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Intestinal Helminthiasis Burden among Primary School Children in Enugu Suburban, Nigeria

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ABSTRACT

Background: Intestinal helminthiasis is a municipal health crisis with high mortality in pre- school and school aged children and affects the general physiological and psychological growth of a child. The main objective of this work is to find out the prevalence and intensity of intestinal helminthasis in primary school Children. **Methods:** Samples of stool and blood were obtained from 557 pupils and were examined for the presence of intestinal helminths and anaemia respectively. The stool was examined using Formol acetate concentration method and helminth egg count was done using Stoll's method. Heamoglobin concentration (Hb) was done using a portable haemocue 301 analyzer. **Results**: A total of 288(51.7%) children were infested with one or more helminthes and 206 (37.0%) children were anaemic (haemoglobin < 11g/dl). *Ascaris lumbricoides* had the highest prevalence 119(21.4%) of the intestinal helminth recorded while *Strongyloides stercoralis* was the least 8(1.4%). The percentage of pupils that had helminthic infection and anaemia were 140(25.1%) and this is statistically significant ($p < 0.05$). Pupils infested with hookworm had the highest prevalence of anaemia than pupil infected by other species. **Conclusions:** This study showed that intestinal helminth is still a public health concern in the study area. This suggests that there is still need for awareness on their existence and control measures to curb the menace

Keywords: intestinal helminth, anaemia, infestation, pupils.

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Author's contributions:
This work was conducted and approved in collaboration between all the authors, who takes responsibility for its accuracy and integrity. NOA, IBE, designed the study; NOA, IBE, CEA, and ANO sourced for funding; NOA, USO, POI wrote the protocol; POI, USO, NOA contributed in literature search; POI, USO recruited participants; NOA, CEA, POI did lab experiments; NOA, ANO did statistical analysis; IBE, NOA and CEA Contributed in discussions; NOA, IBE drafted the manuscript; IBE supervised the study; NOA Wrote the final manuscript; IBE, NOA and ANO proofread the final manuscript for publication.

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INTRODUCTION

Soil-transmitted helminth infestations are among the majority recurrent infections globally and distress underprivileged communities. About 1.5 billion or 24% of the worldwide populace, are infested with intestinal helminthic infections globally with preponderance being children [1]. Intestinal helminths also referred to as geo helminthes or soil transmitted helminths are intestinal parasites with a life cycle that involves no intermediate hosts or vectors [2]. They infect mainly animals, including humans, and are worsened by the faecal contamination of soil, foods and water. Intestinal helminths or soil transmitted helminths (STH) continue to cause significant morbidity in Nigeria and other less developed tropical and subtropical countries [1].

Intestinal helminths infections have a negative effect on human municipal wellbeing and improvement, distressing around a quarter of the global population, causing elevated death rate generally among children [3]. The major helminths that infest humans are *Ascaris lumbricoides* (the roundworm), *Trichuris trichiura* (the whipworm) and *Necator americanus* / *Ancylostoma duodenale* (hookworms) [1]. Intestinal helminthes can infest the digestive tract and occasionally two or more infect a person and can cause infections at the same time and this is described as poly-parasitism of intestinal helminths. [4]. Intestinal helminths are transmitted by eggs that are passed in the faeces of infested people which in turn leads to soil contamination in areas with poor sanitation.[5,6]. It can occur in quite a lot of ways such as eggs /ova of helminths that gets clinked to fruits / vegetables are swallowed when the fruits / vegetables are not properly washed, peeled or cooked, and also from infested water used. Infective eggs are swallowed by children when they play on the contaminated soil and eat with no proper washing of hands. [1,7] When the infective eggs of the parasites are swallowed, they move into the intestine where they can develop and cause disease [5]. People also get infected when walking bare footed on infested soil. Matured helminthic worms reside in the intestine where they turn out large number of eggs each day. Some Persons are symptomatic while others can survive longer time without any noticeable symptoms or without treatment required [8]. A direct person-to-person spread, or infection from fresh stool sample cannot occur because ova excreted in stool need almost 3 weeks to develop to infective stage in the soil, hence re infection is by contact with the infective ova from contaminated soil.[1]

Helminthic infection affects a child's overall physical and psychological development and may cause anaemia and malnutrition.[4, 9]. They affect the nutritional intake of infected person in many ways which includes depleting of vital nutrients like protein and iron [7]. Hookworm infections also cause chronic intestinal blood loss that can lead to anaemia.[10]. In addition, *Ascaris lumbricoides* may probably contend for vitamin A in the intestine [1,11,2] and decrease dietary ingestion which result to poor health.[13].

Several ecological and socio-economic factors have been identified to be accountable for the continuous perseverance of intestinal parasitism in children. Some of these include non-existent sanitary facilities, poor sanitary condition, unhygienic practices, absence of portable water, housing, poverty and socio-cultural practices [14]

According to WHO, 2002, two billion of the populace were affected by anaemia globally especially, children who are at risk as a result of nutritional deficiencies, haemoglobinopathies and parasitic infestations [15]. In school children it impairs substantial growth, cognitive improvement and academic performance.[16].With the recent economic situation in the country, followed by advocacy to feed children with vegetables and fruits to improve their nutritional status and blood levels, there is likely hood increase consumption of fruits and vegetables with inherent increase in helminths infection

This study therefore is to assess the prevalence of intestinal helminthiasis and its association with anaemia among primary school children aged 5-16 years in sub-urban Enugu Nigeria.

MATERIALS AND METHODS

Study design

This cross-sectional study was carried out to assess some parameters of health in primary school pupils in selected sub-urban communities in. Enugu At least two primary schools were selected in each community comprising private and government schools. A total of 557 pupils was used for this study. The study period was from May to October 2019. Permission to sample school children was obtained from Enugu State Education Board. Permission was also obtained from the various School Heads and parents via informed consent given to the pupils to take home.

Inclusion criteria include apparently healthy School pupils 5-16 years within the study area were included in the study, pupils not on any form of worm expeller medication and have not taking it in the past one month were also included while exclusion criteria include pupils below 5 years and above 16 years were excluded**,** sick and debilitating Pupils were excluded and pupils on worm expeller medication or have taken it in the past one month were excluded from

Method of Data Collection

A questionnaire was completed for each of the recruited pupils, English language combined with vernacular where necessary, was used in administering the questionnaire. Demographic information like age, sex, parent occupation, number of people in the family and other variables was assessed by oral interview and was recorded at the end of the data collection.

Sample collection and processing The pupils whose parents signed informed consent upon return of the form, had their blood and stool samples collected

Blood sample

Two millimeter of blood was obtained from the pupil by venipuncture according to the method of (Cheesbrough [17] and dispensed into an appropriately labelled EDTA container and kept on ice pack, after collection and during transportation from the school to the laboratory and analyzed within 4 hours of collection.

Stool Sample

All the stool sample were examined macroscopically for presence of adult helminth or the segment, the presence of mucus, blood, consistency and colour were also noted. Formol acetate concentration method was used to detect helminth egg by microscopy to determine the egg and type of species[17]. Counting of helminthic eggs per slide to quantify the number of eggs per gram of stool was done using Stoll's technique for counting helminth eggs as previously described in [17] and characterized based on WHO classification of Soil Transmitted Helminths infestation intensities as follows

Helminths	Intensity of infection (egg count per gram)		
	Light	Moderate	Heavy
A. lumbricoides	1 – 4999	5000 – 9999	≥ 10 000
T. trichiura	1 – 999	1000 – 9999	≥ 10 000
Hookworm	1 – 1999	2000 – 3999	≥ 4 000

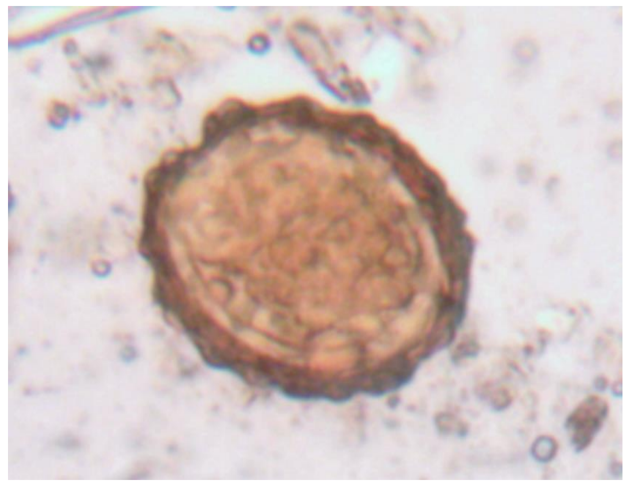
SOURCE [18]

Haematological test:
Haemoglobin cconcentration was determined using HemoCue Hb 301 system, and the result displayed numerically in g/dl. Anaemia was defined as concentration as <11g/dl. [19]

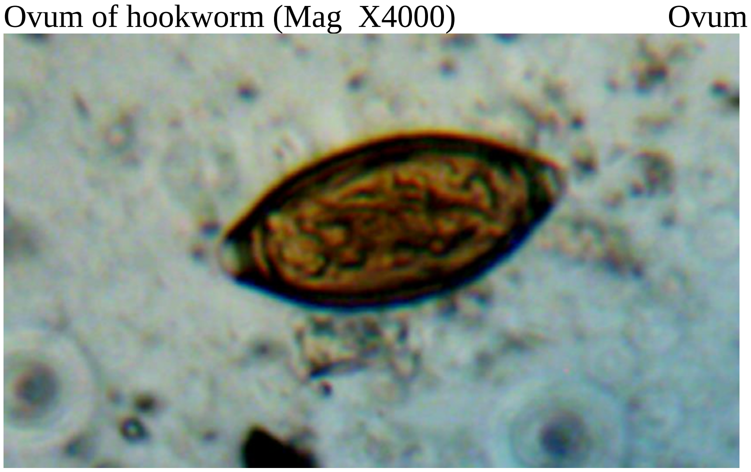
Statistical analysis
Statistical analyses were performed using the statistical software package SPSS Windows Version 20.0 (IBM Corp Armonk, NY: USA). Frequencies, percentage and mean (%) were calculated for category variables in the studied population.

RESULTS

Ovum of hookworm (Mag X4000)



Ovum of *Ascaris lumbricoides* (Mag X4000)



Ovum of *Trichuris trichiuria* (Magnification X4000).

Fig 1:Microphotographs of diagnostic stages of helminth parasites isolated from fresh stool samples of the participants.

This study recorded a prevalence of 288(51.7%) of intestinal helminth. The pupils were infested with at least one of these helminths *Ascaris lumbricoides (119(21.4%)* Hookworm 82(14.75), Taenia species 67(12.0%), *Trichuris trichiura* 12(2.2%*)*, *Strongyloides stercoralis*.8(1.4%).. *Ascaris lumbricoides* was the highest occurring helminth recorded and the least *Strongyloides stercoralis.* Pupils of age group 13-16years had the highest prevalence of intestinal helminthic infection 114(20.5%). There was no statistically significant difference in age groups. ($p < 0.05$). Table 1

The average mean egg intensity for *Ascaris lumbricoides* was 1030.1 epg. Hookworm was 913 epg and the least was *Trichuris trichiura* 397.2 epg. According to WHO classification of soil transmitted helminths infestation intensities, they all had light infestations.

The percentage of pupils infected with intestinal helminths and were also anaemic was 140(25.1%). Pupils infected with hookworm and were anaemic had the highest prevalence 67(12.0%) followed by pupils with anaemia infescted with *Ascaris lumbricoides* 48(8.6%), while the least was pupils infected by) *Strongyloides stercoralis* and were also anaemic 2(0.4. Age group 13-16years had the highest prevalence of infection with anaemia 61(11.0) and more male 77(13.8%) were infected and had anaemia than female 63(11.3%)

There was a significant negative correlation observed between haemogloblin (the indicator of anemia) and helminth count ($r= -0.191$, $p =0.001$) (Fig1)

Table 2 Association of Helminthic Infestationtion with Anaemia

Age	No Examined	*Ascaris lumbricoides* +Anaemia (%)	Taenia +Anaemia (%)	Hookworm +Aanemia (%)	*Strongyloides stercoralis* +Anaemia (%)	*Trichuris trichiura* +Aanemia (%)
5-8	141	17(3.0)	4(0.7)	19(3.4)	1(0.2)	2((0.4)
9-12	206	17(3.0)	4(0.7)	13(2.3)	1(0.2)	1(0.2)
13-16	210	14(2.5)	7(1.3)	35(6.3)	-	5(2.4)
Total	557	48(8.6)	15(2.7)	67(12.0)	2(0.4)	8(1.4)
X^2		13.238	0.8421	21.325	0.000	3.250
Pvalue		0.004	0.768	0.001*	1.000	0.197
Sex						
Male	302	28(5.0)	6(1.1)	36(6.5)	2(0.6)	5(1.0)
Female	255	20(3.6)	9(1.6)	31(5.6)	-	3(0.5)
Total	557	48(8.6)	15(2.7)	67(12.0)	2(0.4)	8(1.4)
X2		13.238	0.8421	21.325	0.000	3.250
P-value		0.004	0.768	0.001*	1.000	0.197

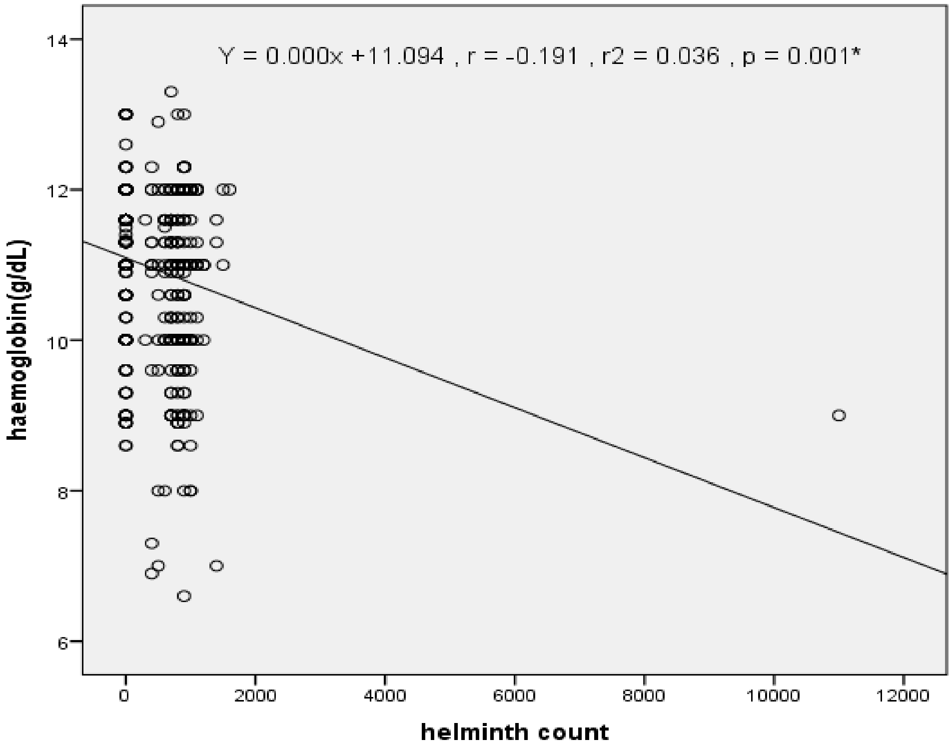


Figure 2: Correlation of haemoglobin (the indicator of anaemia) and helminth count

TABLE .1: PREVALENCE AND INTENSITY OF INTESTINAL HELMINTHIASIS

Age Groups	No examined	Intestinal Helminthiasis		*Ascaris lumbricoides*		Hookworm		Taenia species		*Strongyloidess tercoralis*		*Trichuris trichiuria*	
		No infected (%)	No Not infected (%	N(%	Epg	N(%	Epg	N(%	Epg	N(%	Epg	N(%	Epg
5-8	141	72(12.9)	69(12.4)	35(6.3)	834.1	22(3.4)	310.1	13(2.3)	476.8	0(0.0)	0.0	2(0.4)	350.0
9-12	206	102(18.3)	104(18.)	44(7.9)	1103.3	25(4.5)	986.3	26(4.6)	624.4	4(0.7)	0.0	3(0.5)	432.7
13-16	210	114(37.7)	96(17.2)	40(7.1)	1165.2	35(6.3)	971.0	28(5.0.)	687.1	4(0.7)	0.0	7(1.3)	403.9
Total	557	288(51.7)	269(48.3)	119(21.4)	1030.1	82(14.7)	913.4	67(12.0)	593.4	8(1.4)	0.0	12(2.2)	397.8
X^2		1.560		4.860		4.930		2.153		3.973		1..414	
P-value		0.668		0.102		0.177		0.541		0.264		0.702	

Larva of S *stercoralis*./ egg of taenia could not be not be categorized because the values are not available in WHO classification standard

DISCUSSION

This study recorded the prevalence of intestinal helminthes among the study participant as 288(51.7%). The Pupils were infested with at least one of these helminthes, *Ascaris lumbricoides*, Hookworm, Taenia spp, *Trichuris trichiura* and *Strongyloides stercoralis.* This prevalence was comparable with similar works in Nigeria by Pam *et a*l [19] in their work, studies on parasitic contamination of soil and local drinking water sources, among Doma Local Government Area, Nasarawa State, Nigeria. Who recorded a prevalence of 59.38%, Babatunde *et al* [20] 60.4%, Molla, *et al* [21] 54.0% Adedoja, *et al* [22] 61.2% and Dada- Adegbola, *et al* [23] 64.6%. However, it was above those recorded in different areas, 25.8% recorded by Akingbade *et al*, (2013) and Tefera *et a*l [24] 35.5% and below the prevalence recorded by Kafinta *et al* [25] 72.0% .Level of exposure, mode of transmission, illiteracy level, environmental factors and level of awareness on prevention and control of these helminthes might be the reason for the variation in the results.

The major intestinal helminth recorded was *Ascaris lumbricoides* 119(21.4%) this is comparable with previous prevalence rate by Molla, *et al* [20], 21.7%, Kafinta *et al* [24] 31.0%, Ojuromgbe, *et al* [26] 34.2% ,but higher than that of Amaechi *et al* [27] 8.1%, but lower than that of Osazuwa *et al* [26] 75.6%, Odogbemi , *et al* [29] 76.9%, Umeh, *et al* [30] 56.2%, Unachukwu *et al* [9] 40 .0%. The high Prevalence of *Ascaris lumbricoides* is corroborated by the relatively high occurrence of unhygienic habits among the pupils. The ova of *Ascaris lumbricoides* can survive adverse ecological conditions and is an indication of fecal contamination which could be attributed to improper sewage disposal. The children could equally acquire *Ascaris* through accidental ingestion of the soil contaminated eggs, unhygienic habit of not washing hands before eating, after playing in the school or working in the farm and also due to their habits of picking and eating food like biscuits, fruits and sweets that had fallen on the soil as they play. The presence of large numbers of adult *Ascaris* worms in the small intestine can cause abdominal distension and pain (Shah and Shahidullah [31].

The second most prevalent was hookworm 12.0% which is comparable to the work of Odugbemi *et al* [29] 15.4%, and Kafinta *et al* [24] 19.0% higher than that reported by Njunda *et al* [32] 8.5 %, Ojurongbe *et al* [26] 5.1% Amaechi *et al* [27] 5.1% but is lower than that reported by Adedoja [22] 22.5% Unachukwu and Nwakanma [9] 25%, Osazuwa, *et al* [28] 19%. Infestation of hookworm could be credited to the fact that children walk bare foot at farm, home and field. Hookworm infestation leads to blood loss in the intestinal due to invasion and activity of the matured hookworm. Iron deficiency anaemia occurs in Hookworm infestation when the volume of blood obtained through dietary is less than that loss in the intestine. Hookworm infestation can also lead to protein loss which could result in hypoproteinemia [17].

Strongyloides stercoralis (1.4%) was the smallest helminth recorded and is similar to the works of Ijagbone and Olagunju [33] with prevalence of 0.6% and Adefioye [34] 0.7%. The reason for low prevalence is likely to be linked with its susceptibility to adverse environmental conditions, hence its alternating mode of infestation and autoinfection. Ijagbone and Olagunju [33] but lower than that reported by Kafinta *et al* [24] who recorded a prevalence of 6.0%

Intestinal helminth is mostly contacted through fecal ingestion. Elevated intestinal helminth infestation is attributed to unhygienic ecological condition, unavailability of safe water sources, open defecation, unhygienic sanitary habits and lack of personal hygiene (Emmy-Egbe*et al* [35]. This was observed in this study. Infestation is usually indirect through secondary source such as food and water

(Prajapati *et al*, [36]. These intestinal helminthes were mostly indicator of fecal pollution of food or water and non-hygienically prepared foods, which is a manifestation of lack of environmental sanitation and unhygienic habits of children. Lack of knowledge and awareness to these infestations occurs due to inadequate information on the means of spread, prevention and control of helminthic infestation. These have also been reported by many authors. Yaro, *et al* [37] recorded that the use of plant leaves and used paper / newspaper to clean up after toilet visit are behaviors common among the children and this might be linked to the cause of increased infestation. This study also indicated that prevalence of intestinal helminthic infestations were more common in male 171(30.7%) than in the female 117(21.0%) which is similar to Amaechi *et al* [27], it could be attributed to the fact that they could pick the helminthes as a result of their activities during playing, farming and other domestic activities. Although not statistically significant ($p < 0.05$), therefore all helminthic infestations, recorded were not sex dependent and the observed difference may be attributed to the level of exposure. Intestinal helminth infestation was higher in age group 13-16years 114(20.5%) and least 5- 8 years72 (12.9%). However , the level of parasitism in the children indicates general unawareness and/or ignorance among them.

The total prevalence of pupils infested by helminthes and also aneamic was 140(25.1%), this is similar to the work of Ihejirika, *et al* [38] 21.1% but lesser when compared with 50% by [39]. The discrepancy could be as a result of type of food, size of food consumed, family size, income of parent and the specie of helminth infested with.There was no considerable association between helminth infestations intensity and anaemia in this work. The prevalence of pupilswith hookworm infestation and also anaemia was 67 (12.0%) in this work is lower than of Osazuwa [28], Odebunmi *et al*, [40] Agbolade *et al* [41]. The association between helminth and anaemia in this study showed that pupils infested by hookworm is more likely to be aneamic However, if a person is infected with hookworm, development of anaemia depends on the level of infestation and quality of nutritional intake. (Osazuwa *et al* (2011). A low hookworm load can cause anaemia in people whose nutritional status is compromised. Hotez and Molyneux [41] and Osazuwa *et al* [28]. In this study, there was a significant association between hookworm and anaemic status. This is similar with Osazuwa, *et al* [28], but not with that of [44] where no association was established between hookworm infestation and anaemia

Trichuris infestations are also known to be associated with anaemia, Osazuwa, *et al* [28]. The prevalence of 8(1.4%) recorded in this study is lesser compared to Agbolade *et al* [2], Osazuwa*et al* [28] and Nmorsi *et al* [44]. There was no significant association with anaemia and *T. trichiura* in this study unlike report of Ezeamama *et al* [46] but it agrees with Alelign, *et al* [46 and Adewale, *et al* [47].

Conclusion

Intestinal helminths is still a health concern in the study area. This should serve as a wakeup call to the community leaders, relevant agencies and health worker to improve awareness on mode of transmission, prevention, control and the need to maintain a proper hygiene and good sanitary disposal habit to curb this menace.

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