Journal of Advances in Medicine and Medical Research

23(1): 1-8, 2017; Article no.JAMMR.33804
Previously known as British Journal of Medicine and Medical Research
ISSN: 2231-0614, NLM ID: 101570965

Helminth Infection in School Children of Zing Local Government Area, Taraba State, Nigeria

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Authors' contributions

This work was carried out in collaboration between all authors. Author OSE designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Author SLK supervised the study. Author JAW reviewed the experimental design. Authors DH and DSE managed the analyses of the study. Authors MNI and AAM managed the literature searches. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/JAMMR/2017/33804
Editor(s):
(1) Chris Ekpenyong , Department of Human Physiology, College of Health Sciences, University of Uyo, Nigeria.
Reviewers:
(1) Claudia Irene Menghi, University of Buenos Aires, Argentina.
(2) J. Siwila-Saasa, University of Zambia, Zambia.
(3) Rina G. Kaminsky, Institute for Infectious Diseases and Parasitology Antonio Vidal, Honduras.
Complete Peer review History: http://www.sciencedomain.org/review-history/20183

Original Research Article

Received 29th April 2017
Accepted 18th July 2017
Published 24th July 2017

ABSTRACT

Geohelminths are soil transmitted parasites which are among the most important groups of infectious agents that cause serious global health problems. The disease is more prevalent among children living in conditions of poor sanitation. A study to determine the status of the disease was carried out. Faecal samples from 420 children were obtained and examined using standard parasitological techniques. The nutritional status of the children was determined using anthropometric measurements of wt/ht^2. The overall prevalence of geohelminths and cestodes recorded was 41.90%. Three geohelminths and two cestodes recorded were observed in varying

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degrees; *Ascaris lumbricoides* (5.17%), *Strongyloides stercoralis* (9.04%), *Trichuris trichiura* (3.57%), *Hymenolepis nana* (18.80%) and *Taenia solium* (4.76%). The prevalence rate in males was slightly higher (43.00%) than that of the females (40.85%) but not statistically significant ($\chi^{2=}$0.116, P<0.05). The age bracket 5-7 years gave the highest infection rate (53.5%) while the age bracket 14-16 years assumed the least prevalence of 7.4%. Chi square analysis showed a significant difference in infection among age groups (χ^2= 10.40, P<0.05). The mean nutritional status of the pupils seems to increase with increase in age. The body mass index (BMI) of infected children was found to be lower (BMI< 18.5 kg/m^2) than those of the uninfected children (BMI>18.5 kg/m^2). Pearson correlation coefficient showed a high degree of association between infection and body mass index (r= 0.805). Based on these findings, mass treatment of schoolchildren, health education campaign, improved sanitary conditions, provision of toilet facilities and improved personal hygiene were recommended as control measures.

Keywords: Anthropometry; cestodes; schoolchildren; geohelminths; nutritional status; Taraba State; Nigeria.

1. INTRODUCTION

Geohelminths are major threat to health of children in rural areas of developing countries and they are important cause of morbidity in school children, especially primary school pupils (4-15 years) who habour the highest intensity of worm infection [1]. Five species are responsible for widespread disease in humans and these include *Ascaris lumbricoides, Trichuris trichiura, Hookworm* (*Ancylostoma duodenale* and *Necator americanus*) and *Strongyloides stercoralis.* More than 3.5 billion people worldwide are currently infected with one or more species of intestinal helminths but children are at greater risk of infection [2]. The risk of suffering from geohelminth infection is higher among rural dwellers that defecate around their environment. Significant morbidities attributed to intestinal helminthiasis include malnutrition, growth retardation, anaemia, vitamin A deficiency, and impaired intellectual performance [3]. The relationship between malnutrition and geohelminth, which has been well established, is complex and depends on determinants such as the social, economic and physical environments in which an individual lives. Geohelminths are recognized as major public health problems, because they negatively affect the host's nutritional status through the intake, intestinal absorption, metabolism and excretion of nutrients [4].

Cestodes are parasitic worms commonly called tapeworms, which live in the digestive tract of vertebrates. Over a thousand species have been described and all vertebrate species may be parasitized at least by one species of tapeworm [5]. Humans are predisposed to infection by several species of tapeworm such as the pork tapeworm (*Taenia solium*), beef tape worm (*Taenia saginata*) and fish (*Diphyllobothrium* species). *Taenia saginata* and *Taenia solium* have a worldwide distribution in countries where cattle and pigs are raised and beef and pork are under-cooked before being eaten [6]. *Hymenolepis nana* also known as the dwarf tapeworm is known to infect humans and children are commonly infected than the adults. It is spread through the ingestion of eggs in food or water or from the hands contaminated with infected faeces [7]. Children suffering from *H. nana* infection are found to have abdominal pain, diarrhea, and malnutrition [8]. This study attempted to determine the prevalence of geohelminths and cestodes infections among primary school children in Zing Local Government Area, Taraba State, Nigeria.

2. MATERIALS AND METHODS

2.1 Study Area

The study areas were Bosung, Tajah and Laapo communities, which are rural human settlements in Bubong ward of Zing Local Government Area of Taraba State. Zing is located on latitude 7° North 5° East, longitude 11° south and 20° west. Majority of the indigene are farmers and others are civil servants. The study area is populated with Mumuye people. The inhabitants depend on streams and rivers for their source of drinking water, and most of them defecate in their surrounding environment, as only few use pit latrines.

2.2 Ethical Clearance and Permission

Ethical clearance for the study was sorted from the ethical review committee of the Department

of Biological Sciences, Taraba State University, Jalingo, Nigeria. Additional permission and consent were sought and obtained from Zing Local Government Authorities, Head Teachers, parents and the pupils before commencement of study. Before collection of samples, questionnaires which sought information on age, sex and other demographic characteristics were administered to participants.

2.3 Pre-survey Contact

In this cross sectional study, a visit was paid to the study area before commencement of study to see the community leaders, sensitize the public and to select primary schools for the study. The three primary schools were selected randomly from three major wards with one primary school per ward.

2.4 Collection of Samples

A total of 420 stool samples were collected. A clean plain container with a well label identification number was randomly distributed to the pupils from 5-16 years of age and instructions were given to the pupils to collect their fresh stool samples at home next morning with the help of their parents and return it immediately to the school premises early in the morning. The sample were collected and transported to the laboratory for parasitological analysis.

2.5 Laboratory Investigations

Samples were taken to the laboratory where each sample was examined, for colour, presence of blood, mucous, egg, larva and adult worm. Wet preparation method was first used by emulsifying small quantities of faeces in normal saline and examined microscopically. The formol ether concentration technique which employs centrifugation as described by Cheesbrough [9] was also used to prepare the sample. Microscopic examination was carried out using x10 and confirmed with x40 objective lenses with the assistance of laboratory technicians.

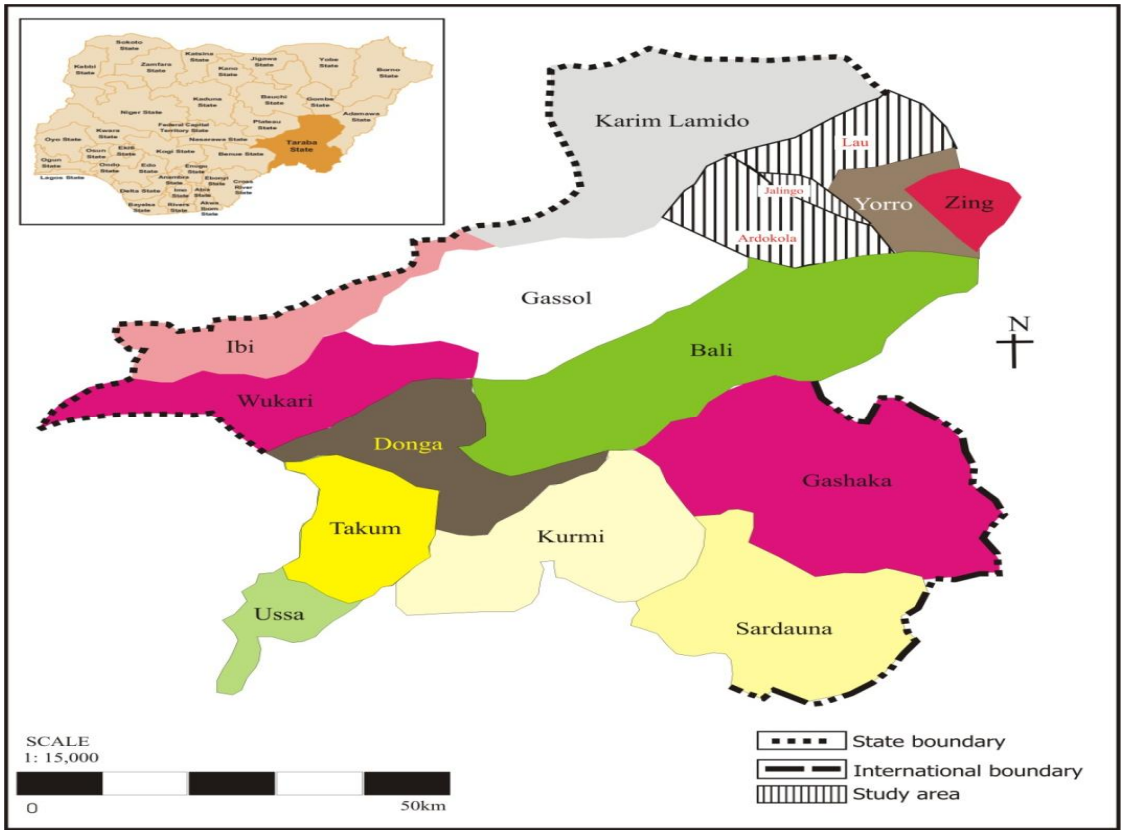

Fig. 1. Map of Taraba State showing the local government areas

2.6 Assessment of the Nutritional Status

The weight and height indices described by WHO [10] and adopted by Elkanah and Akogun [11] were used to determine the nutritional status of the children. The weight (in kg) of each child was taken using weighing scale and their heights were measured (in metres) using meter rule. Pupils were weighed by field assistant without shoes and with least possible clothes. The measured precision was 0.1 kg. For the measurement of height, the meter rule was put vertically against a wall; the child stood up and was measured vertically with 0.5 precision. The nutritional status was determined by dividing the weight by the square value of the [12].

2.7 Statistical Analysis

Chi-square (x^2) statistical tool was used to compare differences in infection among age, sex and school locations. Differences were shown to be significant where $P<0.05$. Pearson Correlation was used to assess the relationship between helminths infections and nutritional status.

3. RESULTS

An overall total of 176 (41.90%) children were infected with various geohelminths and cestodes (Table 1). The geohelminths and cestodes observed included: *A. lumbricoides* (Plate 1)*, S. stercoralis* (Plate 2), *T. trichura* (Plate 3), *Taenia solium* (Plate 4) *and H. nana* (Plate 5)*.* Infection by school location and sex did not differ significantly ($\chi^2= 2.53$, $P>0.05$) and ($\chi^2= 0.116$, $P=0.05$) respectively. Infection appeared to increase with decrease in age (Table 3). Pupils aged between 5-7 years had higher infection rate (54.55%) while those within age bracket 14-16 years had lower infection rate (11.11%). Chi-square analysis showed significant difference in infection between age groups ($\chi^2 = 8.927$, $P<0.05$). Table 2 shows overall prevalence of the parasites encountered. *Hymenolepis nana* had the highest prevalence rate (18.80%; 79/420) while *T. trichiura* had the lowest prevalence rate of 3.57% (15/420).

Table 4 shows the profile of mean nutritional status of the infected pupils in relation to their age. The mean nutritional status of age group 5-7 was 15.3 kg/m^2, 8-10 was 16.5 kg/m^2, 11-13 was 17.4 kg/m^2 and 14-6 was 18.5 kg/m^2. The results showed that mean nutritional status seem to increase with increase in age of pupils. As the nutrition status of pupils improved with increase in age, the prevalence of infection decreased (r = 0.805).

Plate 1. *A. lumbricoides* egg, Mg x40

Plate 2. *S. stercoralis* lavae

Plate 3. *T. trichura* egg

Plate 4. *Taenia sp* egg

Plate 5. *H. nana* egg

Table 5 indicates the body mass index (BMI) of infected and uninfected children. Those with less than 18.5 kg/m^2 are malnourished and were found to be higher in infected pupils than the uninfected children. Those with BMI ≥ 18.5 kg/m^2 are at the normal range and were less infected.

Table 1. Geohelminth and cestode infections among school children in different schools of Zing LGA, Taraba State

School	No. examined	No. infected (%)
Bosung	150	59 (39.33)
Laapo	150	57 (38.00)
Tajah	120	60 (50.00)
Total	420	176 (41.90)

X^2 = 2.53; df =2; P<0.05

4. DISCUSSION

The results of the study showed that geohelminth and cestode infections are endemic in rural communities of Zing LGA of Taraba State, Nigeria.

The observed infection rate of 41.90% agrees with earlier reports of Elkanah et al. [13] and Mordi et al. [14] who recorded high prevalence of intestinal helminthiasis among school children of Kofai community and school children in Aniocha South LGA Delta State, respectively.

Table 2. Distribution of geoheminths and cestodes among school children in Zing LGA, Taraba State

Parasites	No. examined	No. infected (%)
Ascaris lumbricoides	420	24 (5.71)
Strongyloides stercoralis	420	38 (9.04)
Trichuris trichiura	420	15 (3.57)
Hymenolepis nana	420	79 (18.80)
Taenia solium	420	20 (4.76)

Table 3. Occurrence of geohelminths and cestode infections in relation to age among school children of Zing LGA, Taraba State

Age (years)	Male		Female		Total	
	No. examined	No. infected	No. examined	No. infected	No. examined	No. infected
5-7	110	60 (54.55)	105	55 (52.38)	215	115 (53.5)
8-10	67	26 (38.81)	68	28 (41.17)	135	54 (40.0)
11-13	21	2 (9.52)	22	3 (13.63)	43	5 (11.6)
14-16	9	1 (11.11)	18	1 (5.55)	27	2 (7.4)
Total	207	89 (43.00)	213	87 (40.85)	420	176 (41.9)

X2 = 10.4; df = 3 P<0.05

Table 4. Geohelminths and cestodes infection in relation to the mean nutritional status and age groupings among school children of Zing LGA, Taraba State

Age group	No. examined	No. infected	Mean nutritional status (kg/m^2)
5-7	215	115 (53.5%)	15.3
8-10	135	54 (40.0%)	16.5
11-13	43	5 (11.6%)	17.4
14-16	27	2 (7.4%)	18.5
Total	420	176	16.8

r = 0.805

Table 5. Body Mass Index (BMI) of infected and uninfected children in Zing L.G.A, Taraba State

Classification	Interpretation	No. infected (%)	No. uninfected (%)	Total
BMI<18.0kgm^2	Malnourished	176 (44.56)	219 (55.44)	395
BMI>18.5kg/m^2	Normal	0 (0.0)	25 (100)	25
Total		176	244 (58.10)	420

The geohelminths and cestodes observed in this study included *A. lumbricoldes, S. stercoralis, T. trichiura, Taenia solium* and *H. nana.* This finding is consistent with that of Abera et al. [15] who also identified these parasites among school children in Ile-Ife south west, Osun State.

In this study, infection appears to increase with age, with pupils at age group 5-7 years having the highest prevalence. This is consistent with the findings of Nematian et al. [16], who recorded highest infection rate among 7-12 age groups. Abera et al. [15] reported that as children advance in age, they are able to take care of themselves by reducing the rate of playing with soils and also take care of their drinking water and food.

WHO [17] confirmed that geohelminth infections are dependent on age and greater severity of the infection is found in younger children. In this study, *Hymenolepis nana* is the most common geohelminth. The 18.80% recorded in this study is higher than the 2-5% prevalence rate observed by Umoh et al. [18] in Zaria and Kaduna in Nigeria.

The second most common geohelminth observed was *Strongyloides stercoralis*, which can cause chronic persistent infection in man especially in the rural communities, where people living in such areas are predisposed to such infection. This could be attributed to increase in the intake of infested prickled vegetable that is common in Zing L.G.A, Taraba State. It has been reported that the infective stage of *A. lumbricoides* has enormous capacity to withstand the environmental extremes of the semi-urban environment. The eggs of the parasite are coated with mucopolysaccharides that render them adhesive to wide variety of surfaces [19].

The absence of significant difference in infection among sex, is in accord with Stephenson et al. [20] who reported that the prevalence of geohelminth is neither age nor sex dependent but equal exposure to the risk factor as there were no restriction on movement and contact of the pupils with infected egg through drinking contaminated water or contaminated food.

The variation in the prevalence rate among different locations is in agreement with the prevalence recorded by Omah et al. [21] who reported high prevalence and attributed it to improper hygiene, poverty, poor sanitary condition and agricultural habits.

In the results obtained from the current study, there is positive correlation between infection and the nutritional status of the pupils. The mean body mass index between infected and uninfected children showed that infected children had lower nutritional status (malnutrition) than those children who were not infected (BMI < 18.5). This agrees with the work of Elkanah and Akogun [11], Egwanyenga and Ataikiru [12] who observed similar trend among school children in Gyawana, Lamurde L.G.A and Mexican institute of social security, Mexico, respectively.

5. CONCLUSION

The study revealed that there is strong relationship between helminths infection and malnutrition among school children in Zing L.G.A. The intestinal helminths observed (*A. lumbricoldes, S. stercoralis, T. trichiura, Taenia solium, H. nana*) were a reflection of poor state of

hygiene and high rate of carriers in the community. Improved sanitation by provision of modern toilet facilities, health education by enlightenment campaigns, school-based health programme and regular deworming of pupils would go a long way in reducing geohelminth infection.

CONSENT

As per international standard or university standard, patient's written consent has been collected and preserved by the authors.

ETHICAL APPROVAL

As per international standard or university standard, written approval of Ethics committee has been collected and preserved by the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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Peer-review history:
The peer review history for this paper can be accessed here:
http://sciencedomain.org/review-history/20183