SOIL-TRANSMITTED HELMINTHS CO-INFECTED WITH SCHISTOSOMA IN FLOOD-PLAIN COMMUNITIES, SOUTHERN, NIGERIA

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Abstract
This study evaluated the soil transmitted helminths (STH) and Schistosoma co-infection and its epidemiological factors in flood subjected communities. Fecal samples from 672 consented individuals between 5-24 years in Aviara, Igbide, Otor-Owhe and Ohwhelogbo community were examined using Kato-Katz technique and questionnaires. Of 672 samples, 434(64.58%) were infected with STHs and Schistosoma mansoni co-infections. The parasites in a descending were Ascaris lumbricoides (56.40%), Trichuris trichiura (54.32%), hookworm (38.69%) and S. mansoni (7.59%), with significant differences. Female 325 (48.36%) were more infected than male 317(47.17%). But, among all communities, there was no significant difference in gender prevalence. The general prevalence correlated to infection intensity. Ages of 5-9 years old were more vulnerable to STHs infections. Helminthes was not significant ($p<0.05$) with age of children except A. lumbricoides which significantly different with age ($t = 5.16$, 95% CI = 5.44 and 60.12, $P = 0.036$). Age-community prevalence accounted for <0.1% of total variance ($P = 0.035$). Effect of toilet type, toilet paper and washing of hands after defecation was significant ($p<0.05$). ANOVA showed a strong significant impact ($p<0.005$) in maternal educational and water source in each community. This study revealed that STH and intestinal schistosomiasis were highly prevalent among children of 5-14 years. There is need for prompt wash and mass drug administration (MDA) to reduce prevalence/intensity and morbidity in the study area.

Keywords: Isoko, NTDs, geohelminths, bilharziasis, coinfections

Introduction
Soil transmitted helminths (STHs) and S. mansoni infections are group of Neglected Tropical Diseases (NTDS) with chronic, debilitating and severe conditions that occur in tropical and subtropical countries (Ito and Egwunyenga, 2017), particularly in underdeveloped countries (Ito, 2019). Helminthes are transmitted by contact soil or water, feca-oral or walking barefoot (Taiwo et al, 2017), with great impact on the human and animal health (Östan et al, 2007), mainly schistosomiasis (Ito and Egwunyenga, 2015). Infections children were more severe (Hotez et al., 2004). More than 1.5 billion people or 24% of the world population are infected with STHs (WHO, 2022), and Over 500 million people in sub-Saharan Africa heminthes were second to malaria in particular Nigeria (Ito and Utobor, 2023). Treatments are anthelmintic drugs (Ito and Egwunyenga, 2017).

This study aimed to evaluate helminthic infections in Delta State, Nigeria (Aviara, Igbide, Otor-Owhe & Owhelogbo) to be on control helminthes by with 2030.

Materials and Methods
The study area is Isoko South and North Local Government Area, Delta State, which fall within the ever-green tropical rain forest belt of Niger-Delta Southern Nigeria. This investigation was conducted in Aviara (latitude 5.42 & longitude 6.25), Igbide (Lat. 5.56 & Long. 6.15) (Isoko South) and Otor-Owhe (Lat. 5.60 & Long. 6.18) and Owhelogbo (Lat. 5.60 & Long. 6.18) in Isoko North, facing wet season (April to October) and dry one (November to March). Isoko is densely populated, with approximately 300 people/km$^2$ compared with the average of 198 for Delta State and 130 for Nigeria without definitive population numbers, The available one of 2006 population census (Aviara= 18,823, Igbide= 10,224, Owelogbo= 13,200 and Otor-Owhe= 9,500), nowadays were controversial and unsupportable (Ito, 2019).

Subjects and Ethical Permission: A total of
672 of both sexes aged 5-24 years were randomly selected from July-September 2021. A total of 154, 181, 208 & 129 fecal samples were obtained from these areas respectively after permissions from community heads/kings and Ethical committee, Delta State Asaba Ministry of Health.

Samples collection for parasitological examinations, and questionnaires adopted for demographic information. Morning fecal samples were microscopically by direct smears and flotation stained if indicated and eggs number (EPG) were counted intensity following recommendation by WHO.

Statistical analysis: Data were subjected to statistical analysis using Instate Graph pad software Incorporation San Digeo, USA for windows and significant difference between variables were tested using ANOVA and chi square at 5% level of significance.

Results

Of 672 (317 males & 325 females), 434 were infected with at least one parasite/S. mansoni.

Details are given in tables (1, 2, 3, 4, 5 & 6) and Figures (1 & 2).

<table>
<thead>
<tr>
<th>Communities</th>
<th>Overall</th>
<th>A. lumbricoides</th>
<th>Hookworm</th>
<th>T. trichiura</th>
<th>S. mansoni</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aviara</td>
<td>154</td>
<td>98 (63.64)</td>
<td>85 (55.19)</td>
<td>65 (42.21)</td>
<td>79 (51.30)</td>
</tr>
<tr>
<td>Igbide</td>
<td>181</td>
<td>110 (60.77)</td>
<td>98 (54.14)</td>
<td>55 (30.39)</td>
<td>97 (53.59)</td>
</tr>
<tr>
<td>Otor-Owhe</td>
<td>208</td>
<td>149 (71.63)</td>
<td>131 (62.98)</td>
<td>89 (42.79)</td>
<td>122 (58.65)</td>
</tr>
<tr>
<td>Otweologbo</td>
<td>129</td>
<td>77 (59.69)</td>
<td>65 (50.39)</td>
<td>51 (39.53)</td>
<td>67 (51.94)</td>
</tr>
</tbody>
</table>

Males had a prevalence of 47.17%, lower than 48.36% recorded for the females. Relative to gender and communities, males and females in Otor-Owhe had the highest prevalence of 72.97 and 70.10% respectively, without significant difference (p > 0.05) in male and female prevalence (F = 0.12. P = 0.75). They accounted for 0.11% of the total variance; was 75% chance of randomly but without significant.

<table>
<thead>
<tr>
<th>Gender</th>
<th>Aviara No. infected (%)</th>
<th>Igbide No. infected (%)</th>
<th>Otor-Owhe No. infected (%)</th>
<th>Otweologbo No. infected (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Males</td>
<td>42 (64.62)</td>
<td>43 (51.81)</td>
<td>81 (72.97)</td>
<td>32 (55.17)</td>
</tr>
<tr>
<td>Females</td>
<td>56 (62.92)</td>
<td>47 (68.37)</td>
<td>68 (70.10)</td>
<td>45 (63.38)</td>
</tr>
<tr>
<td>Totals</td>
<td>98 (63.64)</td>
<td>110 (60.77)</td>
<td>149 (71.63)</td>
<td>77 (59.69)</td>
</tr>
</tbody>
</table>

Ascaris gave 36,384%, then T. trichiura (33,168), hookworm (21,216) and S. mansoni (4296).

Table 3: Prevalence and intensity of Selected STHs and S. mansoni co-infection

<table>
<thead>
<tr>
<th>Parasites</th>
<th>No. of eggs/slide Mean egg/gram Intensity</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. lumbricoides</td>
<td>379 (56.40) 1516 96.00 36384</td>
</tr>
<tr>
<td>T. Trichinura</td>
<td>365 (54.32) 1382 90.87 33168</td>
</tr>
</tbody>
</table>

Age 5-9 years were 72.67%, least was 45.59% among 20-24 with significant differences

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Subjects</th>
<th>Number infected</th>
<th>Positive %</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-9</td>
<td>300</td>
<td>218</td>
<td>72.67</td>
</tr>
<tr>
<td>10-14</td>
<td>181</td>
<td>115</td>
<td>63.54</td>
</tr>
<tr>
<td>15-19</td>
<td>123</td>
<td>70</td>
<td>56.91</td>
</tr>
<tr>
<td>20-24</td>
<td>68</td>
<td>31</td>
<td>45.59</td>
</tr>
<tr>
<td>Total</td>
<td>672</td>
<td>434</td>
<td>64.58</td>
</tr>
</tbody>
</table>

A. lumbricoides was (77.27%) in Aviara for age 5-9 years, Igbide (59.49%) and Otweologbo (60.78%) but was Otor-Owhe (77.88%). T. trichiura was (65.15%), hookworm was (54.54%), without S. mansoni. A. lumbricoides and T. trichiura were low prevalence of 43.59%, followed by 53.85, 59.09 and 64.41% respectively with significant difference (p<0.05, t= 3.27, P= 0.047, 95% CI = 0.36& 26.38) without significant (P>0.05).
There was significant difference (F=9.083; P = 0.015) between toilets with 1.5% chance (p<0.05), with prevalence of 33.75%. Significant difference (p<0.05) was between helminthes and toilet type. Toilet paper was 32.79% (F = 7.09, P = 0.0263), with 2.6% chance (p<0.05) that differed between subjects with or without hand-washing and helminthes infections (X²= 2.679, p = 0.44).

Discussion
This first current study showed the overall prevalence (64.58%) of helminthes distributed (Aviara 63.64), Igbide (60.77%), Otor-Owhe (71.63%) and Owhelogbo (59.69%). But, Ito and Egwunyenga, (2017) found a
rate of 84.83% in these areas except Aviara. This was higher than 20.9% (Goshu et al., 2021) and 18.1% (Zeynudin et al., 2022).

In the present study, among 5-9 years children A. lumbricoides was (56.4%), and S. mansoni was (7.59%). But, Pukuma et al. (2022) in Quetta reported 11.69% in 7-9 years children. High prevalence may be due the flooding seasonal, low socio-economy, poor sanitation, bad defecation habitat (Ito and Egwunyenga, 2023).

In the present study, children growth deficits were attributed to STHs such as A. lumbricoides, T. trichiura and hookworms, which agreed with Sowemimo and Asaolu (2011) and Sam-Wobo et al. (2012). Winter et al. (2013) reported that the hook-worms infection was related to the child and caused nutritional iron intake. WHO (2002) reported that A. lumbricoides, T. trichiura and S. manosi infections were highest in 5-14 years, but Ito and Egwunyenga (2017) reported a decline in frequency of these parasites in the adulthood. These floorings overflows latrine and causes the availability of hookworm and schistosome larval which penetrate hosts skin (Ito and Egwunyenga, 2015).

The present high rates of these parasites were due the water closet and latrines. Ito and Egwunyenga (2023) found that the high prevalence was due to poor sanitation, improper waste disposal, and walking barefoot. Hot climates rapidly maturate A. lumbricoides & T. trichiura eggs (van der Werf et al., 2013).

Behavioral aberrations such as eating with unwashed hands, nail biting, and thumb sucking have been postulated as risk factors that increases STHs and S. mansoni infection (Ito, 2014). These aberrations are most common in children and predispose them to heavy intensity of helminths infections (Idowu et al., 2022). Hand washing was a risk factor and the prevalence associated with it in this study are in agreement with Akinsanya et al., (2021) who reported high prevalence among respondents who did not was hands after defecation. The observations in this study are similar to findings in Côte d’Ivoire and Brazil were children with increasing infection intensity were coinfected with S. mansoni and hookworm (Keiser et al, 2002). The use of latrines does not always reduce hookworm transmission or prevalence. This was shown to be the case three decades ago in the Burma valley of Zimbabwe (Bradley, 1993). However, latrine facilities have been documented to reduce the prevalence of hookworm by 4% (Albonico et al, 1999).

**Conclusion**

STHs and schistosomes co-infections in post-COVID era were major public health problem mainly more among children. Infection severity in Delta State was increased with suitable environmental conditions; and bad health educations.

The authors declared that they have neither competing interest and agreed in the paper publication

**Recommendation**

Real effort was made in a holistic manner in health improvement combining nutritional supplements, water improvement and sanitation, to help to achieve the SDG goals of reducing diseases among children.

Large-scale use of anthelminthic is a must.

**Acknowledgments**

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**References**


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WHO, 2022: Soil-transmitted helminth infections: WHO Fact Sheet N°366 (Updated October).


Explanation of figures

Fig. 1: Comparative prevalence of STH parasites based on communities investigated.

Fig. 2: Comparative gender prevalence of STHs and S. mansoni co-infections.