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Soil-Transmitted Helminthiasis in Ifite-Ogwari: A Farming Rural Community in Anambra State, Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Aims: The aim was to determine the prevalence of soil-transmitted helminthiasis in Ifite-Ogwari: A farming rural community in Anambra State, Nigeria.
Study Design: This study is a cross-sectional, community-based, descriptive study.
Place and Duration of Study: The study was carried out in Ifite-Ogwari, Ayamelum L.G.A of Anambra State, Nigeria. The laboratory investigations and analysis were done in the Parasitology and Entomology Laboratory, Department of Parasitology and Entomology, Nnamdi Azikiwe University, Awka, between April and June 2023.

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Methodology: A total of two hundred and sixty-five (265) participants from Ifite-Ogwari community were randomly sampled for the study with an age range from five to ninety years. Stool samples were collected and analyzed microscopically using standard procedures.
Results: From the 265 participants examined, 83(31.3%) were males and 182(68.7%) were females. The result revealed an overall prevalence of 77(29.1%), fecal samples of 24 males (28.9%) and 53 females (29.1%) were positive for intestinal parasites. Hookworm emerged as the most prevalent species (16.2%), followed by *Ascaris lumbricoides* (9.8%), and *Trichuris trichiura* (3.0%). The age group 15-24 years had the highest prevalence (36.2%) and least among age group 75-84 years (18.2%).
Conclusion: These findings underscore the urgent need for targeted health education and evidence-based control measures to reduce the burden of soil-transmitted helminthiasis in this rural community.

Keywords: Prevalence; Soil-transmitted helminth; Ifite-Ogwari; Trichuris trichiura; Ascaris lumbricoides; Hookworm.

1. INTRODUCTION

Soil-transmitted helminthiasis is a major neglected tropical disease (NTD) in Nigeria [1]. The disease is caused by various parasitic organisms such as roundworm (*Ascaris lumbricoides*), whipworm (*Trichuris trichiura*), hookworms (*Ancylostoma duodenale*, and *Necator americanus*), and threadworm (*Strongyloides stercoralis*). This disease is commonly associated with poverty and is a significant cause of mortality and morbidity especially children in developing regions such as Africa, South America, the Caribbean, the Middle East, and Asia [2]. The World Health Organization (WHO) has estimated that soil-transmitted helminth (STH) infections affect about 24% of the world's population [3]. Soil-transmitted helminth infections are contracted through ingestion of the parasites' eggs or through active penetration of the larva especially in the case of hookworm infection. Once these helminths mature into adult worms, they can survive for years within the human gastrointestinal tract [4]. The survival, hatching, and embryonation of soil-transmitted helminthic eggs and larvae in the environment are dependent on warm temperatures and sufficient moisture [5]. At least 1.5 billion people globally are infected with the most common species of parasitic worms, including *Ascaris lumbricoides*, *Trichuris trichiura*, *Strongyloides stercoralis*, *Ancylostoma duodenale*, and *Necator americanus* [6], with about 6300 deaths and 3.5 million Disability-Adjusted Life Years (DALYs) in 2016 [7]. In sub-Saharan Africa (SSA), there were 866 million people infected with STH as indicated by the World Health Organization estimate 2012; The respective number of people infected (prevalence) by hookworm, *A. lumbricoides*, and *T. trichiura* was 117 million (13.6%), 117 million (13.6%), and 100.8 million (11.6%), respectively [8].

Research has shown that a significant proportion of school-aged children, may be infected with one or more of these prevalent worm species [9,10]. Factors such as poverty, inadequate sanitation, poor personal hygiene, and overcrowding play a significant role in human infections [1,11]. These infections can lead to various health issues, including anaemia, impaired cognitive development, and stunted growth, and are among the primary causes of absenteeism and DALYs lost [7,12]. Children are the most vulnerable group to soil-transmitted helminth infections, acquired through activities such as playing with contaminated soil and pica habits [6]. Despite a decline in the prevalence of *A. lumbricoides*, *T. trichiura*, and hookworms (*A. duodenale and N. americanus*) in the developed world, the situation in sub-Saharan Africa remains stagnant, as per considerable evidence available [5, 6].

Soil-transmitted helminth infections are highly endemic in Anambra State. A study in Omogho and Awa communities in Anambra State recorded a prevalence of 44.2% [13]. Similar studies in Ozubulu, Ebenebe, Aniocha and Uga communities all in Anambra State recorded a prevalence of 44.08%, 87.7%, 21.7%, 44.71% respectively [14-17].

Ifite-Ogwari community in Ayamelum Local Government Area, Anambra State is one of the areas in Nigeria where the recent prevalence of these diseases is not well documented. However, given the landscape epidemiology of the area and high levels of poverty, poor

sanitation, and limited access to safe water in this area, it is likely that soil-transmitted helminth infections would be a significant public health problem. Hence the need for this research to generate data on the prevalence of this disease in Ifite-Ogwari. This information will be critical in developing effective and sustainable public health interventions to control and prevent these disease in the community.

2. MATERIALS AND METHODS

2.1 Study Area

The study was carried out in Ifite-Ogwari community in Ayamelum Local Government Area, Anambra State. Ayamelum is located geographically between latitude 6o30"- 6o50" N and longitude 6o50"-7o10" E [18], at altitude 213 meter above sea level [19]. The climate is tropical with two seasons: the wet and dry. It has five months of dry season (November to March) and substantial annual average temperature is 20oC to 28oC and 18oC in the coldest month. The vegetation is Guinea Savanna with loamy soil and soil pH ranging from 5 to 9.5 [19]. The Indigenes are mostly farmers, cultivating food and cash crops such as rice, sugar cane, cassava, yam, maize, Okro and melon. Ifite-Ogwari is made-up of five villages namely: Ama, Amadei, Aniocha, Isiudala and Umuawa. The rivers and streams present include Omambala, Okpu, Iyiakwa, Iyiushi, Ohiaozu etc.

2.2 Study Design

The study was a community-based, cross-sectional study involving parasitological techniques. Random sampling technique was adopted as participants were drawn from Ifite-Ogwari community. Sample collection was a one-time collection conducted between April 2023 and June 2023. Consent forms were used to obtain approval from study participants cum parents/guardians where necessary.

2.3 Study Population

The population of Ayamelum Local Government Area according to 2006 national census was 158,152 [20]. The study population included both male and female between the age group of five to ninety years. A total of 265 participants were enrolled in the study.

2.4 Sample Size Determination

Sample size was calculated using modulated Daniel's formular [21].

n = (z^2 p(1-p))/(p/2)^2

Where

n = population size,
Z = calculated ztab (1.96),
p = assumed prevalence (in proportion of one,
p = 0.60 (this figure was used because of limited data on the recent prevalence of intestinal helminthiasis in Ifite-Ogwari)).

To find n, where z= 1.96 and p = 0.06.
n = (⟦1.96⟧^2 0.06(1-0.06))/ (0.06/2) ^2
n=240

Therefore, the minimum sample size is 240. However, a total of 265 samples were recruited.

2.5 Ethical Consideration

Ethical approval with reference number COOUTH/CMAC/ETH.C/Vol.1/FN:04/265 for the study was obtained from Chukwuemeka Odumegwu Ojukwu University Teaching Hospital Amaku, Awka, Anambra State. Prior to this, a letter of introduction for the study was obtained from the Department of Parasitology and Entomology, Nnamdi Azikiwe University, Awka.

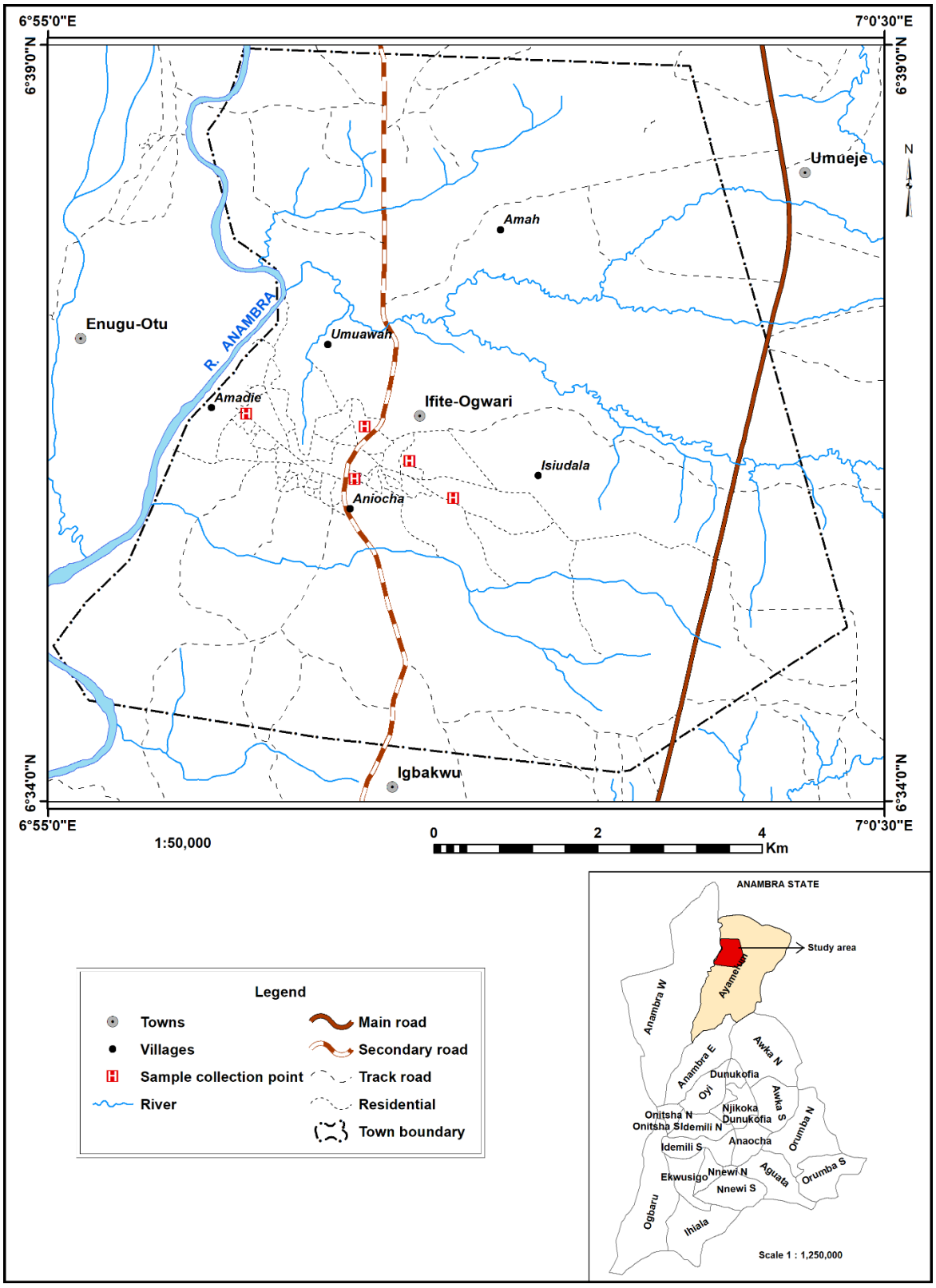
2.6 Advocacy and Community Engagement

Before the commencement of the study, the objectives and plan were explained to the opinion leaders of villages in order to get their cooperation and permission to conduct the survey.

2.7 Collection of Stool Samples

One screw-capped, prenumbered, tagged and sterile plastic containers were given to each person for stool sample collection together with applicator sticks and plain paper. The participants were directed to use the paper provided to defecate in the morning of the following day to prevent contamination from the toilet environment. Using an applicator stick, they were instructed to pick up a stool sample about the size of a thumb and transfer it into the provided clean plastic container. Upon arrival at collection venue that morning, the stool samples were promptly mixed with 10% formalin to maintain the integrity of the eggs' morphology. The container was then capped, sealed with paraffin film to prevent spillage, and transported to the laboratory for analysis. The samples were transported for subsequent examination at a Parasitology Laboratory, Department of

Parasitology and Entomology, Nnamdi Azikiwe University, Awka, Anambra State. Collection was done in batches in order to allow for a better and efficient sample analysis.



Map 1. of Ifite-Ogwari community

2.8 Determination of STHs Infection using Formol-Ether Concentration Method

Stool analysis was performed using the formol-ether concentration method (FEC) as described by [22]. First, gloves were worn when handling stool specimens to avoid contamination. A suitable container was used to mix a portion of stool specimen, approximately 1 ml or the size of a walnut, into 10 ml of normal saline. The mixture was then thoroughly mixed with the help of a vortex. The emulsion was filtered through fine mesh gauze or alternatively wire sieve into a conical centrifuge tube. The suspension was then centrifuged at 2000 rpm for 10 minutes. The supernatant was decanted, and the sediment was washed with 10 ml of saline solution. The sediment was then centrifuged again, and the washing process was repeated until the supernatant was clear. After the last wash, the supernatant was decanted, and 10 ml of 10% formalin was added to the sediment. The mixture was then left to stand for 5 minutes to effect fixation. Two to three ml of ethyl acetate was added, the tube was stopped, and vigorously shaken. The tube was then centrifuged at 1500 rpm for 10 minutes, resulting in four layers: a top layer of ethyl acetate, a plug of debris, a layer of formalin, and sediment. The plug of debris was freed from the side of the tube by ringing with an applicator stick. The top three layers were carefully decanted, and the remaining sediment was mixed with a pipette. One drop of the mixture was transferred to a drop of saline and iodine on a glass slide, mixed, and covered with a coverslip. The slide was observed first for the presence of parasitic forms under low power (10X) objective and then high power (40X) objective under the microscope. This method was chosen for its ability to concentrate parasite eggs and larvae, making them more visible under the microscope. It was also a widely accepted and recommended method for stool analysis in detecting helminthic infections [23].

2.9 Statistical Analysis

The data generated from laboratory analysis were collated, analyzed and presented using social science statistics package (SPSS) software for windows version 23.0. The relationship between variables were analyzed using chi-square test of independence. Test of statistical significance was set at a P-value of .05 (95%) confidence interval.

3. RESULTS

Out of 265 examined for STH infections, 29.1% (77/265) were positive. The STH parasites identified were Hookworms 16.2% (43/265), *A. lumbricoides* 9.8% (26/265) and *T. trichiura* 3.0% (8/265) (Table 1).

The prevalence of soil-transmitted helminths varied between genders (Table 2). The result showed that among those infected with STH infection 28.9% (24/83) were males and 29.1% (53/182) were females. It was also found that out of 83 males sampled, 16.9% (14/83), 7.2% (6/83) and 4.8% (4/83) had Hookworm, *A. lumbricoides* and *T. trichiura* infections, respectively. Also out of 182 females sampled, 15.9% (29/182), 11% (20/182) and 2.2% (4/182) were infected with Hookworm, *A. lumbricoides* and *T. trichiura* infection, respectively. The observed difference between gender was not statistically significant for STH species as $\chi 2 = 2.150$, df = 3, P = 0.54.

On prevalence of soil-transmitted helminthic infection by age in Ifite-Ogwari, the result showed that participants between 5-14 years had the prevalence of 30.3% (27/89), 15-24 years 36.2% (17/47), 25-34 years 25% (5/20), 35-44 years had 34.4% (11/32), 45-54 years had 20% (7/35), 55-64 years 25% (3/12), 65-74 years had 26.3% (5/19), 75-84 years had 18.2% (2/11) (Table 3). Participants in the age group 15-24 years had the highest prevalence of hookworm infection 21.3 % (10/47), 45-54 years for *A. lumbricoides* 11.4% (4/35), whereas age group 35-44 years had the highest prevalence for *T. trichiura* 12.5% (4/32). The observed difference in the prevalence age was not statistically significant as $\chi 2 = 18.52$, df = 2, *P* = .62.

Among the villages in Ifite-Ogwari, the highest prevalence for STH was recorded in Aniocha village 32.9% (24/73), followed by Umuawa village 31.5% (17/54), Amah village had 30.8% (12/39), Isiudala village had 27.5% (11/40), whereas Amadie village had the least infection rate 22% (13/59) (Table 4). Aniocha village had the highest prevalence for Hookworm infection 15.1% (11/73), *A. lumbricoides* 12.3% (9/73) and *T. trichiura* 5.5% (4/73). Whereas Isiudala village had the least prevalence for hookworm infection 15.0% (6/40). Amah village had the least prevalence for *A. lumbricoides* 2.6% (1/39). Amadie village had the least prevalence for *T. trichiura* 0% (0). The observed difference in the prevalence by village was not statistically significant as $\chi 2 = 9.614$, df = 12, *P* = .65.

Table 1. Prevalence of soil-transmitted helminthic infections among the participants at Ifite-Ogwari Ayamelum LGA

Type parasite identified	No. Examined	No. Infected	Prevalence (%)
Hookworm	265	43	16.2
Ascaris lumbricoides	265	26	9.8
Trichuris trichiura	265	8	3.0
Total	265	77	29.1

Table 2. Prevalence of soil-transmitted helminthic infection by gender in Ifite-Ogwari, Ayamelum LGA, Anambra State

Gender	No. Examined	No. Infected (%)	Parasite Prevalence (%)		
			Hookworm	*A. Lumbricoides*	*T. trichiura*
Male	83	24 (28.9)	14 (16.9)	6 (7.2)	4 (4.8)
Female	182	53 (29.1)	29(15.9)	20 (11.0)	4 (2.2)
Total	265	77 (29.1)	43 (16.2)	26 (9.8)	8 (3.0)

$\chi 2 = 2.150$, df = 3, P = 0.54.

Table 3. Prevalence of soil-transmitted helminthic infection by the age in Ifite-Ogwari, Ayamelum LGA, Anambra state

Age group (years)	No. Examined	No. Infected (%)	Parasite prevalence (%)		
			Hookworm	*A. lumbricoides*	*T. trichiura*
5-14	89	27 (30.3)	15 (16.9)	10 (11.2)	2(2.2)
15-24	47	17 (36.2)	10 (21.3)	5 (10.6)	2(4.3)
25-34	20	5 (25)	4 (20.0)	1 (5.0)	0
35-44	32	11 (34.4)	4 (12.5)	3 (9.4)	4 (12.5)
45-54	35	7 (20)	3 (8.6)	4 (11.4)	0
55-64	12	3 (25)	2 (16.7)	1 (8.3)	0
65-74	19	5 (26.3)	4 (21.1)	2 (10.5)	0
75-84	11	2 (18.2)	1 (9.1)	1 (9.1)	0
Total	265	77 (29.1)	43(16.2)	26 (9.8)	8 (3.0)

$\chi 2 = 18.52$, df = 2, P = .62.

Table 4. Prevalence of soil-transmitted helminthic infections by villages in Ifite-Ogwari, Ayamelum LGA, Anambra state

Village	No. Examined	No. Infected (%)	Parasite Prevalence (%)		
			Hookworm	*A. lumbricoides*	*T. trichiura*
Amah	39	12 (30.8)	10 (25.6)	1 (2.6)	1 (2.6)
Amadie	59	13 (22)	7 (11.9)	6 (10.2)	0
Aniocha	73	24 (32.9)	11 (15.1)	9 (12.3)	4 (5.5)
Umuawa	54	17 (31.5)	9 (16.7)	6 (11.1)	2 (3.7)
Isiudala	40	11 (27.5)	6 (15.0)	4 (10)	1 (2.5)
Total	265	77 (29.1)	43 (16.2)	26 (9.7)	8 (3.0)

$\chi 2 = 9.614$, df = 12, P = .65.

4. DISCUSSION

The overall prevalence of soil-transmitted helminthic infections in Ifite-Ogwari community was 29.1%. This is similar to the prevalence of 21.7%, 30.3%, 34.2% and 34.4% reported in the studies in Anambra, Imo, Kogi and Osun states respectively [17,24-26] However, it is lower than the prevalence of 87.7%, 55.2% and 46% reported in Ebenebe town in Anambra, Edo and Ogoja in Cross River State respectively [16,27,28]. Conversely, it is much higher than the prevalence of 11.3%, 6%, 2.5% observed in some States in Southern Nigeria [29-31]. These varying prevalence of soil-transmitted helminthic infections across different localities could be

attributed to differences in sanitary standards, environmental factors, timing, socio-cultural habits, and the level of knowledge regarding prevention and control of these helminths. Furthermore, the availability and utilization of toilet facilities in these communities may also be a contributing factor.

The present study observed *Ascaris lumbricoides*, *T. trichiura*, and hookworm, which have been previously documented in other studies [25,29,31]. Hookworm had the highest prevalence (16.2%), *Ascaris lumbricoides* (9.8%) and *Trichuris trichiura* (3.0%). [28,32] reported higher prevalence of hookworm infection when compared to the other soil-transmitted helminthic infections. This high prevalence of hookworm infection could be attributed to the fact that hookworm can infect human through active penetration of larva through the skin. As a notable percentage of the study population especially children walk on barefoot when in contacted with potential sources of infection.

The prevalence by gender showed no significant difference. This is in line with the work of [33] whose findings established that both genders have the same chances of contacting the disease. In as much as boys go barefooted during soccer, girls do so in most of their games too. The age group of '15-24 years' had the highest prevalence in this study. This age group is the most active age. They always play in the soil and walk about barefooted, hence they have greater exposure to these parasites. And, could easily assist their parents in farming activities as the farm land also serve as defecating ground and thereby source of infection.

Prevalence by village showed no significant difference. This is in line with [34] in Imo State whose finding showed no significant difference across the three villages. Although Aniocha had the highest prevalence of soil-transmitted helminthiasis. Place of residence has no influence on the prevalence of STH as people living in the different villages have equal chances of getting the infection. There is poor environmental sanitary practices among the communities. The correlation of parasitic diseases with poor environmental sanitation and unhygienic practices has been established by [35]. This confirms the fact that parasitic disease transmission depends on poor environmental conditions and personal hygiene [36].

5. CONCLUSION

The study found 29.1% prevalence of soil-transmitted helminthiasis in Ifite-Ogwari, Ayamelum Local Government Area, Anambra State, Nigeria. This work has shown from the study population that people of all age groups and gender harbour soil-transmitted helminthiasis and thereby contributed to the transmission of the disease in Ifite-Ogwari community. Health education and awareness campaigns should focus on the transmission, symptoms, and prevention of helminthiasis. STH remains a major public health concern in Anambra State. Targeted interventions and mass drug administration are essential in reducing the burden of the disease and improving the health and well-being of the population.

CONSENT AND ETHICAL APPROVAL

Consent was sort from the participants after a clear explanation of the study had been given to them. They were equally informed that the data generated from the study will be kept confidential and used for academic purposes and their identity will not be disclosed for any reason. Chukwuemeka Odumegwu Ojukwu Teaching Hospital, Amaku, Awka gave the ethical clearance for this work (COOUTH/CMAC/ETH.C/Vol.1/FN:04/265).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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