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Research Article

Prevalence of Soil Transmitted Helminthes Among Primary School Children in Orlu Imo State, Nigeria

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Abstract:

The prevalence of soil-transmitted helminthiasis in Nigeria's Orlu Imo State elementary schools was investigated in this study from February 2022 to April 2024. The cross-sectional survey and experimental analysis were the study designs used in this investigation. A total of 750 students were recruited from fifteen primary schools that were chosen at random. They included students from Primary 3, 4, and 5 classrooms, and their ages ranged from 9 to 16. After receiving sufficient training, participants' stool samples were taken every four weeks using a sterile specimen vial. The stool samples were collected, kept with 10% formalin, and processed within 48 hours of collection at the Parasitological Unit, Department of Medical Microbiology and Parasitology, Imo State University Teaching Hospital, Umuna Orlu, Imo State. Frequency and percentage tables, together with ANOVA, were used to enter and analyse the data. The results showed that men participated more than women (420, 56.0%), and that the biggest number of participants were between the ages of 15 and 16 (300, 40.0%), as were those in class 5. There was equal participation from 250 (33.3%) urban, suburban, and rural schools. A total of 404 (53.9%) STHs infections were found in the study, with 112 (44.8%) occurring in urban areas, 126 (50.4%) in suburban areas, and 166 (66.4%) in rural areas. The infection prevalence was higher in males (59.2%), the infection rate decreased with age, and the infection prevalence was higher in children whose parents were farmers (32.2%) and those who lived in mud-plastered or earthen homes (69.3%). In the study, Ascaris lumbricoide (39.1%) and hookworm (41.8%) were more common. Significantly high infection rates were found in the investigated schools.

Key words: prevalence; soil transmitted helminthes ; primary school; children; orlu

Introduction

The poorest and most destitute communities are impacted by soil-transmitted helminth (STH) infections, which are among the most prevalent neglected tropical diseases (NTDs) globally and the most prevalent in Nigeria [1]. It is primarily seen in regions with warm, humid climates with inadequate sanitation and hygiene, including temperate zones in the warmer months. The intestinal nematodes known as soil-transmitted helminths (STH) include the hookworm species Necator americanus, Ancylostoma duodenale, and An. ceylanicum, as well as Ascaris lumbricoides and Trichuris trichiura [2]. These species, which impact more than 1.5 billion people worldwide, are among the most prevalent illnesses in humans. Light infections caused by STHs typically show no symptoms. Malnutrition, poor absorption, cramping, fatigue, and decreased cognitive and physical development are some of the signs of more severe illnesses. STH's burden has significantly decreased; according to the 2016 Global Burden of Disease survey, between 1990 and 2016, the number of disability-adjusted life years attributed to STH decreased by 43–78% [3]. These decreases most likely result from expanded access to self-treatment and the direct effects of scaling up community- or school-based deworming programs.

Children are most at risk for infection, and those living in rural regions with limited access to clean water and sanitary facilities are most vulnerable [4]. These parasite infections have nutritional consequences as well as impaired physical and cognitive development [5]. Lactose intolerance, poor absorption of vitamin A and other nutrients, and stomach pain are all possible outcomes of A. lumbricoides infections. A severe whipworm infection causes inflammation at the intestinal attachment site, which in turn causes colitis and rectal prolapse. Hookworm infections can cause intestinal blood loss, which can lead to iron-deficiency anaemia [6].

Children in low-income schools are particularly vulnerable to infections linked to water, sanitation, and hygiene (WASH), including trachoma,

soil-transmitted helminths (STH), and bacteria that cause diarrhoeal illnesses [7]. Unhygienic, crowded environments can encourage the spread of viruses and raise the risk of illness for students [8]. In addition to halting the transmission of diseases inside the school domain, improved access to WASH facilities and adequate behaviour modification may also promote healthy WASH practices at home and throughout life [9]. According to the data that is currently available, just 69% of schools globally have access to sanitary facilities, and only 66% have water. The Sustainable Development Goals now incorporate WASH in schools (WinS) targets and indicators [10]. Evidence of impact has been conflicting, despite WinS treatments' biological plausibility to lower illness and, consequently, school absenteeism.

Soil-transmitted helminths (STHs) infect about two billion people globally, with school-aged children having the highest STH morbidity [11]. Faecal exposure, whether by ingesting or skin contact, is directly linked to STH infection. School-aged children's growth and cognitive development can be negatively impacted by persistent, severe infections [12]. Thankfully, periodic chemotherapy, usually with anti-helmintics, can safely and affordably cure a large portion of the morbidity linked to STH infection. Infection rates among untreated children and community members can also be decreased by treating school-aged children, typically through school-based deworming. [13]

Humans can contract a class of parasite disorders known as soil-transmitted helminthes, which are brought on by nematode worms and spread by contaminated soil from human faeces. These are some of the most common illnesses among people in countries in sub-Saharan Africa. According to the most recent estimates, about 2 billion people are afflicted with these parasites. The highest frequency is found in places with hazardous water supplies and poor sanitation.

There has been more coordination and cooperation between the neglected tropical diseases and WASH sectors, according to studies. There are still important policy questions regarding the role of WASH in controlling STH, though, such as (i) whether better access to WASH is a necessary supplement to deworming in order to control and eradicate STH, (ii) what WASH interventions and behaviours are appropriate to accomplish these goals, and (iii) how to best implement those improvements. By lowering exposure to STH infectious phases in the environment, economic growth and easier access to better WASH facilities and services have also probably helped to lower the burden of STH disease. However, far too many people still do not have access to basic WASH services, such as 844 million people who do not have access to a basic water service, 4.5 billion people who do not have access to safely managed sanitation, and 892 million people who continue to defecate in the open [14]. By addressing these disparities, the strain on STH may be lessened and transmission may be interrupted.

Low-income school-age children are particularly vulnerable to infections linked to water, sanitation, and hygiene (WASH), including trachoma, soil-transmitted helminths (STH), and bacteria that cause diarrhoeal illnesses. Pupils are more susceptible to illness in crowded, unhygienic settings, which can aid in the transmission of germs [15]. In addition to halting the transmission of diseases inside the school domain, improved access to WASH facilities and adequate behaviour modification may also promote healthy WASH practices at home and throughout life [16]. The Sustainable Development Goals now incorporate WASH in Schools (WinS) targets and indicators. The majority of community trials that are currently available have assessed sanitation interventions meant to lessen open defecation. Sanitation measures had varying effects on STH infection, according to three trials. Latrine construction campaigns did not appear to have any protective effects against STH infections, according to trials [16].

However, a lot of parasite infections—particularly those caused by helminths—are frequently ignored since they typically show no symptoms or only minor ones. According to preliminary research, intestinal parasites are becoming a bigger issue in Nigeria as the country's economy and access to essential services deteriorate. Imo State has been endemic for soil-transmitted helminthes. Moreover, medication has been the main focus of disease control.

WASH treatments appear to have varying effects depending on the underlying degree of STH infection, with the greatest effects occurring at lower infection levels. This discovery may be explained by the fact that WASH interventions need a longer follow-up period to show results at high levels of illness and environmental contamination—the majority of trials have follow-up periods of 1-2 years. The existence and duration of continuing deworming programs may also have an impact. This demonstrates that WASH measures are crucial to preventing infection rebound when deworming is stopped, but they have little short-term effect on STH infections in the context of ongoing deworming programs, particularly community-wide deworming. More focus should be placed on WASH modelling, which makes use of trial data to increase the predictability of model predictions. The prevalence of soil-transmitted helminthiasis in primary schools in the Orlu area needs to be investigated because there is a lack of research in Imo State on the effects of WASH interventions, which have been shown to be somewhat effective against STH, and the administration of chemotherapy and drugs.

Materials And Method

Study Area

The study was conducted in fifteen (15) primary schools in Orlu Local Government Area, Imo State, Nigeria between February, 2022 and April, 2024. Orlu is the second largest city in Imo State with an estimated population of 420,000 (Nigeria Census, 2006). Its geographical coordinates are 5°47'0E North, 7°2'0N East. The towns in Orlu have different cultural masqurade heritages through which they express their communal attributes, descents and heritages like Mmuowu, Ebuebu, Oghu, Okonko and Okorosha etc. The city is underlain by crystalline pre-Cambrian Basement complex of igneous and metamorphic origin noted for poor groundwater bearing properties. The main occupation of the indigenes is local textile making trading, fishing, farming and pottery. The nature of their occupation and many other environmental factors enhance the growth and development of the disease agents in Orlu. Knowing the dangers posed by disease contractions in relation to these occupations of the people, soil transmitted helminthes presents a serious medical emergency because it may rapidly progress health complications and even death without prompt and appropriate treatment.

Ethical Consideration

This study was approved by the Postgraduate Board of the Department of Animal and Environmental Biology (Zoology) Imo State University, Owerri. Permission was obtained from Orlu L.G.A. Health Unit while informed consent was obtained from Traditional Rulers (Ezes) in the study areas and thereafter, the head teachers of schools selected for the study were visited with authorizing letter from the study supervisor(s).

The stool samples of the consented pupils were collected after obtaining parental consent through Parents Teachers Association (PTA).

Advocacy Visits to Schools

This aspect of the study was done immediately after the consent has been obtained from the Local Government Education and Health authorities with introductory letter. The researcher and her team visited the heads of the selected schools. The aim was to create a forum for interaction and to familiarize with them. The objectives of the study were explained to them and their consents were obtained before the start of the study. Then, the research team had an interactive session with the pupils where they were acquainted with the purpose of the study and its benefits to them.

Head teachers and some other teachers were educated intensely to assist the researcher's team in further explaining to the pupils the purpose of the study, data/specimen collection and administration of drugs.

Study Design

A comprehensive checklist of all the public and private primary schools in Orlu was made/collected from Ministry of Education. A two staged sampling method with random sampling was used to select schools. Each school was assigned a number and random selection was made to choose the schools which formed the study area. Schools in this zone were categorized into three (3); Urban, Semi-urban and Rural following SUBEB criteria.

Stage 1: Fifteen (15) schools (5 each from Urban, Semi-urban and Rural) were chosen.

Stage 2: For each categorization, six (6) schools (2 from each of Urban, Semi-urban and Rural) were selected for WASH Intervention while as others non WASH Intervention (Comparison schools) were left out for other intervention. The selection took into consideration the logistic demands and prevalence status of each school based on baseline data.

Procurement of WASH Materials, Distribution and Training of Personnel

Prior to the commencement of the study WASH materials were bought from the market together with other parasitological materials needed for the study. These included toothpastes, toothbrushes, nail choppers, towels/handkerchief, cotton buds, combs, toilet soaps, water storage vessels/buckets, etc.

These materials were distributed to the six WASH Intervention Schools following the results and then selections. This was complemented by active surveillance and follow up surveys after baseline surveys on soil transmitted helminthes prevalence and health education.

Personnels employed to assist as well as school staff used for the study were trained. Also, the medical laboratory Scientists, Nurse and other recruits were trained on the objectives of the study. Those who assisted in questionnaire administration were also trained on the techniques involved.

Baseline Survey

Pupils in primary schools in Orlu Zone were visited and interviewed about WASH techniques. Water handing hygiene and sanitation practices and use of point-of-use water treatment were the indices solicited for while other practices were observed directly by the researcher.

WASH Intervention in Schools

Starting from April 2022, the teachers in WASH intervention selected schools were trained about hand-washing and sanitation and were provided with instructional materials. This method involved use of exercises and educational games to teach children about link between personal hygiene and health.

In these schools, water and sanitation facilities were provided near toilets for hand-washing and classrooms for drinking. The water station consisted of 60L plastic buckets with a lid and tap placed on a standing chair (Plate 1). Schools were provided with toilet soaps. School children were adequately taught on hygiene and prevention of water-related diseases. Class-based method was employed to provide knowledge that improved the pupils' knowledge, skills and behaviours related to health and hygiene. Hygiene kits (toothpaste, toothbrush, soaps, towels/ handkerchiefs, nail choppers, combs and cotton buds) were given to pupils. Also, information, education and communication (IEC) materials (posters) were produced and shared to assist in hygiene promotion and learning. Each school was made to form a water and sanitation committee. The membership were; head teacher, one parent-teacher association (PTA) member and a member of the research team who head and oversees all WASH-related activities in the school. They had two days training workshop to improve their skills in pupil hygiene promotion .

Between May 2022 and July 2022, research team visited the intervention schools and a follow up survey was done in August 2022 and February 2023; pupils were interviewed using questionnaires.

WASH Intervention Impact Assessment

The study was carried out between March and August, 2023. In this study, data were collected from six (6) public primary schools or the intervention schools that has completed the WASH intervention. Other schools which had not received the WASH intervention (comparison schools) were to be/forthcoming beneficiary schools. All schools both intervention and comparison schools included boys and girls from classes 3 to 5 (aged 9 to 15 years).

After intervention schools had received WASH intervention for more than 6 months prior to the impact assessment. The impact of WASH intervention within the schools was based on a number of variables such as the status of water and sanitation facilities, hygiene knowledge and behaviour. In addition, pupils' households were selected randomly and visited to assess if WASH intervention in schools had any effect on household members hand-washing attitudes. Observations were equally made about water storage vessels, hand-washing facilities, toilets and stored drinking water.

Study Population/Sample Size

Fifteen primary schools were randomly selected from Orlu between May and July, 2023. The study area were divided into 3 zones (Urban, Sub-Urban and Rural) according to State Universal Basic Education Board (SUBEB) criteria. Five (5) schools were selected from Urban, 5 from sub-urban and 5 from rural areas respectively. A total of 750 pupils were recruited. The pupils' age ranged from 9 to 14 years and included Primary 3, 4 and 5 classes.

A multistage sample technique was employed to determine the population. In the first place, the schools were stratified according to their location i.e. urban, suburban and rural schools. Also, the pupils were classified by their class levels. Then, 5% of each stratum were selected for the study (Nwanna et al., 1981).

$$\text{Therefore, } \frac{1}{100} \times 15{,}012 \times \frac{5}{750} =$$

Therefore, the sample size of this study equals 750 primary school pupils.

Selection Schools for the Survey

Urban Schools

Community Primary School, Umuna

Premier Primary School, Amaifeke

People's Primary School, Ihioma

Excel Primary School, Umuna

IMSUTH Primary School, Orlu

Sub-Urban Schools

Central School, Umuowa

Premier School Umuowa

Central School, Owerre-ebeiri

Central School, Okporo

Community School Eziachi

Rural Schools

Community School Mgbe

Community School Umutanze

Community School Umudioka

Community School Obibi-Ochasi

State Primary School Ogbueru

Inclusion and Exclusion Criteria

Inclusion Criteria

Primary school children with ages from 9 to 14 years whose parents/guardians/ school teachers were willing to participate in the study and are living in the communities under study for at least six (6) months were included in the study.

Exclusion Criteria

Primary school children who are seriously ill and not attending school at the time of the study were excluded for the study. Also, preschool-aged children (less than 9 years) and children older than 16 years attending schools in the communities under study were not included in this study.

Data Collection

Water and Sanitation Facilities Survey

This was made in each school following protocol. The protocol included number/condition of toilets, water sources and availability, hand-washing facilities and waste disposal.

Observation of Pupils' Hand-washing

School children hand-washing after toilet use was checked for each school without the knowledge of teachers and heads. They were not informed so that they would not prompt pupils to wash their hands. The researcher stayed motionless at a place and watched how pupils clean their hands after toilet use.

Survey on Hygiene and Sanitation

School children in each class were given a questionnaire, which was explained to them. Also, another set of questionnaire was given to them to give to adult family member to fill and return.

Pupils Absenteeism

To ascertain whether the WASH intervention impacted on the pupils absenteeism, data from weekly absenteeism reports from SUBEB and Ministry of Education were consulted. Also, results from two (2) non-WASH intervention schools located not more than 10km radius to the intervention schools were collected and compared

Sample Collection and Parasitological Examination

The stools from the pupils for both WASH intervention and non-intervention (comparison) schools were collected as described during prevalence survey report. The fecal samples were preserved using 10% formalin and taken to the Parasitological Unit Laboratory, Department of Medical Microbiology and Parasitology, Imo State University Teaching Hospital Umuna Orlu, Imo State. Samples were processed within 48hours of collection. Parasitological examination was done by formal ether sedimentation technique

Statistical Analyses

Data obtained was entered and analyzed using frequency and percentage tables. Descriptive statistics was used to compute prevalence, incidence and impact of WASH Interventions. All analyses were done using standard mean deviation.

Results

Table 1 shows the socio-demographic characteristics of the study subjects. The investigation revealed that males 420(56.0%) participated more in the study than their female 330(44.0%) counterparts with age 15-16 years 300(40.0%) recording the highest participation, followed by age 12-14 years with 250(33.3%) while ages 9-11 years 200(26.7%) as the least participants. Also, 300(40.0%) of those in class 5 showed more interest in the study as well as those in class 4, then those in class 3 were the least. There were no different in the number of participants from urban, suburban and rural.

Participants according to their parents' occupation revealed that traders 285(38.0%) were more, followed by farmers 241(32.1%), civil servants 127(16.9%) and then artisans 97(12.9%). In relation to type of dwelling observed that those living in stone walls with cement 673(89.7%) recorded highest participation while mud-plastered earthen were only 77(4.3%). In same vein, 718(95.7%) owned latrine, only 32(10.3%) do not own latrine. Those without latrine make use of open defecation (4.3%) while those with latrine, 476(63.5%) use water-cistern while 242(32.3%) use pit latrine. Majority 512(68.35) make use of pipe borne water while 238(31.7%) spring water.

Variables	Frequency (N = 750)	Percentage (%)
Gender		
Male	420	56.0
Female	330	44.0
Age (in years)		
9-11	200	26.7
12-14 15-16	250 300	33.3 40.0
Class Level		
Class 3	200	26.7
Class 4	250	33.3
Class 5	300	40.0
Location of School		
Urban	250	33.3
Sub-urban	250	33.3
Rural	250	33.3
Parents' Occupation		
Trader	285	38.0
Civil Servant	127	16.9
Farmer	241	32.1
Artisans	97	12.9
Type of Dwelling		
Stone walls with cement	673	89.7
Mud-plastered, earthen	77	10.3
Latrine availability		
Yes	718	95.7
No	32	4.3
Type of Latrine		
Pit	242	32.3
Water cistern	476	63.5
Open defecation	32	4.3
Water source		
Pipe borne water	512	68.3
Spring water	238	31.7

Table 1: Socio-demographic Characteristics of the study participants

Table 2 revealed overall prevalence of soil transmitted helminthes 112(44.8%) urban, 126(50.4%) suburban and 166(66.4%) rural. From the result, rural recorded highest prevalence, followed by suburban then urban; people's Primary School, Ihioma recorded highest prevalence of STHs 26(52.0%), Community School Eziachi was highest 31(62.0%) among suburban while State Primary School Ogbueru 40(80.0%) was highest among the schools in rural area. Statistical analysis showed that there was no significant difference in the prevalence of soil transmitted helminthes among primary school children (P>0.05)

Schools	No. Exam.	No. Infected (%)
Urban Schools		
Community Primary School, Umuna	50	22(44.0)
Premier Primary School, Amaifeke	50	21(42..0)
People's Primary School, Ihioma	50	26(52.0)
Excel Primary School, Umuna	50	23(46.0)
IMSUTH Primary School, Orlu	50	20(40.0)
Subtotal	250	112(44.8)
Sub-Urban Schools		
Central School, Umuowa	50	19(38.0)
Premier School Umuowa	50	24(48.0)
Central School, Owerre-ebeiri	50	30(60.0)

Central School, Okporo	50	22(44.0)
Community School Eziachi	50	31(62.0)
Subtotal	250	126(50.4)
Rural Schools		
Community School Mgbe	50	33(66.0)
Community School Umutanze	50	33(66.0)
Community School Umudioka	50	28(56.0)
Community School Obibi-Ochasi	50	32(64.0)
State Primary School Ogbueru	50	40(80.0)
Subtotal	250	166(66.4)
Grand Total	750	404(53.9)

Table 2: Overall prevalence of soil transmitted helminthes among primary school children

(P>0.05, P=0.5)

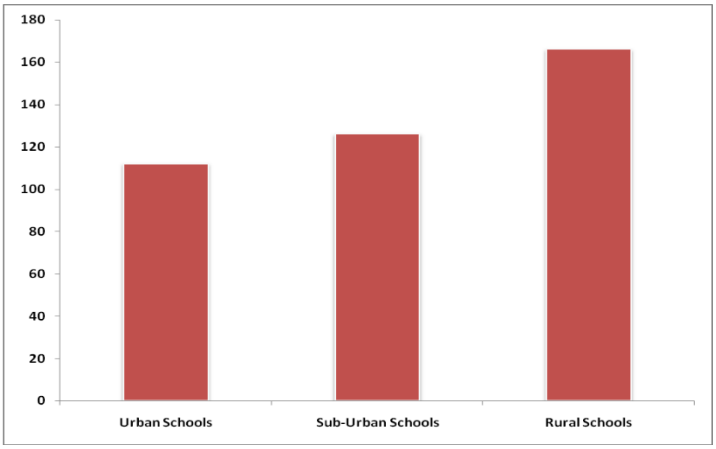

Figure 5: Overall prevalence of soil transmitted helminthes among primary school children in the study areas

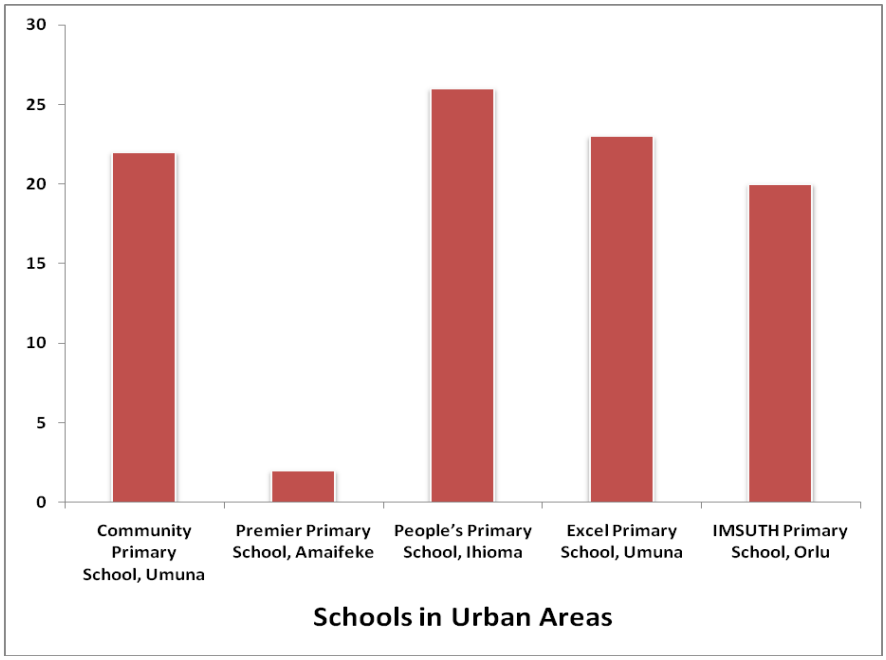

Figure 6: Overall prevalence of soil transmitted helminthes among primary school children in the study area (Urban)

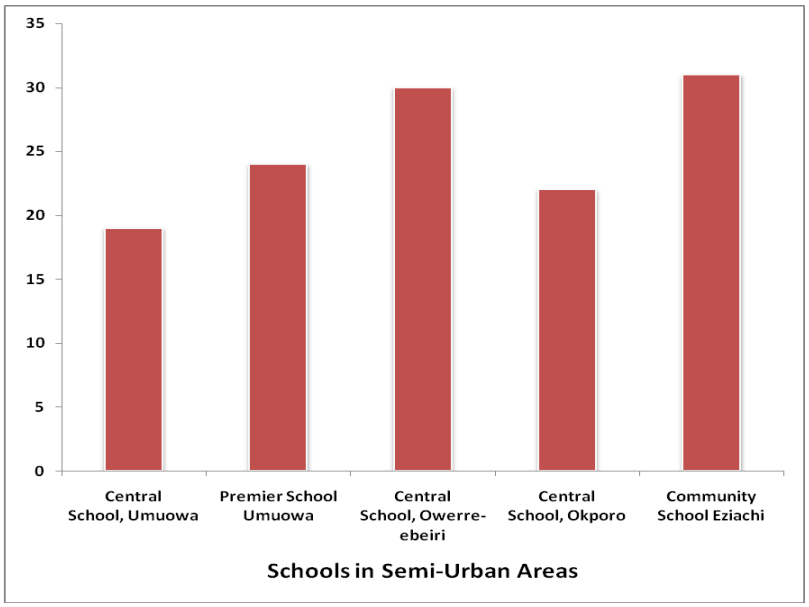

Figure 6.5: Prevalence of soil transmitted helminthes among primary school children in the study area (Semi-Urban)

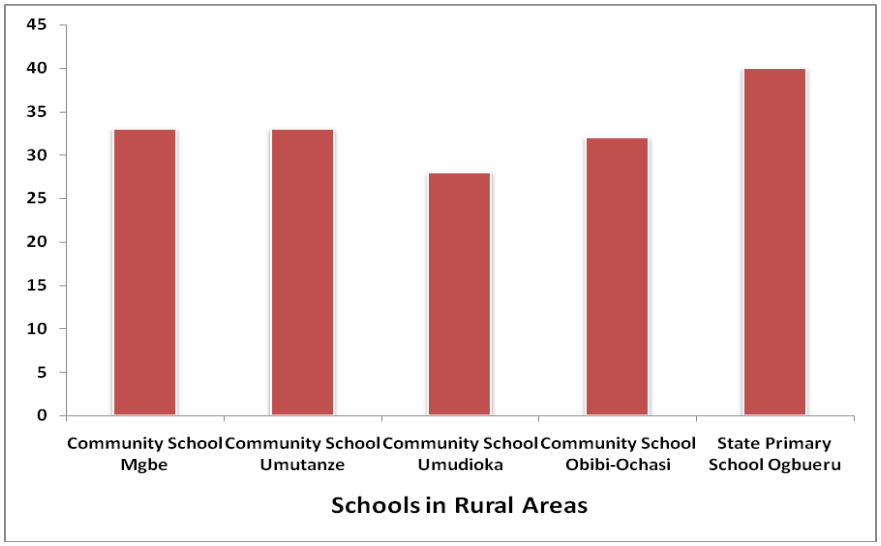

Figure 8: Prevalence of soil transmitted helminthes among primary school children in the study area (Rural)

Table 3 shows prevalence of STHs in relation to gender; and it was observed that males 239(59.2%) were highest against their female 165(40.8%) counterparts. Statistical analysis showed that there was no significant difference in the prevalence of soil transmitted helminthes relation to gender among primary school children (P>0.05)

Discussion

The prevalence and severity of STHs infection among school-age children in Imo State's Orlu Local Government Area, ranging from 9 to 16, were reported in this study. In tropical nations, STH infections pose a serious threat to public health. In third-world countries, intestinal parasite infections remain a significant health concern, in contrast to affluent nations where effective control, urbanisation, and other socioeconomic variables have improved circumstances for the fall in prevalence. In many developing nations, soil-transmitted helminthic diseases in particular have been identified as significant public health issues [17, 18, 19].

53.9% of schoolchildren in this sample had an overall STH infection prevalence. With an overall incidence of intestinal parasitism of 48.4%, the work's findings are comparable to the study conducted on soil-transmitted helminth infections: the nature, aetiology, and burden of the illness [20,21]. Based on the aforementioned results, it is feasible to conclude that, as suggested by [22], there is a high chance of finding 50 or more schoolchildren with at least one intestinal helminth if 100 of them had their stool analysed. Additionally, our study's findings regarding the prevalence of STHs were corroborated by research done in Ethiopia, Nigeria, and the Ecuadorian Amazon [23]. However, the prevalence of STHs infection was higher than that of a research done in Jimma, where it was 20.9% [24,25] and equivalent to 32.5% [26] in Cameroon. In reality, a number of investigations in the research area have long confirmed the endemicity of intestinal parasitosis, with varying reports of prevalence [27]. 404 of the 750 schoolchildren who were screened had intestinal parasite infections, either one or multiple. This demonstrates the

widespread prevalence of helminthic infections, particularly soil-transmitted infections, in elementary schools.

In conclusion

The findings indicated a significant frequency of soil-transmitted helminthes (STH) in school-aged children, making STH infection a serious public health concern in the research area. Children in the research area were more likely to get STH infections if they followed the practices of not wearing shoes, washing their hands before eating, and being between the ages of 9 and 16. Deworming, when combined with other strategies like health education and better sanitation and hygiene, keeps the level of infection caused by chemotherapy lower and finally helps to eradicate helminth infections in the study region.

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