ISSN: 2536-7153 SJMLS

Sokoto Journal of Medical Laboratory Science 2024; 9(3): 93 - 98

SJMLS - 9(3) - 009

Determination of Intestinal Parasitic Contamination of Naira Notes in Sokoto Metropolis

Bunza, N.M.*[1], Iduh, M.U.[1], Jibrin, M.[1] and Yusuf, S.[2]
Department of Medical Microbiology, School of Medical Laboratory Sciences, Usmanu Danfodiyo University, Sokoto, Nigeria[1], School of Public Health, University of Witwatersrand, Johannesburg, South Africa[2].
Author for Correspondence*: nuramuhdbunza2@gmail.com/+234-706-088-8501/https://dx.doi.org/10.4314/sokjmls.v9i3.9

Abstract
Money is the most widely handled material throughout the world. It goes through clean and dirty hands and can get contaminated with parasites and pathogens. This study investigated the prevalence of intestinal parasitic contamination of naira notes in Sokoto metropolis. A total of one hundred and sixty (160) samples of Nigerian Naira notes consisting of twenty (20) pieces of each denomination were used for this study. Samples were collected from food vendors, fruits/vegetables sellers, petrol attendants, butchers, and then screened using microscopic technique. Out of the 160 samples examined, 50 (31.3%) were contaminated with parasite species that spread across *Ascaris lumbricoides* 34 (68%), *Entamoeba histolytica* 22 (44%), *Hookworm* 26 (52%), *Balantidium coli* 16 (32%) and Strongyloides stercoralis 11 (22%). The 100 notes (40%) were the most contaminated denomination of the currency examined and naira notes obtained from food vendors were the most contaminated with intestinal parasites. The physical conditions (clean, dirty and very dirty) of all Naira notes accommodate parasites on them, with very dirty notes having the highest prevalence rate of 53.3%. This study showed that the Nigerian currency notes in circulation within Sokoto metropolis are contaminated with five parasite species that are known to be pathogenic to humans. Thus, the handlers of such Naira notes may possibly stand a chance of being infected with the parasites recorded if their hands are not properly washed and sanitized after transactions.
Keywords: Intestinal parasites, Naira notes, Contamination, Sokoto metropolis

Introduction
The Nigerian currency notes of the denominations (5, 10, 20, 50, 100, 200, 500 and 1000) are used as a means of exchange during buying and selling of goods and commodities. In the ancient times, people did not need money for successful daily transactions. In the 1900s, Scientist Alemu began the theory that transmission of money was associated with the transmission of diseases (Alemu, 2014). Due to the numerous functions of currency notes such as payment of debts, buying and selling, deferred payment in economic activities (Prasai *et al.,* 2008). Money is the most widely used and sought-after service on planet earth with the potential of changing from one user to the other so could fuel disease spread and a risk to public health (Neel, 2012). An individual living in unhygienic condition will therefore contaminate the notes and these acts as a vehicle to the next user (Ogba, 2007). Currency is handled by large number of people under a variety of personal and environmental conditions thus increasing the possibility of acting as environmental vehicle for transmission of potential pathogenic organisms. Paper currency provides a large surface area as breeding ground for pathogens (Michael, 2002). Lower denominations of currency are exchanged more than higher denominations because they are frequently handled in petty daily transactions, more widespread and exchangeable between lower economic classes (Michael, 2002). Higher denominations show lesser contamination (Matur *et al.,* 2008). The Nigerian Naira note is a mixture of 75% Cotton and 25% linen). Accumulated data over the last 20 years on microbial status and survival of pathogens on currency notes indicated that they represent a potential cause of food borne diseases (Alemu, 2014).

Parasites that have been observed to be contaminants of the naira notes are mainly of faecal origin (Awodi *et al.,* 2000). The contamination of notes could be from several sources i.e. the atmosphere, storage, usage, handling or production (Matur *et al.,* 2008). Parasites with direct life cycles do not need an intermediate host to infect a new host so can be acquired by direct ingestion of eggs or cyst and this can be from contaminated surfaces like banknotes. Parasites that have been isolated from currency in Nigeria are eggs of worms like *Ascaris lumbricoides, Hookworms, Trichurus trichiura, Enterobius vermicularis, Taenia, Toxocara, Hymenoplepsis nana and dimunuta. (*Awodi *et al.,* 2000). *Cysts of protozoans like Entamoeba histolytica, Giardia lamblia, Balantidium coli and Isospora* have been recovered so also flagellates, lice and mites (Matur *et al.,* 2010, Orji *et al.,* 2013). Even Automated teller machines (ATM) and currency counting machines have been observed to be infected with pathogens in Nigeria, presenting a risk to bankers and customers (Enemuor *et al.,* 2012).

Materials and Methods

Study Design: Cross- sectional study designed to determine the prevalence of intestinal parasitic contamination of naira notes in Sokoto metropolis.

Study Area: The study was carried out in Sokoto state which is located within the North-western geopolitical zone of Nigeria. According to the National Population Commission (2010), population figures stand at 3,702,676 persons with a land area of 33,776.89 square kilometres. The population mainly consists of the Hausa/Fulani ethnic groups; the major occupation of the people is farming and animal husbandry. Majority of its Indigenes are Muslims. Sokoto state is located between latitude 9°N and 4°N and between 3°E and 8°E in the Northern Nigeria. Most of the agriculturists here practice harshness of the sunlight (WHO, 2016).

Sample Size Determination

Sample size for this research was calculated based on the prevalence of 14% obtained from previous study (Okoh and Morenikeji, 2016).

Number of sample size was determined using the formula;

$$n = \frac{Z^2PQ}{d^2}$$

n = ?
Z = 1.96
P = 14% (0.14) (Okoh and Morenikeji, 2016).
Q = (1-0.14) = 0.86
d = 5% (0.05)

$$N = \frac{(1.96)^2 \times (0.14) \times (0.86)}{(0.05)^2}$$

$$N = \frac{(3.8416) \times (0.14) \times (0.86)}{0.0025}$$

$$N = \frac{0.46252864}{0.0025}$$

N = 160

Sample Collection

A total of one hundred and sixty (160) samples of the Nigerian naira notes comprising of (5, 10, 20, 50, 100, 200, 500, and 1000) were randomly collected from food vendors, butchers, petrol attendants and vegetable sellers. The notes were collected with hands gloves, kept separately in clean polythene bags and transported to the medical Microbiology Laboratory, School of Medical Laboratory Sciences for examination. The naira notes were grouped into three, depending on the extent of their physical outlook viz, clean, dirty and very dirty/mutilated notes.

Laboratory Examination

The parasitological screening was carried out according to the methods outlined by Leonard and Olajumoke (2016) and Ahmed and Mujittapha (2015). Each group of the identified currencies within the selected denominations were inserted into a sterile bottle containing 15ml of sterile normal saline, the bottle was vigorously shaken and left standing for 30 minutes, then shaken all over again for the last time. The Naira notes were then removed using a pair of sterile forceps and transferred into a sterile polythene bag. The contents of each bottle were poured into centrifuge tubes and centrifuged at 2000 rpm for 2 minutes. The supernatant was carefully decanted, while the resultant sediment was stirred, and a drop placed on a clean grease-free glass slide and then covered with a glass cover slip. The slide was then examined microscopically under x10 and x40 magnifications for presence of parasite cysts, eggs and larvae.

Results

Of the 160 naira note samples examined for parasitic contamination, 50(31.3%) were positive for intestinal parasites. We observed that 34.4% were clean notes, 29.4% were dirty notes, and 37.5% were very dirty/mutilated notes. Out of the different naira denominations, 100 notes recorded the highest contamination of 40%, followed by 20, 50, 200 (35% each), 5, 10 (30%), 500 (25%) and 1000 (20%) as shown in table 1.

Table 2 indicated the prevalence of intestinal parasitic contamination in relation to the source of the naira notes. Naira notes collected from food vendors had the highest intestinal parasitic contamination of 50%, followed by fruits and vegetables sellers (37.5%), butchers (22.5%) and the least were seen in naira notes sourced from petrol attendants (15%).

Prevalence of intestinal parasitic contamination in relation to the conditions of naira notes is depicted in table 3. Very dirty/mutilated (53.3%) and dirty (29.8%) naira notes were the most contaminated with intestinal parasites while clean naira notes recorded the least (5.5%) contamination.

A total of five (5) different parasites were detected from the notes which included *Ascaris lumbricoides* (68%), Hookworm (52%), *Entamoeba histolytica* (44%), *Balantidium coli* (32%) and *Strongyloides stercoralis* (22%) (table 4).

Table 1: Prevalence of Intestinal Parasitic Contamination of Naira Notes

Denomination of Naira Notes	Number Examined	Number Positive (%)	Number Negative (%)
5	20	6(30)	14(70)
10	20	6(30)	14(70)
20	20	7(35)	13(65)
50	20	7(35)	13(65)
100	20	8(40)	12(60)
200	20	7(35)	13(65)
500	20	5(25)	15(75)
1000	20	4(20)	16(80)
Total	**160**	**50(31.3)**	**110(68.7)**

Table 2: Prevalence of Intestinal Parasitic Contamination in Relation to Source of Contamination

Source of Naira Notes	Number Examined	Number Positive (%)	Number Negative (%)
Petrol Attendants	40	6(15)	34(85)
Food Vendors	40	20(50)	20(50)
Fruits and Vegetables Sellers	40	15(37.5)	25(62.5)
Butchers	40	9(22.5)	31(77.5)
Total	**160**	**50(31.3)**	**110(68.7)**

Table 3: Prevalence of Intestinal Parasitic Contamination in Relation to Physical Condition of the Currency

Naira Denomination	No. Examined	Clean notes (%)	Cont. (%)	Dirty notes (%)	Cont. (%)	Very dirty notes (%)	Cont. (%)	Total Cont. (%)
5	20	5(25)	0(0)	6(30)	2(33.3)	9(45)	4(44.4)	6(30)
10	20	2(10)	0(0)	6(30)	1(16.7)	12(60)	5(41.7)	6(30)
20	20	8(40)	1(12.5)	5(25)	2(40)	7(35)	4(57.1)	7(35)
50	20	5(25)	1(20)	7(35)	1(14.3)	8(40)	5(62.5)	7(35)
100	20	7(35)	1(14.3)	5(25)	1(20)	8(40)	6(75)	8(40)
200	20	12(60)	0(0)	8(40)	5(62.5)	2(10)	2(100)	7(35)
500	20	10(50)	0(0)	4(20)	2(50)	6(30)	3(50)	5(25)
1000	20	6(30%)	0(0)	6(30)	1(16.7)	8(40)	3(37.5)	4(20)
Total	**160**	**55(34.4)**	**3(5.5)**	**47(29.4)**	**14(29.8)**	**60(37.5)**	**32(53.3)**	**50(31.3)**

Cont. = Contamination

Table 4: Prevalence of Intestinal Parasites on Naira Notes

Denomination of Naira Notes	No. Cont.	A.L. (%)	H.W. (%)	S.S. (%)	E.H. (%)	B.C. (%)
5	6	7(20.6)	1(3.8)	1(9.1)	9(40.9)	2(12.5)
10	6	3(8.8)	2(7.7)	3(27.3)	1(4.5)	0
20	7	2(5.9)	1(3.8)	3(27.3)	1(4.5)	1(6.3)
50	7	4(11.8)	2(7.7)	1(9.1)	4(18.2)	2(12.5)
100	8	9(26.5)	10(38.5)	1(9.1)	3(13.6)	3(18.8)
200	7	5(14.7)	4(15.4)	0	1(4.5)	3(18.8)
500	5	2(5.9)	2(7.7)	2(18.2)	2(9.1)	4(25)
1000	4	2(5.9)	4(15.4)	0	1(4.5)	1(6.3)
Total	**50**	**34(68)**	**26(52)**	**11(22)**	**22(44)**	**16(32)**

Key: Cont. = Contamination, **A.L. =** ***Ascaris lumbricoides***, **H.W. = Hookworm, S.S. =** *Strongyloides stercoralis,* **E.H. =** ***Entamoeba histolytica*****, B.C. =** *Balantidium coli*

Discussion

Currency notes are used as a means of exchange during buying and selling of goods and commodities; thereby making them agents of disease transmission. An overall prevalence rate of 31.3% was recorded for the currency notes examined in this study. This agrees with the finding of Metur *et al.* (2010) who reported relatively similar parasitic contamination of 32% in the Federal Capital Territory, Abuja. The 31.3% parasites contamination recorded in the circulating notes in this study implies that the notes are a bit contaminated in comparison to the findings of Ahmed and Mujittapha (2015), Leonard and Olajumoke (2016) and Nasiru *et al.* (2017) who recorded a lower parasitic contamination of 14.0%, 21.9% and 12.04% prevalence in Katsina metropolis, Ibadan city in Oyo State and Dustin-ma metropolis in Katsina State respectively.

The 100 denomination notes were the most contaminated with parasites possibly due to the fact that it is commonly at the reach of most people at the lower income group in the populace than the 500 and 1000-notes. This implies that the 100 denomination passes more hands and gets contaminated in the process than the 1000 notes which is not handled by many people. This finding agrees with the reports of earlier works of Leonard and Olajumoke (2016) and Simon-oke and Ajileye (2019) who found that the 100 notes carried more contaminants.

The naira notes sourced from food vendors were more contaminated than notes from other sources. This suggests that these sources are fun of unhygienic practices in relation to notes handling. For instance, food vendors often a times handle money while they serve food at the same time to their customers. Previous work by El-Dars and Hassan (2005) suggests that simultaneous handling of food and money contributes and may as well cause sporadic food borne-diseases. This result is in contrast to the findings of the studies in Dutsin-ma and Akure metropolis where currency notes handled by butchers were highly contaminated (Nasiru *et al.,* 2017; Simon-oke and Ajileye, 2019).

The very dirty/mutilated notes (53.3%) were the most contaminated with parasites in the present study probably due to the fact that they had been in circulation for long and exchanged hands more frequently thus exposed to contamination. This agrees with the findings of Ahmed and Mujittapha (2015), Simon-oke and Ajileye (2019) and Ombugadu *et al.* (2019) who reported that the very dirty notes collected from Katsina, Akure and Keffi metropolis were the most contaminated with parasites. However, this is contrary to the finding of George and Ifenyinwa (2019) in a study in Akure metropolis who reported that the dirty notes were the most contaminated with parasitic contaminants.

Out of the five (5) parasites detected, *Ascaris lumbricoides* was the most prevalent parasite on the Naira currency notes probably due to high chances of the notes falling on the ground surface and as well as the possibility of users using soiled hands to handle these notes. Contrary to the studies on parasites, cyst and egg on the Nigerian currency by Ombugadu *et al.* (2019) who reported that hookworm was the most prevalent parasites screened from currency notes sourced within Keffi metropolis, Nasarawa State.

Conclusion

Findings from this study have shown that circulating Naira notes in Sokoto metropolis were contaminated irrespective of currency sources and note types. The physical conditions (clean, dirty and very dirty) of all Naira notes accommodate parasites on them. The 100 notes were the most contaminated denomination of the Naira notes examined. Naira notes collected from food vendors were the most contaminated with intestinal parasites and *Ascaris lumbricoides* appeared the most predominant intestinal parasitic contaminants of naira notes in this study.

References

Ahmed, A. and Mujittapha, A. (2015). Prevalence of parasite eggs and cysts on the Naira notes in Katsina metropolis. Katsina. *Journal of Natural and Applied Sciences;* **4(1)**: 61-69

Alemu, (2014). Potential for parasites and bacterial transmission by paper currency in Nigeria. *Journa*l *Environmental Health*; **69(9)**: 50-60

Awodi, N.O., Nock, I.H. and Akenova, T. (2000). Prevalence and public health significance of parasitic cysts and eggs on the Nigerian currency. *The Nigeria Journal of Parasitology*; **2(1-2)**: 137-142.

El Dars, F.M. and Hassan, W.M. (2005). A preliminary bacterial study of Egyptian paper money. *International Journal of Environmental Health Research;* **15(3)**: 235-239.

Enemuor, S.C., Victor, P.I. and Oguntibeju, O.O. (2012). Microbial contamination of currency counting machines and counting room environment in selected banks. *Science Research and Essays;* **4(3)**: 1508-1511.

George, U.I. and Ifenyinwa, J.E. (2019). Currency notes and associated risk of neglected tropical diseases: Study on the Nigerian Naira. *International Journal of Research-Ganthaalayah;* **7(12)**: 252-258.

Leonard, O.A. and Olajumoke M. (2016). Parasite contamination of Nigeria currencies in Ibadan city, South-west Nigeria. *Annual Research and Review in Biology*; **10(6)**: 1-6.

Matur, B.M., Malann, Y.D. and Edhomeriegue, Y. (2008). A Survey of Parasite Cysts, Eggs and Bacteria on Nigerian Currency in FCT, Abuja. *New York Science Journal*; **3 (1)**: 10-13.

Matur, B.M., Malann, Y.D. and Edhomerigue, R. (2010). A survey of parasite's cyst, eggs and bacteria on Nigeria currency in FCT Abuja. *Science Journal;* **5(3)**: 10-13.

Michael, B. (2002). Handling money and serving ready to eat food. *Food Service Technology;* **2(3)**: 1-3.

Nasiru, M., Nuhu, I. and Bawa, J.A. (2017). Microbes associated with currency Notes in circulation within Dutsin ma metropolis, Katsina state, Nigeria. *FUDMA Journal of Sciences;* **1(1)**: 123-127.

Neel, R. (2012). Isolation of pathogenic microorganisms from contaminated paper note currency in circulation from different marketplace in korogwe and mombo towns in Tanzania. *Journal of Microbiology*; **2(3)**: 470-474.

Obi, M. (1999). Abuse of the Naira. National Concord Newspaper.

Ogba, O. (2007). Potential for parasite and bacterial transmission by paper currency in Nigeria. *Journal of Environmental Health*; **5(4)**: 34-60.

Okoh, Arome, L. and Morenikeji O.A. (2016). Parasite contamination of Nigerian currencies in Ibadan city, South-West Nigeria. *Annual*; **10(6)**:1-6.

Ombugadu, R..J., Tongjura, J.D., Hassan, S.C. and Ajuzie, U. (2019). A survey of parasites cysts and eggs (ova) on Nigerian currency notes in Keffi; Nasarawa state, Nigeria. *FUW Trends in Science and Technology Journal*; **4(1)**: 83-85.

Orji, N., Esiaka, E., Anyaegbunam, L., Obi, R. and Ezeagwuna, D. (2013). Parasite contamination of Nigerian Currency (Paper and Polymer notes) in the Ihiala Local government area of Anambra State, Nigeria. *The Internet Journal of Infectious Disease*; **5(10)**: 1-8.

Prasai, T., Yami, K.D. and Joshi, D.R. (2008). Microbial load on paper/polymer currency and coins. *Nepal Journal of Medical Science Technology*; **8(9)**:105-109.

Simon Oke, I.A. and Ajileye, O.D. (2019). Evaluation of parasites as contaminants of currency notes in Akure, Nigeria. *International Journal of Enteric Pathogen*s; **7(2)**: 44-48.

World Health Organization (2016). WHO recommendations hygiene and environmental sanitation experience World health Organization.

Citation: Bunza, N.M., Iduh, M.U., Jibrin, M. and Yusuf, S. Determination of Intestinal Parasitic Contamination of Naira Notes in Sokoto Metropolis. ***Sokoto Journal of Medical Laboratory Science*; 9(3): 93 – 98.** https://dx.doi.org/10.4314/sokjmls.v9i3.9