pathogenic bacteria have been isolated from paper currency notes and coins (Khin *et al* 1989).

The culture of poor handling and abuse of currency notes is widely prevalent in Nigeria. Various money handling habits such as keeping currency notes in socks, brassiere, under the carpets or rugs and squeezing in hands is a common practice. Many people tongue-wet their fingers when counting currency notes thereby, contaminating their fingers used to handle or eat food without washing of hands.

Most of the contaminants are members of the skin, oral and nasopharyngeal flora. However, some of them (such as *S. aureus, P. aeruginosa*) can be opportunistic pathogens. This point to the fact that currency notes could serve as fomites for the transmission of infectious agents. The objective of our study was aimed at identifying the various bacterial contaminants present on currency notes in circulation, and to determine if there is a relationship between job occupation and the contamination of the currency notes in Maiduguri.

2. MATERIALS AND METHODS

Study Area

Maiduguri, a city located in the north -eastern part of Nigeria, lies within latitude 11.15 °N and longitude 30.05 °E in the sudano-sahelian savanna zone with a dense population that are mostly crop farmers, fishermen, herdsmen and traders (Udo 1978). It is a city with a rich cultural heritage and a home to the kanem Borno Empire.

Sampling Technique

A total of 108 samples of the Nigerian currency (The Naira) comprising notes of six denominations (N5, N10, N20, N50, N100, N200) were collected from six different occupational groups namely; Traders, Restaurant operators, Drivers, Fish/Meat sellers, Students, and Bank workers. Random method of sampling was adopted. The appearance of the notes was grouped into Mint, Clean and Dirty/Mutilated. 3 samples per denomination were collected, which gives a total of 18 samples per occupational group. The samples were collected in a sterile polythene bags using sterile gloves.

Sample Processing

The general appearance of the notes was observed. Each sample was placed in a 25ml test tube aseptically, containing 10ml of normal saline. It is then shaken and allowed to stand for 10 minutes. The tube is shaken for the last time and the samples removed aseptically, using sterile forceps. The remaining solvent is used for the identification of contaminating bacteria (Benson 1994).

Bacterial identification

Gram stain was conducted as a preliminary test. The samples were cultured on Nutrient Agar, Blood Agar, and MacConkey Agar, which were incubated aerobically and, Chocolate Agar anaerobically. Further biochemical tests conducted include sugars reaction, voges-proskauer reaction, Methyl red test, citrate utilization test, catalase test, coagulase test, oxidase test, indole test and urease test. (Cheesbrough 2009).

RESULTS

29 samples out of 108 yielded bacterial growth, which gives a total recovery rate of 27%. Currency note with the highest contamination was N50 (24.1%), followed by N10 (17.2%), N100 (17.2%), N200 (17.2%), N20 (14%) and N5 (10.3%) (Table 1).

Table 1: Rate of contamination of notes obtained from the various occupational groups

OCCUPATIONAL GROUPS	CURRENCY DENOMINATIONS					
	N5 (%)	N10 (%)	N20 (%)	N50 (%)	N100 (%)	N200(%)
Fish/Meat seller	3.448	3.448	-	6.896	3.448	3.448
Traders	3.448	3.448	6.896	-	6.896	3.448
Restaurant	-	3.448	3.448	13.79	3.448	6.896
Taxi drivers	3.448	3.448	-	3.448	3.448	-
Bank	-	3.448	-	-	-	3.448
Students	-	-	3.448	-	-	-
Total	**10.34%**	**17.24%**	**13.79%**	**24.13%**	**17.24%**	**17.24%**

The most prevalent organisms isolated from the currency notes are *Staphylococcus aureus* (24.1%) and *Streptococcus spp* (24.1%), followed by *E. coli* (17.3%), *Klebsiella* spp (13.8%), *Enterobacter spp* (10.4%), *Pseudomonas spp* (3.45%), *Coliform bacteria* (3.45%) and *Candida spp* (3.45%). (Table 2).

Table 2: Percentage occurrence of isolates on the various denominations of the Nigerian Naira notes

Denomi-nations	(%)Staph Aureus	(%)E.coli	(%)Kleb siella	(%)Strepto coccus	(%)Entero bacter	(%)Pseudo monas	(%)Coli form	(%)Can-dida
N5	10.34	-	-	-	-	-	-	-
N10	-	6.896	-	10.34	-	-	-	-
N20	-	-	-	3.448	-	3.448	3.448	3.448
N50	3.448	3.448	10.34	-	6.896	-	-	-
N100	6.896	6.896	3.448 -	-	-	-	-	-
N200	3.448	-		10.34	3.448	-	-	-
			13.78%					
Total	**24.13%**	**17.33%**		**24.13%**	**10.34%**	**3.448%**	**3.448%**	**3.448%**

The highest currency note contamination among occupational groups was obtained from Restaurant operators (31%), followed by Traders (24%), Fish/meat sellers (21%), Taxi drivers (14%), Bank (7%) and Students (3%) (Table 3).

Table 3: Percentage occurrence of isolates from different occupational groups

| Occupational Groups	(%)Staph Aureus	(%)E.coli	(%)Kleb-siella	(%)Strepto coccus	(%)Entero bacter	(%)Pseudo monas	(%)Coli form	(%)Can dida
Traders	6.896	6.896	-	3.448	-	3.448	3.448	-
Restaurant	6.896	3.448	6.896	6.896	6.896	-	-	-
Taxi drivers	3.448	3.448	3.448	3.448	-	-	-	-
Bank	-	-	-	3.448	3.448	-	-	-
Students	-	-	-	-	-	-	-	3.448
Fish/Meat sellers	6.896	3.448	3.448	6.896	-	-	-	-
Total	**24.13%**	**17.24%**	**13.79%**	**24.13%**	**10.34%**	**3.448%**	**3.448%**	**3.448%**

3. DISCUSSION

The recovery of bacterial contaminants from currency notes in this study confirmed the fact that currency notes might serve as a vehicle of transmission of pathogenic bacteria across a population. All the denominations sampled were contaminated with varying levels of bacterial contaminants. N50 note has the highest level of contamination while N5 note has the least. This is unconnected with the fact that N50 is the most abundant note in circulation since the 50 years independence celebration in the year 2010. The poor economic situation in Nigeria has led to the devaluation of the Naira to the extent that higher denominations have suddenly become available at all levels of business transactions. This led to a decline in the use of N5 note. As a result it became the least circulated, the least contaminated.

Staphylococcus aureus and *Streptococcus spp* represent the most prevalent organisms isolated. This is in agreement with the findings of Janardan (2009). These two bacterial species are known to have developed resistance to conventional antibiotics (W.H.O 2000), as such; infection with these organisms could be difficult to treat.

Although *Enterobacter spp* and *E. coli* could sometimes be described as non pathogenic or opportunistic pathogens, some strains could cause serious food poisoning and urinary tract infections. *Pseudomonas spp*, *Coliform bacteria* and *Candida spp* represent the least isolated organisms. *Coliform bacteria* are indicators of faecal pollution whereas *Candida spp* are implicated in the etiology of the various forms of candidiasis. It is the only organism isolated from notes obtained from students.

Figure 1: A chart illustrating the percentage contamination of the various currency notes with respect to occupational groups from which they were collected.
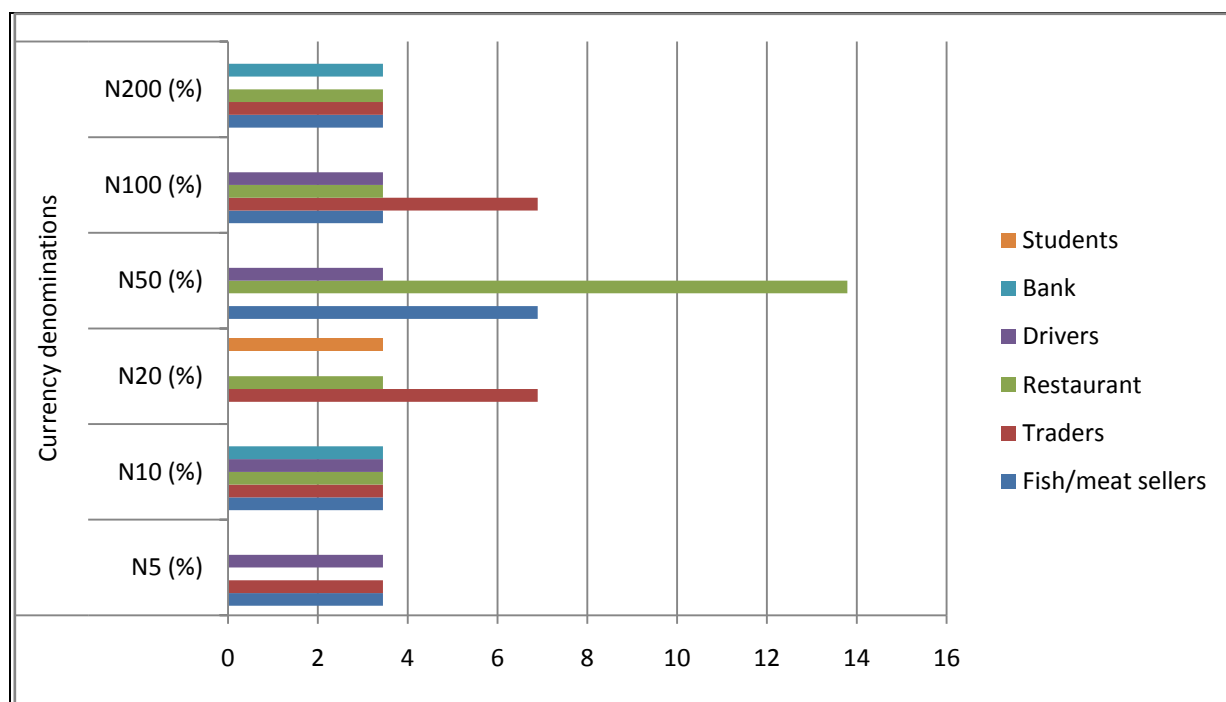
A significant association has been established between contamination and occupation, which serve as source of currency notes. The highest level of contamination was found to be among restaurant operators. This is correlates with the findings of FSA (2000). The least contaminated currencies are those collected from students.

Currency contamination by potentially pathogenic bacteria could pose a serious public health risk to communities, as it could serve as a medium for the transmission of such organisms across a population. It was observed that during food vending operations, the same hand alternatively served and held food and money respectively (Barro et al, 2006). These routes of transmission are of great importance in the health of many populations in developing countries, where the rate of infection is directly proportional to local hygiene and environmental sanitation. Strict adherence to personal hygiene as well as the use of food handling tools between handling money and serving food is advocated as a means of limiting the contamination of currency notes in circulation.

4. REFERENCES

1. Abrams B.L and Waterman N.G. (1972). 'Dirty Money'. *Journal of American Medical Association.* **219**: 1202-1203.
2. Barro N, Nikiema P, Outtara C.A.T, Ilboudo A. J and Traore A.S. (2006). 'Hygienic status and assessment of dish washing waters, utensils, hands and pieces of money from sreet food processing sites in Ouagadougou (Burkina Faso). *African Journal of Biotechnology.* **5(10)**:1107-1112.
3. Barry A.M. (2002). 'Handling money and serving ready-to-eat food. *Food Service Technology.* **2:** 1-3.
4. Benson H. J. (1994). *A laboratory Manual in General Microbiology.* (6th edition). Wm C. Brown Company Publishers, Dubuque Lowa.
5. Cheesbrough, M. (2009). *District laboratory practice in tropical countries*, Part 2. Cambridge University Press, Cambridge, UK.
6. Food Science Australia (FSA). (2000). Money handling in food service operations. *Food Safety and Hygiene*. A bulletin for the Australian Food Industry.
7. Janardan L, Satish S, Prson G, Rajani M and Bishal D. (2009). 'Risk of Handling Paper Currency in Circulation, Chances of Potential Bacterial Transmittance'. *Nepal Journal of Science and Technoogy.* **10:** 161-166.
8. Khin, N.O., P.W. Phyu, M.H. Aung and T. Aye, (1989). Contamination of currency notes with enteric bacterial pathogens. J. Diarrhoeal. Dis. Res., 7: 92-94
9. Udo, R.K. (1978). *A comprehensive geography of West Africa.* 1st ed. Heinemann Educational Books Nig. Ltd. 304 pp.
10. W.H.O. 2000. Overcoming antimicrobial resistance. *Report on infectious diseases*.World Health Organisation.