Nigerian Veterinary Journal
Vol 34 (1) 726-735

Evaluation of Microbial Contaminants and Antibiogram of Nigerian Paper Currency Notes (Naira) in Circulation in Gwagwalada, Abuja, Nigeria.

MAILAFIA, S. *[1], MICHAEL, O. [2] and KWAJA, E. [3]

[1]Department of Veterinary Microbiology, Faculty of Veterinary Medicine, University of Abuja, Nigeria, [2]Department of Biological Sciences, University of Abuja, Nigeria, [3] Faculty of Veterinary Medicine, University of Abuja.
*Corresponding Author: smailafia@gmail.com

ABSTRACT

A total of 160 mutilated Naira notes of 8 different denominations were randomly sampled from different occupational groups in Gwagwalada and analyzed for the presence of pathogenic microorganisms, which were subsequently screened for their antibiotic resistance status. The results revealed highest prevalence for Bacillus species (27.1%), Streptococcus species was seconded with prevalence of (18.8%), Staphylococcus species was (5.1%), and Clostridium species (1.9%) while E. coli was least (1.4%). Contamination based on the occupational groups was higher for the meat and fish sellers than the other groups. Bacterial counts for the different denominations revealed highest counts for N5 notes (1.59×10^5) and lowest count was for N1000 notes (1.43×10^2). Statistical findings indicated the level of association between naira notes and contamination of microorganisms. Susceptibility studies revealed that Staphylococcus and Streptococcus isolates were all resistant to all the six antimicrobial agents used; while Bacillus species and E. coli were susceptible to tetracycline and penicillin but were resistant to Ampicillin, Streptomycin, Gentamicin and Erythromycin. The Clostridium species were susceptible to Erythromycin but resistant to other drugs used. Our study suggested that the Nigerian paper currency is contaminated with pathogenic microorganisms which could be involved in the transmission of diseases such as meningitis, diarrhea, respiratory syndromes and skin infections. It is important to routinely screen our currency notes for microorganisms and determine their susceptibility to commonly used antimicrobial agents. This is necessary to safeguard public health and control the likelihood of spread of disease to man.

KEY WORDS: Contaminants, Antibiogram, Naira, Evaluation.

INTRODUCTION

The Naira note is the official legal tender of the Federal Republic of Nigeria, issued and regulated by the Central Bank of Nigeria (CBN). According to the CBN act, the expected life span of the naira notes in circulation is about 24 months but the mishandling practices resulting in abuse of the naira notes reduces this to less than 6 months (Awodi *et al.*, 2000). The constant mutilation of the currency usually results in, structural deformation, disfiguring, and for most of the time it gets dirty, chalky, dusty, inky, oily, or wetly. These notes when poorly handled or saved, may lead to cross contamination by pathogenic zoonotic bacteria, fungus or other parasitic infectious agents (Okon, *et al.*, 2003 and Matur, *et al.*, 2010).

The abuse of the Nigerian currency became an issue of public health concern in recent times and this motivated the CBN to embark on a nationwide enlightenment campaign aimed at educating the public on the proper ways of handling its national currency (Ameh and Balogun, 1997). Studies from other parts of the world such as Egypt, Sudan, Niger republic, Bangladesh, Ghana and Saudi Arabia have also indicated that bank notes offers larger surface area for breeding of pathogenic microbes, resulting in the presence of high load of infectious agents, which could cause human diseases such as: tuberculosis, meningitis, pneumonia, tonsillitis, peptic ulcer, renal infections, gastro-intestinal tract infections and severe lung diseases (Feglo and Nkansa, 2010; Ahmed *et al.*, 2010). Contact with the contaminated currency notes could also cause diarrhea and urinary tract infections besides skin burn and septicemic infections (Awe *et al.*, 2010).

Currently, there are eight denominations of the naira in paper form for use in Nigeria including: N5, N10, N20, N50, N100, N200, N500 and N1,000 notes. The smaller denominations such as N5, N10, N20, N50 and N100, N200 are more frequently found in circulation, and are usually engaged in daily cash transactions by larger percentage of Nigerians, whereas, the higher denominations like the N500 and N1000 notes are restricted in use by the wealthy individuals and corporate bodies (Okon *et al.*, 2003).

The transmission of the infectious agents to the notes can be through contact with dust, soil, water, skin, mucus membranes or via saliva especially when counting the notes and sometimes through open wounds which could disseminate micro-flora from the body of handlers to the susceptible hosts (Awe *et al.*, 2010). Some bad money handling habits such as keeping naira notes in brassiere, socks and pockets or under the carpet or rugs and squeezing it with the hand may frequently introduce microbes to the notes (Awe *et al.*, 2010).The survival of microorganisms on money and their transmission via the hands of food vendors is often overlooked. Pathogenic microorganisms that survive on Nigerian currency notes may serve as potential source of entero pathogens causing food poisoning. Bad money handling practices by food vendors and allied professionals may transfer bacteria from currency notes to humans through food chain (Feglo and Nkansali, 2010).

There is a dearth of information on the microbial contamination of the naira currency, particularly the paper currencies in Nigeria. This research is therefore conducted to add knowledge to the limited body of literature on microbial diversity of naira notes and to emphasize on the antimicrobial properties of the isolates to enhance effective control and prevention of spread of the infectious agents found in Nigeria paper currency notes.

MATERIALS AND METHODS

Study Area

This study was carried out in Gwagwalada, FCT, Abuja between January- June, 2011. Gwagwalada Local government development council is one of the five area councils of the

FCT located in the north central of Abuja metropolis and lies between latitude 8° to 9°N and between longitudes 7° to 8°E, the town has a total land area of 1,043km. Average temperature is between 27°C – 32°C, with an estimated population of about 580,000 inhabitants (NPC, 2006). It is referred to as the industrial zone of the FCT because it houses the production of major agricultural produce such as yam, cassava, maize, millet and guinea corn.

Table I: Physical Condition of Paper Currency Of Nigeria Collected From Different Occupational Groups

Naira (N) Denomination	New	Moderate	Old	Dirty	Torn	Total
5	2	4	6	8	10	30
10	2	3	4	5	8	23
20	2	3	4	5	6	20
50	2	3	3	5	6	19
100	2	3	3	4	5	17
200	2	3	4	4	5	18
500	2	3	3	4	5	17
1,000	2	3	3	4	4	16
Total	**16**	**25**	**30**	**40**	**49**	**160**

Physical Conditions of the Naira Denomination at Collection

A total of 160 samples of all the eight available denominations of the Nigerian currency paper notes were randomly from: Fish sellers, Meat sellers, Vegetable sellers, Food vendors, Okada riders, Taxi drivers, Office workers, Students and Beggars. Corresponding minted notes obtained from the Central Bank of Nigeria, Abuja served as control. The currencies were observed to have been in circulation from 2 – 8 years (2002 – 2010). The paper currency notes were graded using physical condition, appearance and degree of dirtiness as new, moderate, wrinkled, odorous, dirty, fairly dirty and torn as shown on Table I.

Sample Collection

Table I: Physical Condition of Paper Currency Of Nigeria Collected From Different Occupational Groups

N a i r a (N)
DenominationNewModerateOldDirtyTornTotal5246810
30102345823202345620502335619100233451720023
4451850023345171,0002334416**Total1625304049160**

A total of one hundred and sixty (160) paper currencies were randomly collected from persons representing each occupational categories of interest namely: Fish sellers, Meat sellers, Vegetable sellers, Food vendors, Okada riders, Taxi drivers, Office workers and Beggars. To collect the paper money, the individual was requested to drop the paper money onto a plastic sterile packet. The packet was promptly sealed and the individual was given a replacement paper money. The packets were immediately transported to the Microbiology Laboratory of the University of Abuja Teaching Hospital for analysis.

Qualitative Bacterial Analysis

This was done according to the method of Shakir *et al.* (2010) and Cheesborough, (1992). Each paper money was placed in 100ml of sterile nutrient broth and incubated for 6 – 8 hours at 37°C. Thereafter, the broth cultures were plated on both selective and differential media namely: Lactose broth, Peptone water, Nutrient agar, Eosin Methylene Blue Agar, Xylose Lysine Deoxycholate agar, blood Agar, mannitol salt agar, MaCconkey Agar, Salmonella Shigella Agar, Cetrimide agar, Bairel parker agar, Bismuth sulfite agar. The plates were incubated at 35°C – 37°C overnight. Bacterial colonies in each medium were then characterized on the bases of colonial, cellular morphology, staining and biochemical characteristics using standard microbiological techniques (Cheesborough, 1992).

Determination of Bacterial Load

This was done according to the methods adopted by Feglo and Nkansali (2010). Sterile forceps were used to transfer the currency aseptically into a sterile universal bottle was capped and shaken vigorously by hand for about 2min to dislodge the microorganisms into the fluid. The resulting fluid (Buffered peptone water) served as the test sample, whilst the currency note was removed aseptically

from the universal bottle with a sterile forceps, rinsed with water and dried to recover the note.

Serial doubling dilutions were prepared from the test samples as shown thus: 1:10, $1:10^2$, $1:10^3$..... 1:10. This was done by transferring dispensed 1ml aliquot transferred into the test-tube using a micropipette. Starting with the highest dilution 0.1ml of the test dilution (after agitation) was dispensed onto plate count agar also called PCA (Oxoid LTD, Basingstoke, Hampshire, England) plates in duplicate. The inoculums were spread evenly over the entire surface of the PCA using a sterile bent spreader. All plates were inculcated at 37^0C, aerobically in an incubator overnight. After overnight incubation, all colonies on the plates containing 30 – 300 colonies were counted from the duplicate plates and the mean counts determined.

Antimicrobial Susceptibility Test

Nutrient broth was prepared and 5mls were dispensed unto 30 test tubes. The test-tubes were autoclaved at 121^0 C for 15 minutes after which the test tubes were labeled with the corresponding bacterial isolates on the nutrient agar slant in bijou bottles. A sterile Pasteur's loop was used to scoop each organism from the bijou bottles in order to inoculate it into the test-tubes. The test-tubes were incubated at 37^0 C for 24 hrs. Mueller Hinton agar was prepared and autoclaved at 121^0 C for 15 minutes after which it was poured into 50 sterile Petri dishes and allowed to solidify. The Petri dishes were adequately labeled with the corresponding bacterial isolates on the nutrient agar slants in the bijou bottles. Sterile swabs were put inside each of the test tubes in order to stir the solution and it was used to spread the organism on the Petri dishes.

The antibiotic sensitivity was conducted with each of the disks manufactured by Jireh laboratories (Nigeria) with lot No. 0120 containing: Tetracycline (T, 15mcg), Ampicillin (Amp, 5mcg), streptomycin (S, 10mcg), gentamicin (CN, 10mcg), erythromycin (E, 5mcg) and penicillin (P, 25Mcg); was conducted by the disk diffusion method as described by Mackie and McCartney (1989) The invested plates were incubated at 37^0 C for 16 to 18 hrs. A millimeter ruler was used to measure the zones of inhibition and the distance in millimeter from the edge of the disk to the zone edge. According to the measurement of the zone size; the categories of sensitivity were; Sensitive: zone size of the test strain measured greater than 14 mm; Resistant: the zone size of the test strain measured is equal to 11 mm or less; and intermediate: the zone size of inhibition is between 12 – 13 mm.

TABLE II: Percentage prevalence of microorganisms of Nigerian paper currency from different occupational groups (Total Sample = 160)

Denomination (Naira)	*Bacillus* species	*Streptococcus* species	*Staphylococcus* species	*Clostridium* species	*E. coli* species
5(n – 30)	26.66	72.00	74.46	21.33	85.33
10(n = 23)	27.82	69.60	62.60	20.86	69.56
20(n = 20)	24.00	64.00	84.21	16	67.36
50(n = 19)	16.84	26.31	50.52	8.42	58.94
100(n = 17)	18.82	37.64	56.47	0.00	47.05
200(n = 18)	17.77	35.55	17.77	0.00	44.44
500(n = 17)	9.41	0.00	9.41	0.00	18.82
1000(n = 16)	10.00	0.00	0.00	0.00	10.00
Total frequency among All denominations	12.5%	28.75%	29.37%	6.25%	33.75 %

n = number of samples per denomination

X^2 =(62.63; df=7.5, P< 0.05)

STATISTICAL ANALYSIS

All the values were expressed as mean ± standard deviation while analysis of Chi square (X^2) was used to analyze the extent of variation between groups and P values s≤ 0.5 were considered significant (Mead and Currow, 1982). Graphed instant 3.0 for windows USA@ computer soft ware was used to analyzed the data

The findings of the present study were shown

on Tables 1 – 5. One hundred and sixty samples consisting 30 from N5 note, 23 from N10 note, 20 from N20 note, 19 from N50 note, 17 from N100 note 18 from N200 note, 17 from N500 note and 16 from N1,000 note, were examined for the presence of microorganisms that contaminated the Nigerian currency notes (Table 1). The percentage prevalence was highest for *E. coli* (33.75%), followed by *Staphylococcus* species (29.37%), *streptococcus* species (28.75%) and *Bacillus* species (12.5%) and *Clostridium* species (6.25%) in that descending order. Statistical analysis showed the level of association between the various Naira denomination and bacterial contamination was significant (X^2= 40.05; df=7.5) and (X^2=62.63, df=7.5; P<0.05); (Table II).

The average bacterial counts of the isolates was highest 1.59×10^5 for N5 note, Others included: 6.32×10^4 for N10 note, 1.27×10^5 CFU/ml for N100 note, 8.34×10^4 /ml for N50 note, 7.52×10^4 CFU/ml for N20 note, 9.19×10^3 CFU/ml for N200 note, 3.29×10^2 CFU/ml for N500 and 1.43×10^2 CFU/ml for N1000 note (Table V).

The results of the percentage of occurrence of the different isolates from nine different occupational groups showed that *Bacillus* species and *E. coli* were more prevalent in meat sellers with bacterial load of 70 and 90% respectively. This was followed by fish sellers which had 80% *E. coli*, 70% *Staphylococcus*, and 60% *Bacillus*. Beggars had 80% *E. coli* while Okada riders, taxi drivers, students and office workers had prevalence rate ranging

TABLE III: Percentage occurrence of different isolates from different Occupational Groups

Occupational group	*Bacillus* species %	*Streptococcus* species %	*Staphylococcus* species %	*Clostridium* species %	*Escherichia coli* %
Fish sellers (n – 10)	60.00	50.00	70.00	20.00	80.00
Meat sellers (n = 10)	70.00	40.00	60.00	40.00	90.00
Vegetable sellers (n=10)	0.00	0.00	10.00	10.00	70.00
Food vendors (n = 10)	10.00	10.00	40.00	0.00	60.00
Okada riders (n=10)	0.00	10.00	40.00	0.00	20.00
Taxi drivers (n=10)	0.00	10.00	40.00	0.00	20.00
Office workers (n=10)	0.00	0.00	0.00	0.00	10.00
Students (n = 15)	0.00	10.00	20.00	0.00	50.00
Beggars (n = 15)	20.00	40.00	30.00	20.00	80.00

n = number of sample

Table IV: Antibiotic susceptibility of bacterial isolates from Nigerian currency notes

Antibiotic concentration	*Staphylococcus* species	*Bacillus* species	*Clostridium* species	*E. coli* species	*Strep.* species
Tetracycline	R	S	R	R	R
Ampicillin	R	R	R	S	R
Streptomycin	R	R	R	S	R
Gentamicin	R	R	R	S	R
Erythromycin	R	R	S	S	R
Penicillin	R	S	R	R	R

Table V: Average bacteria count of different denominations of the Naira

Denomination (₦)	Number examined	Bacterial counts (CFU/ml)
1000	10	1.43×10^2
500	10	3.29×10^2
200	10	9.19×10^3
100	10	1.27×10^5
50	10	8.34×10^4
20	10	7.52×10^4
10	10	6.32×10^4
5	10	1.59×10^5

Staphylococcus and *Streptococcus* isolates tested for antibacterial properties were all resistant to the six antimicrobial agents used; while *Bacillus* species and *E. coli* were susceptible to tetracycline and penicillin but were resistant to Amphicillin, Streptomycin Gentamicin and Erythromycin. The *Clostridium* species were susceptible to erythromycin but resistant to other drugs used (Table IV).

DISCUSSION

The prevalence of pathogenic microorganisms isolated from the Nigerian paper currency notes from N5 to N1,000 from different occupational groups showed that the currency denominations were contaminated with microorganisms. The N500 and N1,000 (higher denominations) had lower prevalence than the other denominations like N5, N10, N20, N50, N100 and N200. These lower denominations of currency are often used on routine daily basis, covering wide range of petty transactions. They are therefore more highly contaminated than the higher denominations. Moreover, the smaller denominations are more abused and are often mal-handled hence, rendering the currency tattered and dirty and are more likely to be exposed to risk of being contaminated (Oshim *et al.*, 1996).

Our results concur with the findings of Umeh *et al.* (2007) and Ahmed *et al.*, 2010, which in their study isolated *E. coli* at 80% prevalence with lower prevalence for *Streptococcus* species (31.8%) and *Staphylococcus*, (18.2%). Based on the level of contamination by these microorganisms in the different occupational groups, fish sellers, meat sellers were highly contaminated with *E. coli* (80%), while *Bacillus* (0%) and *Staphylococcus* species (0%) had no contaminations. Awe *et al.* (2010) reported *E. coli, Staphylococcus* species *Bacillus* species, *Clostridium* species and *Streptococcus* species to have been involved in food poisoning. Efforts should therefore be intensified to ensure proper preparation, handling and processing of food before consumption (Selman *et al.*, 1987; Liang and Doyle, 1999). This finding could be attributed to cross-contamination between fecal samples or visceral of animals often at times during processing, slaughter and dressing of animal carcasses for human consumption. Contamination could also be from open wounds and skin abrasions leading to invasion by infectious agents.

Our study indicated that the highest level of contamination was observed from fish sellers, meat sellers and beggars. *Clostridium* species were highly contaminated from currency notes in fish sellers, meat sellers, vegetable sellers and beggars, this is in contradiction with the findings of Feglo and Nkansa, (2010) in Ghana. Since *Clostridium* organisms are known to survive in soil and open wounds, environmental factors could facilitate its preponderance from beggars. This could be a possibility and could provide vehicle for its dissemination. The paper money recovered from Okada riders, taxi drivers and office workers have lower level of contamination with the microorganism. Probably, the low level of education amongst these groups necessitates the lack of attention to hygienic practices, during exchange of the naira notes to reduce contact with foods like fish, meat, vegetables or other sources of infection. The exchange of notes by the same people could reduce the rate of contamination of the naira by pathogenic bacteria. Students and office workers have higher level of education and are more likely to maintain higher hygienic measures which may render the notes less exposed to microbial contamination.

Most of the bacteria encountered in this study are members of the normal flora of humans. This further suggests that humans could be the major source of bacteria contamination through poor handling of naira notes. Individuals handling the notes could shed their

body flora to the paper currency notes. These organisms have been implicated in to cause serious health hazard in man including diarrhea, meningitis, skin infections and respiratory syndromes which could cause impairment of body function and hence, death (Oshim, 1996). The currencies could have been colonized when placed in areas where they have direct contact with the skin, since the skin harbors a complex ecosystem of organisms, which could be transient or resident. Pathogenic *Staphylococci* could be harbored either by asymptomatic carriers or person with a disease. The organism can be spread by the hands or expelled from the respiratory tract to susceptible individuals. The *Staphylococci* and *Streptococci* species are natural inhabitants of the animal body, which could be the source of those found elsewhere. As saprophytes, *Staphylococci* are ubiquitous, being found and normal skin and in the nose, mouth and intestine as well as air, water, milk, sewage and on formites. The presence of *Staphylococcus* species on Nigerian paper currency has been due to skin to skin contact from a skin flake (Ahmed *et al.*, 2010). Infections could occur when *Staphylococci* organisms enter the body through breaks, cuts, bruises and abrasions in the skin (Jiang and Doyle, 1999). These are routine unwholesome practice common to the Nigerian situation.

Bacillus species are a vast group of hardy spore forming bacteria that live in the soil and are found in the environment. The organism could be transferred to the currency notes as a result of poor storage regime such as under the carpets, burial in the soil, under the bed or dirty surfaces or handling using dirty hands. *Bacillus* species are known to produce an emetic serotoxins capable of inducing disease in man (Pomerayer and Gaylard, 2000). Therefore, the Nigerian paper currency could play an important role in the pathogenesis of several diseases including Anthrax in man.

Enteric pathogens such as *E. coli* which could be responsible for diarrhogenic symptoms (Awe *et al.*, 2010). These organisms were isolated from our paper currency notes obtained from fish sellers, and meat sellers. Some strains of *E.coli* could survive for up to two weeks on surfaces of paper currency notes hence the possibility of transfer of infectious disease to man (Awe *et al.*, 2010). Our finding clearly suggests that the Nigerian currency notes carry substantive load of enteric pathogens. It goes a long way to reveal the poor sanitary conditions in which meat and fish products are processed in Nigeria. Cross-contamination from fish or meat to man is via the paper currency note is therefore possible. Adequate hygiene of the environment and facilities for meat processing is therefore necessary for use in Nigeria.

The overall mean viable count on the currency notes ranged 1.59×10^5 CFU/ml and 1.42×10^2 CFU/ml. The lower denominations showed the higher average mean viable count of than the higher denominations. This implies that contamination is higher in lower denominations which are the more commonly used in daily cash transactions. Our findings concur with Okon *et al.* (2003), but there is significant association in the levels of contamination between the notes ($P<0.5$). Currency notes are therefore possible vehicles through which infectious agents could be transferred to humans (Lamichane *et al.*, 2009).

In situations by which humans are infected by these pathogens, therapeutic measures are always attempted to treat or control the spread of infections by the use of different antibiotics. It is therefore significant to carry out antimicrobial bioassay to determine the properties of the agents that could be useful in managing the infections. The implication of this finding is that these antibiotics are being misused, probably because they can be easily accessed over the counter in the medicine stores or from drug hawkers across the streets, without adequate regulation or medical

prescription. This results in rampant use and misuse of these useful antimicrobial agents which results in subsequent resistance to such drugs especially in the human population.

CONCLUSION AND RECOMMENDATION

Our study clearly demonstrates that the Nigerian paper currencies are contaminated with pathogenic bacteria. Poor handling of such paper currencies may play a significant role in the transmission of diseases to man. Antimicrobial studies also revealed that these organisms are also resistant to commonly used antimicrobial agents. This further strengthens possibility of rampant use and misuse of these useful antimicrobial agents in the human population. It is therefore recommended that people should be educated to adhere to strict personal hygiene whenever they have contact with money. Further studies should involve proper regulation and molecular diagnoses of infections to further reveal the true extent of emerging strains of bacteria involved in Nigerian paper currency contamination.

REFERENCES

AHMED, M.C.U, PARVEEN, S., NASREEN, T. and FEROZA, B. (2010): Evaluation of the Microbial contamination of Bangladesh paper currency notes (Taka) in circulation. Journal of Advances in Biological Research **4** (5): 266 – 271.

AMEH, J.B. and BALOGUN, Y.O. (1997): The health implications of microbial load of abused Naira notes. *The spectrum* **4**:138-140

AWE, S., ENIOLA, T., OJO, F.T. and SANI, A. (2010): Bacteriological quality of some Nigerian currencies in circulation. *African Journal of Microbiology Research.* Vol. **4** (21), pp. 2231 – 2234.

AWODI, N.O., NOCK, I.H. and AKENÓVA, I. (2000): Prevalence and public health significance of parasitic cysts and eggs on the Nigerian currency. *Nigerian Journal of Parasitology,* 22: 137- 142

CHEESBOROUGH, M. (1992): Medical Laboratory Manual for Tropical countries. 2nd ed. University Press Cambridge Part I: 200-357.

FEGLO, P. and NKANSALI, M. (2010): Bacteriological Load on Ghanaian currency notes. *African Journal of Microbiological Research* **4**(22)2375-2380.

JIANG, X. and DOYLE, M.P. (1999): Fate of *Escherichia coli* 0157: 47 and *Salmonella enteritidis* on currency notes. *Journal of Food Protozoan,* **62** (7): 805 – 807.

LAMICHANE, J., ADHIKARY, S., GAUTAM, P., MAHARJAN, R. and DHAKAL, B. (2009): Risk handling of paper currency in circulation chances of potential bacterial transmittance. *Nepal Journal of Science and Technology.* **10**:161 – 166.

MACKIE, A.O. and MACARTNEY,C. (1989): *Practical Medical Microbiology,* (13th Ed.). Longman group, UK. 65-67.

MATUR, B.M., MALANN, Y.D. and EDHOMERIEGUE, Y. (2010): A Survey of parasite cysts, eggs and bacteria on Nigerian currency in FCT, Abuja. *New York Science Journal.* **3**(1). http//www.science pub.med/newyork.

NATIONAL POPULATION COMMISSION, (2006): NPC Results. http//qtsnigeria.com. Page 1-2.

OKON, A.I., AKINLOYE, O., OKOH, O.M. and OLADIPO, A.A. (2003): The Microbiological quality and heavy metal regimes of some dirty currency notes found in a typical Nigerian community, *Science Focus.* **4**:116 – 119.

OSIM, E.E. and ESIN, R.A. (1996): Lung function studies in some Nigerian bank workers. *Central African Journal of Medicine.* **42**(2):43 – 46.

PROMERAYER, R.D.M.C. and GAYLARDE, M. (2000): The influence of temperature on the adhesion of mixed culture of *Staphylococcus aureus* and *Escherichia coli* to Propylene. *Food Microbiology*, **17**: 361 – 365.

SHAKIR, M.D., AHMED, U., PAVEN, S., NASREEN, T. and FEROZA, B. (2010):

Evaluation of microbial contaminants of Bangladesh paper currency notes (Taka) in circulation. *Advances in Biological Research,* **4**(5):266-271.

SELMAN, R., RALIM, S. and SHALES, D.M. (1987): Serious infectious caused by *Bacillus* species. *Journal of Medicine*, 66: 218 – 223.

UMEH, E.U., JUKULU, J.U. and ICHOR, T. (2007): Microbial contaminants of naira notes in circulation. *Research Journal of Environmental Science* 1: 336-339.