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Incidence of Intestinal Parasites among School-aged Children: A Case Study of Nnarambia, Ahiazu Mbaise Local Government Area of Imo 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 intestinal parasites among children in Nnarambia community, Imo 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 Umunnachi and Amaokwe Nnarambia, Ahiazu Mbaise L.G.A of Imo State, Nigeria. The laboratory investigations and analysis were done in the Zoology Laboratory, Department of Zoology, Nnamdi Azikiwe University, Awka, between April and September 2021.

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Methodology: A total of two hundred and fifty (250) children from the two villages were randomly sampled for the study with an age range from 2-15 years. Stool samplings were collected and analyzed microscopically using standard procedures.
Results: From the 250 pupils examined, 118(47.20%) were males and 132(52.80%) were females. The result revealed an overall prevalence of 19(7.60%), faecal samples of 11 males (9.32%) and 8 females (6.06) were positive for intestinal parasites. Intestinal parasites detected include: *Ascaris lumbricoides* 6(2.40%), *Entamoeba histolytica* 5(2.00%), Hookworms 6(2.40%) and *Trichiuris trichiura* 2(0.80%). The infection rate was higher among children aged 2-7yrs 11(13.92%) and least among children aged 10-14yrs 2(3.03%).
Conclusion: A low incidence of intestinal helminth infestations among school-aged children was observed in Nnarambia, but an improved routine de-worming among children should be maintained to sustain the low infection rate observed.

Keywords: Intestinal parasites; Entamoeba histolytica; Ascaris lumbricoides; Hookworms; Trichiuris trichiura; children.

1. INTRODUCTION

"Intestinal parasites are parasites that populate the gastrointestinal tract. Typically, protozoa and helminths are humans' major types of intestinal parasites" [1]. Children are an important risk group for intestinal helminthiasis [2]. This is due to the common practices found among children or due to the heavy infections they harbour and their vulnerability to nutritional deficiencies [3-5].

Intestinal parasite affects the overall growth, development and academic performance of children [6-10]. Children especially those below 10 years are prone to infections because they may not be properly clothed or covered and also their behavioural activities like walking barefoot [5,11]. Some of the children in Nnarambia are from poor family backgrounds lacking necessary sanitation and toilet facilities. Therefore, a study such as this must be carried out to investigate the prevalence of IPs (Intestinal parasites) among children below the age of 14 years.

The range of infections caused by soil-transmitted Helminths (STHs) constitutes a major health problem among children in developing countries, especially in Nigeria [12]. This helminths infection often presents with anaemia, malnutrition, diarrhoea, mal-absorption, physical and mental impairment, delayed growth in children, weight loss and fatigue [7,13]. Infected children are nutritionally and physically impaired [14].

"Soil-transmitted helminths impair the nutritional status of the people they infect in multiple ways such as feeding on host tissues, including blood, which leads to a loss of iron and protein, hookworms in addition cause chronic intestinal blood loss that can result in anaemia, especially in adolescent girls and women of reproductive age, worms increase mal-absorption of nutrients; roundworm may compete for vitamin A in the intestine and some soil-transmitted helminths also cause loss of appetite and, therefore, a reduction of nutritional intake and physical fitness. In particular, *T. trichiura* as well as *Entamoeba histolytica* can cause diarrhoea and dysentery" [5].

"It is important to note that morbidity in helminth infection is related to the number of worms harboured. People with infections of light intensity (few worms) usually do not suffer from the infection. Heavier infections can cause a range of symptoms including intestinal manifestations (diarrhoea and abdominal pain), malnutrition, general malaise and weakness, and impaired growth and physical development. Infections of very high intensity can cause intestinal obstruction that should be treated surgically" [5].

Some studies have reported that helminthiasis causes more harm by stunting the growth of children both mentally and physically and thus robbing them of a proper healthy life [15]. However, some have not established any relationship between helminth infection and stunting but agreed that stunting itself may affect the pathogenesis of STH infection [10,16].

"Intestinal helminths are often neglected possibly because of their low mortality rate; however, it accounts for the highest Disability-Adjusted life Years (DALYs) among parasitic diseases in the world" [17]. "New estimates from the Global Burden of Disease Study 2015 indicate that

together helminth infections resulted in more than 6 million disability-adjusted life-years (DALYs)" [18]. Also, in a study to determine the Reduction in DALYs lost due to soil-transmitted helminthiases and schistosomiasis from 2000 to 2019, Antonio et al. (2022), reported that the cumulative gain during the 19 years was estimated at over 26 million DALYs.

Various studies [19-21] carried out in Nigeria have reported that soil transmitted helminths STHs (Soil transmitted helminths) infections involving *Ascaris lumbricoides*, *Strongyloides stercoralis*, *Trichuris trichiura* and hookworms are highly prevalent across Nigeria which escalates and persist in communities without better housing, sanitation, water supplies, health care, education and low income. Other studies further stressed that children between the age group of 4-10 years are the highest risk group and most infected [17,22,23]. Contrastingly, [24] reported that the individual prevalence of intestinal helminths infection was highest among the age group 7- 9 years (37.2%) followed by the age group 3- 6 years (36.8%) and then age group 11-14 years (31.6%) This study shows that age brackets studied are equally exposed to infection with helminths. This is unexpected as studies conducted among primary school children have reported them to be the highest risk group as far as helminth transmission is concerned [24].

WHO recommends periodic medicinal treatment (de-worming or preventive chemotherapy) without a previous individual diagnosis to all at-risk people living in endemic areas because the intervention reduces morbidity by reducing the worm burden. De-worming can be easily integrated with child health days or vitamin A supplementation programmes for preschool children [25,5]. Regions with a prevalence ≥ 50% require de-worming 2 to 3 times a year [14]. School children are one of the main target groups for this type of intervention, the health benefit of de-worming has been conspicuous but the awareness and enlightenment on the need to de-worm frequently have not been greatly publicized especially in rural areas [26]. "De-worming substantially improves health and school participation for both treated and untreated children, in treatment schools and neighbouring schools. As a result, treating only school-age children can reduce the total burden of disease due to intestinal worm infections by 70% in the community" [27]. However, some studies reported that public health programmes to regularly treat all children with de-worming drugs do not appear to improve height, haemoglobin, cognition, school performance, or mortality [28].

The main objective of the study is to determine the prevalence of intestinal parasites among children 2 – 15 years in Umunnachi Nnarambia in Ahiazu Mbaise Local Government Area (LGA) of Imo State.

2. MATERIALS AND METHODS

2.1 Study Area

The study was carried out in Umunnachi and Amaokwe Nnarambia (Fig. 1), Ahiazu Mbaise L.G.A of Imo State, Nigeria, between April and June 2021. Umunnachi and Amaokwe Nnarambia, Ahiazu Mbaise L.G.A have an annual rainfall range from 2500 mm to 3000 mm and an annual temperature range of 26- 32 C. The area falls within the tropical zone, latitude 5° 32' 44" N and longitude 7° 18' 10" E with a climate characterized by a rainy season (February/March-November) and dry season (November- February/March). Ahiazu-Mbaise LGA, created in 1976, derived its name from two ancestral clans, Ahiara and Ekwerazu. The area has a fairly levelled landscape covering 107 square kilometres with a population of about 170,902 thousand people according to the 2006 population census count. The majority of them are farmers, artisans, craftsmen, civil servants and traders. The LGA is made up of 27 autonomous communities. The sanitary condition of this area is on average with the pit toilet and water system as their method of faecal deposition; their sources of drinking water include the river but mainly boreholes.

2.2 Experimental Design

This study is a cross-sectional, community-based household descriptive study involving two hundred and fifty (250) children of age ranging from 2 -15 years. The participants for the study were selected using a systematic sampling technique.

2.3 Population Study

The population of the study is all the children in the three villages in the community. The community has an estimated number of 25,000 people according to the 2006 population census.

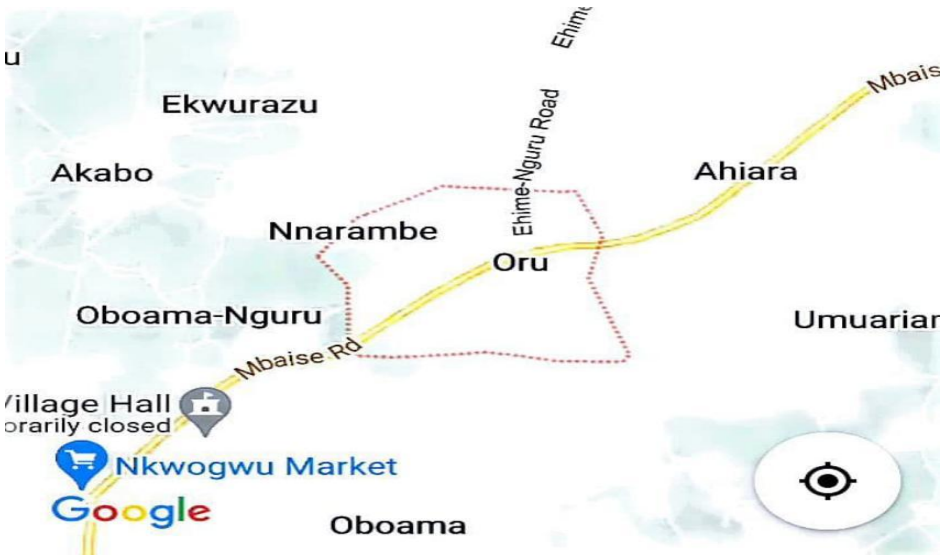

Fig. 1. Map of Ahiazu Mbaise local government area of Imo State, Nigeria showing Nnarambia community [29]

2.4 Determination of Sample Size

The sample size was calculated according to Yamane [30]. A total of 250 children from the three villages were randomly sampled for the study, their ages ranged from 2 -15 years.

2.5 Stool Sampling Collection

The children and their parents were educated on sample collection and were given a clean container for the collection of stool samples with their ages and sex labelled on them. The children were interviewed orally to sort for information on the type of sanitary facilities at home.

2.6 Parasitological Analysis

The laboratory investigations were done using standard procedures [31,32]. The macroscopic parameters checked include the colour of the stool sample, consistency (formed, unformed or watery), presence of blood, mucus and pus and presence of motile worms. The parasitological atlas in Cheesbrough [31] was used as a guide for the identification of the different eggs. Smears made for microscopic examination were viewed using the X10 objectives lens of the light microscope.

2.7 Statistical Analysis

Chi-square test ($\chi 2$) and Minitab statistical package version 17 were used to test for statistically significant differences between the prevalence of infection among the age group, sexes and toilet facilities.

3. RESULTS

From the 250 pupils examined, 118(47.20%) were males and 132(52.80%) were females. Faecal samples of children examined from the three villages revealed that 19(12.67%) faecal samples were positive for intestinal parasites (11 males and 8 females). The intestinal parasites identified are *Ascaris. lumbricoides, Trichuris. Trichiura,* Hookworms and *Entamoeba histolytica.* Intestinal parasites were more prevalent in males (9.32%) than in females (6.06%). The differences in the prevalence are not significant ($p>0.05$) (Table 1).

The prevalence of intestinal parasites varied among different age groups (Table 2). The age group from 2-7 years (13.9%) is high than the age group from 10-15 years (3.03%) with no statistic significant ($p>0.05$).
Also, higher prevalence of children use buckets for defecation (16.00%) while those who use the bush had the least (6.06%).The difference is not statistically significant ($p>0.05$).

Furthermore, the result of the study shows that the prevalence of intestinal parasites varied among different villages (Table 4). Children from Amaokwe had the highest (10.67%) while those from Umuezereugwu had the lowest (6.25%), the difference in prevalence is also not statistically significant ($p>0.05$).

Table 1. Prevalence of intestinal parasites among children in Nnarambia, Ahiazu Mbaise Imo State by sex

Sex	Number examined	Number Infected	Prevalence (%)
Males	118	11	9.32
Females	132	8	6.06
Total	250	19	7.60

χ^2 = 0.944, df = 1: p=0.331

Table 2. Prevalence of intestinal parasites species among school children in Nnarambia, Imo State in relation to age

Age	Number examined	*A. lumbricoides* (%)	*T. trichiuria* (%)	Hookworm (%)	*E. histolytica* (%)	Total (%)
2-7	79	3(3.80)	1(1.27)	3(3.80)	4(5.06)	11(13.92)
8-11	105	2(1.90)	1(0.95)	2(1.90)	1(0.95)	6(5.71)
10-15	66	1(1.52)	0(0.00)	1(1.52)	0(0.00)	2(3.03)
Total	250	6(2.40)	2(0.80)	6(2.40)	5(2.00)	19(7.60)

χ^2 = 2.178, df = 6; p=0.903

Table 3. Prevalence in relation to toilet facilities

Toilet facilities	Number examined	*A. lumbricoides* (%)	*T. trichiuria* (%)	Hookworm (%)	*E. histolytica* (%)	Total (%)
Water cistern	115	2(1.74)	1(0.87)	2(1.74)	2(1.74)	7(6.09)
Pit	77	2(2.60)	1(1.30)	2(2.60)	1(1.30)	6(7.79)
Bush	33	1(3.03)	0(0.00)	1(3.03)	0(0.00)	2(6.06)
Bucket	25	1(4.00)	0(0.00)	1(4.00)	2(8.00)	4(16.00)
Total	250	6(2.40)	2(0.80)	6(2.40)	5(2.00)	19(7.60)

χ^2 = 3.137, df = 9; p=0.959

Table 4. Prevalence across villages

Villages	Number examined	*A. lumbricoides* (%)	*T. trichiuria* (%)	Hookworm (%)	*E. histolytica* (%)	Total (%)
Umunnachi	111	3(2.70)	2(1.80)	1(0.90)	1(0.90)	7(6.31)
Umuezereugwu	64	1(1.56)	0(0.00)	2(3.13)	1(1.56)	4(6.25)
Amaokwe	75	2(2.67)	0(0.00)	3(4.00)	3(4.00)	8(10.67)
Total	250	6(2.40)	2(0.80)	6(2.40)	5(2.00)	19(7.60)

χ^2 = 5.824, df = 6; p=0.443

4. DISCUSSION

This study carried out among children of Nnarambia to determine the prevalence of intestinal parasites showed a low prevalence of 12.67%. The prevalence of different intestinal parasites revealed that only four (4) parasites were found. *Ascaris lumbricoides* and Hookworm were the most common parasites observed followed by *E. histolytica* and *Trichiuris trichiura*. Several studies have identified *A. lumbricoides* as the most common STHs infection [9,33-40] and the major route of transmission is ingestion of contaminated food, water and vegetables.

In a cross-sectional study of intestinal parasitosis among school- aged children in Saptari district of southern Nepal, *E. histolytica* and (7.7%) and *A. lumbricoides* were among the intestinal parasites reported [41]. Also, the study on the review of prevalence and pattern of intestinal parasites in Nigeria from 2006 to 2015 revealed the prevalence of *A. lumbricoides,* hookworm and *T. trichiura. A. lumbricoides* was the most prevalent helminth in the South-western (21%) and South-southern (13%) parts of Nigeria [42]. Similarly, among the five different intestinal *helminths* observed in Dutsin-Ma Local Government area of Katsina State, Nigeria, are *A. lumbricoides* (21.43), *T. trichiura* (4.76) and hookworm (13.10)

[41]. Further comparison with reports from the western part of Nigeria showed that there was an overall lower percentage of infections among the infected and uninfected study participants compared to 23.95% and 86.2% of school children reported in Makoko, an urban slum located in the heart of Lagos, Nigeria [42-44].

This may be attributed to the fact that the stool samples were collected from households while other studies collected samples from schools. High or low prevalence of intestinal parasites maybe attributed to low socioeconomic statuses such as overcrowded living areas, poor environmental sanitation, improper waste disposal, unsafe water sources, unhygienic habits, low immune status, lack of latrine, and inadequate provision of safe water in schools [44,45]. Also, the children confessed to being de-wormed. It is interesting to note that the four intestinal parasites reported in this study have been reoccurring in many parts of the country especially in the rural areas of Nigeria.

Male infected participants have more intestinal parasites than females infected participants which contradict the study [20] concerning gender. In a study carried out in the Democratic Republic of Sao Tome and Principe (DRSTP) the overall prevalence of intestinal parasites in school aged children was 64.7% but no significant gender difference in prevalence between boys (67.8%) and girls (61.8%) was found [46,47]. In rural communities of district Dir Lower, Pakistan, male students were more infected than females (64.8% male and 35.1% females) [48]. Similarly in a study of the prevalence of intestinal parasitic infections among primary schools aged children in Ombda Locality, Omdurman city, Khartoum state, Sudan, intestinal parasites was 29% among males while it was 20.9% among females [49].

Hilary [50] argued that “the sex-based difference could be the result of behavioural differences, with one sex coming into contact with sources of infection more than the other and the immunosuppressive role for testosterone which would hamper the elimination of parasite”. Also it is [51] argue that females maybe have higher prevalence due to environmental exposure and due to heavy enrolment in agricultural work, as a result of gender discrimination.

Age ranges between 2-7 and 8-11 of the infected children had a higher prevalence. This is similar to some studies [17,22]. Also, in Ombda Locality, Sudan the highest prevalence rate (35%) was reported among the 6-8 years age groups, while the lowest prevalence rate (10.3%) was reported among 12-14 years age groups [49]. “Among school children in Dakahlia governorate in Egypt, the most prevalent parasitic species reported were *E. histolytica* (12.3%), *G. lamblia* (8.5%), *H. nana* (7.7%), and *A. lumbricoides* (5.7%). There were significant differences in the prevalence of infection among the infected age groups. Children of the age group between 6 and 10 years have the highest prevalence of IPIs (46.6%) whereas other age groups (11–14 and 15–18 years) have lower prevalence (36.4% and 18.0%, respectively)” [52]. High infection in the lower age group may be because of their poor application of good hygiene practices in association with other risk factors.

The prevalence of helminth parasite infection in the infected children using varying toilet facilities was determined in this study. Children that made use of flushed toilets had the highest infection followed by those who use a pit toilet. The lowest infection was found among infected children who defecated in the open or bush. However, Pukuma et al. [53] reported that children, who used the water closet system, had the least prevalence of 18(5.00 %), while those who used the pit toilet recorded the highest prevalence of 51(14.17 %). The differences may come from the type or source of water used in flushing the toilet or poor or lack of hand washing after defecation.

The prevalence of helminth parasites and the source of drinking water were also examined.

The safety of drinking water [54-57] concerning parasitic infection has been emphasized. This result is similar to that of [58] in Southeastern Nigeria where significant difference between the water source and the prevalence of *A. lumbricoides* infection ($p< 0.05$), no significant difference between the water source and the prevalence of hookworm infection ($p>0.05$) and *T. trichiura* infection ($p> 0.05$ was reported.

Generally, the availability of sanitation facilities has been a risk factor in the transmission of helminth parasites therefore, hence their availability is associated with significant protection against infection with soil-transmitted helminths (OR = 0.46 to 0.58) [59]. Also, intestinal parasitosis was statistically significant with family income, hand-washing habits, type of drinking water, and availability of a toilet facility at home [60].

5. CONCLUSION AND RECOMMENDATION

This study has revealed a low incidence of intestinal helminth infestations among school-aged in Nnarambia, but an improved and sustainable sanitary environment is recommended.

CONSENT AND ETHICAL APPROVAL

Consent was sort from the parents of the children 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:04/0108 (2021).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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