Parasitic Contamination of Naira Notes in Circulation Within Yenagoa Metropolis, Bayelsa State, Nigeria

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Abstract:
The study focused on the investigation of parasitic contamination of naira notes in circulation within Yenagoa metropolis, Bayelsa State. A total of 200 (25 each) naira notes of N5, N10, N20, N50, N100, N200, N500 and N1000 denominations were randomly collected from members of the public. Normal saline and Zinc Sulphate concentration techniques were used to isolate the parasites from the samples. The results from the laboratory analysis of the naira notes revealed that 52 (26%) out of the 200 various denominations of the naira note was contaminated with one form of parasite or the other. The results further indicated that contamination was more on the #100 note (48), followed by #200 note (40%), #50 note (32%), #20 note (24%), #5 and #500 (20% each), while #10 and #1000 notes were the least contaminated (12% each). Among the various species of parasites identified, Ascaris lumbricoides and Enterobius vermicularis were most prevalent (26.9%) each, followed by Giardia lamblia (25%), while Entamoeba histolytica was the least prevalent (21.2%). Education and sensitization on the need to use wet pads or simply clean water instead of tongue wetting the fingers while counting money, putting of money into wallets and not on dirty surfaces, discouragement of spraying the naira notes on individuals during parties and proper hand washing with soap and water after using the toilet are recommended to reduce contamination of the naira notes.

Keywords: Parasites, Naira notes, Contamination, Yenagoa metropolis.

Introduction
In ancient times, before the introduction of modern currency (notes and coins) people used trade by barter as a means of exchange of goods and services. Presently paper currencies are the tools widely used for the payment of goods and...
services worldwide and it was first developed in China (Prasai, Yam, & Joshi, 2008). Money is used as a medium of exchange for goods and services, settlement of debt and for various payments in economic activities (Beg, & Fisher, 1997). Paper currency 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).

The paper currencies also known as naira notes in Nigeria are highly abused, hence making the legal tender a vehicle for transmission of associated parasites from one user to another (Ogba, 2007; Awodi, Nock, & Aken’ova, 2000). The level of contamination and type of parasite on the money vary depending on the country, season, and environmental conditions. Parasites that have been observed to be contaminants of naira notes are mainly of faecal origin (Awodi, Nock, & Aken’ova, 2000).

The contamination of the naira notes could be from several sources such as the atmosphere, during storage, usage, handling or production. Daily transactions have made the naira notes to pass through many dirty hands, in some cases placed in a dirty spot where they could be contaminated with pathogens (Awodi, Nock, & Aken’ova, 2000; Ameh, &Balogun, 1997; Matur, Malann, & Yvoun, 2010).

Parasites with direct life cycles do not need an intermediate host to infect a new host so can be acquired by direct ingestion of egg and this can be from contaminated surfaces like bank notes. Parasites reduce host biological fitness by specialized pathology ranging from parasite castration and impairment of secondary sex characteristics to modification of host behavior, parasites increase their own fitness by exploiting host of resources necessary for their survival (Gift, 2018). Hence, they present a great risk to public health as parasitic diseases can be spread through contact with such contaminated notes (Pope et al., 2002).

One of the parasitic diseases associated with naira notes is ascariasis, this is a disease of humans caused by the parasitic roundworm which could contaminate the naira note as a result of the poor hygiene, hands used in cleaning up the anus after passing out faeces by an infected person, are not properly washed. Moreover, poor money handling culture which exposed money to being contaminated include keeping naira notes in socks, shoes and pockets, under the carpet or rugs and squeezing them in the hand and lubricating of hands with saliva before counting etc.

**Materials and Methods**

**Study Area**

The study was conducted in Yenagoa, Yenagoa Local Government Area of Bayelsa State. Yenagoa L.G.A is located by the Epie Creek which is an extract of the Nun River sharing boundaries with the Southern Ijaw Local Government Area on the South, Kolokuma L.G.A on the West and the Ahoada West LGA of Rivers State on the East. Yenagoa lies between latitude 4°55′29″ N and longitude 6°5′51″ N. It is the headquarters of Yenagoa Local Government Area of Bayelsa State in Nigeria, with a population of 352,285 (Nigeria Population Commision, 2006) and has an area of 1,698 km² (656sqm). The city lies on a low and swampy area, hence most of the communities within the city are prone to perennial flooding. The Yenagoa metropolis in particular is predominantly composed of the indigenous Epie-Atisa People (flocked around by several visiting tribes being a State Capital) (Ayibadinipre et al., 2023).

**Collection of Samples**

Different denominations of the naira note were randomly collected from the public. A total of 200 notes were collected (25 pieces each of the ₦5, ₦10, ₦20, ₦50, ₦100, ₦200, ₦500 and ₦1000 notes).

**Processing and Examination of Samples**

The samples collected in the field were transported to the research laboratory for examination and identification of parasites.
Isolation of Parasites from Samples
Normal saline and zinc sulphate concentration techniques were used.

Normal Saline Concentration Technique
Each naira note was dipped into test tube containing normal saline which covered the naira note. Shaken and allowed to stand for 5 minutes, it was then centrifuged at 3,000rpm for 5 minutes. The supernatant was poured off gently and the residue was placed on a clean glass slide, covered with a cover slip and examined microscopically using x10 and x40 objective lenses to identify the probable human parasites. Identification of parasites was done by comparing the observed parasites with those on the Atlas of Parasitology (Cheesbrough, 2005).

Zinc Sulphate Concentration Techniques Method
165g of zinc sulphate was weighed and dissolved in 500ml of distilled water. It was stirred until the zinc sulphate dissolved completely. The naira note was then placed inside a test tube and the zinc sulphate solution was poured into to the test tube, filling it to the brim and covered with a cover slip. It was left for 45 minutes to allow impurities settle down. After then, the cover slip was removed, placed on a slide and viewed under the microscope for evaluation using x10 and x40 objective lenses to identify the probable human parasites (Cheesbrough, 2005).

Results
Overall prevalence of parasitic contamination of naira notes
The results of the laboratory analysis of the naira notes revealed that a total of 52 (26%) out of the 200 various denominations of the naira note were contaminated by one form of parasite or the other (Table 1).

<table>
<thead>
<tr>
<th>Denomination of naira note</th>
<th>No. examined</th>
<th>No. Contaminated (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>₦5</td>
<td>25</td>
<td>5(20)</td>
</tr>
<tr>
<td>₦10</td>
<td>25</td>
<td>3(12)</td>
</tr>
<tr>
<td>₦20</td>
<td>25</td>
<td>6(24)</td>
</tr>
<tr>
<td>₦50</td>
<td>25</td>
<td>8(32)</td>
</tr>
<tr>
<td>₦100</td>
<td>25</td>
<td>12(48)</td>
</tr>
<tr>
<td>₦200</td>
<td>25</td>
<td>10(40)</td>
</tr>
<tr>
<td>₦500</td>
<td>25</td>
<td>5(20)</td>
</tr>
<tr>
<td>₦1000</td>
<td>25</td>
<td>3(12)</td>
</tr>
<tr>
<td>Total</td>
<td>200</td>
<td>52(100)</td>
</tr>
</tbody>
</table>

Parasitic contamination of naira notes in relation to species of parasites
Among the parasites identified from the laboratory analysis of the naira notes, *Enterobius vermicularis* and *Ascaris lumbricoides* were more prevalent (26.9% each), while *Giardia lamblia* recorded a 25%, prevalence, with *Entamoeba histolytica* having the least prevalence (21.2%) (Table 3).

Discussion
The parasitic contamination of naira notes in circulation within Yenagoa metropolis was investigated between June 2023 to August, 2023. The results obtained from the laboratory analysis of the naira notes revealed and overall contamination of 26%. This is greatly lower than the 32% reported by (Matur, Malann, & Yvoun, 2010). It is also lower than the 59% reported by (Okwa, & Bello, 2016). The 26% contamination recorded in this study agrees with the 27.5%
reported by (Orji et al., 2012). Also, the 26% recorded in this study is slightly lower than the 21.9% reported by Abdulhamid, & Asma’u, (2015). It is further lower than the 14.0% reported by Okoh, & Olajumoke, (2016). The 26% recorded in this study might be due to spraying of the naira notes during occasions which fell to contaminated soils, and having contacts with the notes without proper hand washing after using the toilet.

Denomination based analysis of the naira notes revealed that contamination was more on the ₦100 note (48%). This contradicts the report of (Okwa, & Bello, 2016) in which they reported that contamination was more on the ₦5 and ₦10 notes (23.7%). In their report ₦100 was the least contaminated among naira notes in circulation within Ojo Local Government Area, Lagos State. While ₦100 was most contaminated in this study, ₦10 and ₦1000 notes were the least contaminated (12%). This disagrees with the report of (Orji et al., 2012) which reported that ₦100 notes were the most contaminated (52%). However, it is in agreement with the same report by Orji et al., (2012) which reported 1000 note as the least contaminated. The 48% contamination of ₦100 notes reported in this study agrees with the report of (Okoh, & Olajumoke, 2016) in which ₦100 recorded the highest contamination (41.7%). The high contamination of the ₦100 naira note reported in this study may be owing to the fact that ₦100 notes are often times sprayed during occasions by individuals. It could also be due to the fact that the ₦100 is a paper compared to ₦5, ₦20 and ₦50 which are polymers, hence, it could easily allow cysts and eggs to stick to it. It could also be due to poor hand washing habit.

Among the various parasite species identified in this study, *Enterobius vermicularis* and *Ascaris lumbricoides* were most prevalent (26.9% each). This is at variance with the report of (Matur, Malann, & Yvoun, 2010) in which *E. vermicularis* and *Ascaris lumbricoides* recorded 0.5% and 4.5% respectively. The 26.9% prevalence of *A. lumbricoides* is lower than the 38.9% recorded by Okwa, & Bello, (2016). Also, the 26.9% prevalence of *E. vermicularis* is greatly higher than the 3.38% reported by Okwa, & Bello, (2016). Furthermore, the 26.9% prevalence of *A. lumbricoides* and *E. vermicularis* recorded in this study is higher than the 1.9% and 3.8% reported by Abdulhamid, & Asma’u, (2015) for *A. lumbricoides* and *E. vermicularis* respectively. The 26.9% recorded for *A. lumbricoides* and *E. vermicularis* in this study may be attributed to the fact that more naira notes were exposed to their parasites as compared to other parasite species. It could also be due to the fact that these parasites are more prevalent in the study area as a result of facial pollution on the land.

*Giardia lamblia* was next to *E. vermicularis* and *A. lumbricoides* in terms of prevalence (25%). This is slightly lower than the 22.6% reported by Savioni, Bundy, & Tomkins, (1992). The 25% reported in this study might be due to contact of naira notes with contaminated hands/water.

*Entamoeba histolytica* recorded a prevalence of 21.2%. This is at variance with the 12.5% reported by Matur, Malann, & Yvoun, (2010) and the 8.4% reported by Okwa, & Bello, (2016). It is again higher than the 9% reported by Orji et
al., (2012) and the 1.9% reported by Abdulhamid, & Asma‘u (2015). The 21.2% prevalence recorded in this study could be attributed to contaminated hands. Poor sanitary habits and contact of the naira notes with facially contaminated hands/water.

**Conclusion**

From the findings of the study, it is established that there is parasitic contamination of naira notes in circulation within Yenagoa metropolis, Bayelsa State, Nigeria. The contamination was more prevalent on ₦100 naira notes, followed by ₦200 notes, while ₦10 and ₦1000 notes were the least contaminated. Some of the parasite species identified in this study includes *Ascaris lumbricoides*, *Enterobius vermicularis*, *Giardia lamblia* and *Entamoeba histolytica* with *A. lumbricoides* and *E. vermicularis* most prevalent, while *E. histolytica* recorded the least prevalence.

**Disclosure of Conflict of Interest**

The authors declare that there is no conflict of interest.

**References**
