THE RELATIONSHIP BETWEEN ANTHROPOMETRIC INDICES AND GASTROINTESTINAL HELMINTH INFECTION IN PRIMARY SCHOOL CHILDREN OF BATAGARAWA LOCAL GOVERNMENT AREA, KATSINA STATE, NIGERIA

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Abstract

A study was conducted from December, 2010 to March, 2011 to determine the prevalence of gastrointestinal helminthiasis in relation to anthropometric indices among primary school pupils in Batagarawa Local Government Area, Katsina State, Nigeria. Out of 300 stool samples examined, using the formol-ether concentration technique, 72 (24%) were infected with four species of intestinal parasites. The prevalence of hookworm infection was 30 (10%), *Hymenolepis nana* 24 (8%), *Schistosomamansoni* 12 (4%) and *Enterobius vermicularis* 6 (2%). The prevalence of the infection was significantly higher among males than females ($p<0.05$). The highest prevalence was recorded in males in the 9-11 years age-group, followed by 12 years and above age-group. The anthropometric indices showed that the correlation of males and females infected with respect to their height was $r=0.904$, while the correlation *t*-test was 2.1145 and weight correlation was $r=0.0823$, while the *t*-critical was =12.71 for height and weight indices. A total of 36 (12.0%) of infected pupils had body mass index (BMI) <18 (underweight), while 29 (9.7%) had body mass index of 18-24.9 (normal) and 7 (2.3%) of infected pupils had BMI of 25-29.9 (overweight). No infected child had BMI above 30. The results of the findings imply that inadequate water supply, poor personal hygiene and lack of knowledge favoured increase in the prevalence of infection, disease prevalence may have an effect the BMI of the children. Control measures suggested include good sanitation, enlightenment campaigns and construction of more wells and boreholes as a means of providing safe drinking water to the populace.

Keywords: prevalence, gastrointestinal helminthosis, anthropometry, Batagarawa.

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Introduction

Gastrointestinal helminthiasis is caused by pathogenic helminth parasites and is regarded as an important public health problem affecting many people in tropical Africa (Anosike *et al* 2006). The disease is prevalent in approximately one quarter of the world's population. School children are usually the main target primarily due to their poor hygienic and sanitary habits coupled with their voracious eating habits (WHO, 2002).

Helminthic diseases, whether soil-transmitted, vector borne or resulting from particular social habits, provide some of the great public health problems to man (Luka *et al* 2000). The public health hazards of helminth infections include mortality, growth impairment, development and educational attainment in children, significant inhibition of productivity resulting in low output, anemia and intestinal obstruction which may eventually lead to death (Bassey, 1999).

Over the years, several investigations have been carried out in different communities in Nigeria on the prevalence of helminthiasis (Akogun, 1989; Bassey, 1999; Anosike *et al* 2006). The prevalence of gastrointestinal helminthiasis varies considerably from place to place in relation to the pattern of transmission

of the disease (Pugh *et al* 1979, Luka *et al* 2000). In northern Nigeria, to the best of our knowledge there are no known reports of the relationship between anthropometric indices of humans in relation to the frequency of intestinal helminthiasis.

This study was therefore undertaken to determine the prevalence of gastrointestinal helminthiasis in relation to anthropometric indices of primary school pupils in Batagarawa Local Government Area, Katsina State, Nigeria.

Materials and methods

Study area

The study-area was Batagarawa Local Government Area located at latitude 12^0 46′ to 13^0 10′ N and longitude 7^0 22′ to 7^0 5′ E. The Local Government Area has a total area of about 926, 85 sq km with a total projected population of about 189,059 (96,693 males and 92,366 females) (National Population Commission [NPC], 2006).

Batagarawa Local Government Area comprises of two district headquarters namely; Batagarawa and Ajiwa districts. The area is inhabited by Hausas and farming is their major occupation.

Study population

The study was carried out in ten primary schools (six from Batagarawa District and four from Ajiwa District). Male and female pupils aged 6-12 years were randomly selected for the study. A total of 300 pupils (30 from each primary school) were selected randomly for the cross sectional study, Due to the unavailability of data on the prevalence of gastrointestinal helminthiasis in Batagarawa Local Government Area, a prevalence of 75% was used to determine the sample size using the equation of Sarmukaddam and Gerald (2006). Ethical clearance was obtained from the local government authority through the Local Government Education Secretary before the collection of the samples.

Collection of faecal samples

Each pupil was given a sterile labelled specimen bottle in which to collect some of their early morning faeces and the samples were collected randomly. A demonstration of how to collect faeces and transfer into the bottles was done to enhance understanding. The faecal samples were transported to the Veterinary Helminthology and Parasitology Laboratory, Faculty of Veterinary Medicine, Ahmadu Bello University, Zaria, for analysis.

Structured questionnaires were administered to the pupils. Information on the school, age and sex of the pupils, demographic variables were obtained from the pupils. Housing sanitation, weight and height of the children, source of water and out-door activities of each pupil were documented. The feacal samples were transported to the laboratory for analysis.

Sample analysis

The formol-ether concentration method of Neva and Brown (2000) was used to process all feacal samples as follows. About two grams of faeces was emulsified in 10 ml of 10% formal-saline. The suspension was sieved into a centrifuge tube through a double layer of gauze placed in a funnel. About 2 ml of diethyl-ether was added to the filtrate, shaken and centrifuged at 2,000 rpm for two minutes. The supernatant was decanted. Pasteur pipette was used to transfer a drop of the sediment unto a slide, a drop of Lugol's iodine was added and cover slip was placed on the slide. This was examined under the light microscope at x 10 and x 40 magnification.

Statistical analysis

Prevalence of helminth infection was calculated and expressed as a percentage (%). *Chi* square and Odds Ratio (OR) were used to find out whether there was any association between the epidemiological factors and helminth infection among the pupils in Batagarawa LGA of Katsina State. Correlation analysis was used to determine the relationship between gastrointestinal helminthiasis and anthropometric indices. The body mass index (BMI) of infected pupils was used to define the relationship of height, weight (anthropometric indices) and prevalence of the helminthiasis. The body mass indeces in pupils are divided into four ranges. Any one with BMI <18 is underweight, BMI 18-24.9 has a normal weight, BMI 25-29.9 is overweight while a child with BMI >30 is said to be obesed.

Results

A total of the 300 pupils were examined out of which 72 (24.0%) were infected with various helminth parasites. The parasites detected were hookworm 30 (10%), *Hymenolepisnana* 24 (8%), *Schisto-somamansoni* 12 (4%) and *Enterobiusvermicularis* 6 (2%). The sex-specific prevalence showed higher prevalence in males 60 (29.8%) than females (12.2%). Higher prevalence of hookworm and *Hymenolepis nana* 11.9% each was recorded among males followed by *Schistosomamansoni* (6.0%). In females, only two parasites were recorded (hookworm and *Enterobiusvermicularis*) with equal pervalence of 6.1% each (Table 1).

Table 1: Prevalence of gastrointestinal helminth infection in primary school pupils in Batagarawa Local Government Area, Katsina State.

Gastrointestinal helminths	Males (*n*=201) number infected	Females (*n*=99) number infected	Total number infected
Hookworm	24 (11.9)	6 (6.1)	30 (10.0)
Hymenolepis nana	24 (11.9)	0 (0)	24 (8.0)
Schistosomamansoni	12 (6.0)	0 (0)	12 (4.0)
Enterobiusvermicularis	0 (0)	6 (6.1)	6 (2.0)
Total	**60 (29.8)**	**12 (12.2)**	**72 (24.0)**

The highest prevalence of helminthic infection (37.6%) was obtained in the 9-11 years age-group and all the four parasites recovered in this study were recorded in this age-group, hookworm had the highest prevalence (15.0%) followed by *H. nana* (11.3%), *S. mansoni* (7.5%) the least was *E. vermicularis* (3.8%). The 12 years and above age-group was second (13.0%) and two parasites were recovered from this age-group that is hookworm and *H. nana* each with a prevalence of 6.5%. No single parasite was recovered in the 6-8 years age-group pupils (Table 2).

Table 2: Age specific prevalence of gastrointestinal helminth in school pupils in Batagarawa L.G.A, Katsina State.

Parasites	Age-groups		
	6-8yrs (*n*=47)	9-11yrs (*n*=160)	12 and above yrs (*n*=93)
Hookworm	0 (0)	24 (15:0)	6(6.5)
Schistosoma mansoni	0 (0)	12 (7.5)	0 (0)
Enterobius vermicularis	0 (0)	6 (3.8)	0 (0)
Hymenolepis nana	0 (0)	18 (11.3)	6 (6.5)
Total Infected	**0 (00)**	**60 (37.6)**	**12 (13.0)**

Table 3 shows the prevalence of helminthiasis in relation to anthropometric indices of school pupils. The body mass index (BMI) of infected pupils was used to define the relationship of height, weight and prevalence of the helminthiasis. The body mass indexes in pupils are divided into four groups. A child with BMI <18 is underweight, BMI 18-24.9 is normal, BMI 25-29.9 is overweight while a child with BMI >30 is obesed. A total of 36 (12.0%) of infected pupils had body mass index <18, while 29 (9.7%) had body mass index of 18-24.9 and 7 (2.3%) of infected pupils had BMI of 25-29.9. No infected child had BMI above 30. Out of the total number of males infected, 32 (15.9%) had BMI <18, followed by 22 (10.9%) had BMI values of 18-24.9, while 6 (3.0) had BMI of 25-29.9, none had BMI value >30. Out of the infected females, 4 (4.0%) had BMI< 18, 7 (7.1%) had BMI of 18-24.9, 1 (1.0%) had BMI of 25-29.9 while none had BMI >30 (Table 3).

Table 3: Prevalence of helminth infection in relation to body mass index of primary school pupils.

Ranges of Body Mass Index (BMI)	Number of males infected (%)	Number of females infected (%)	Total number infected (%)
<18	32 (15.9)	4 (4.0)	36 (12.0)
18-24.9	22 (10.9)	7 (7.1)	29 (9.7)
25-29.9	6 (3.0)	1 (1.0)	7 (2.3)
>30	0	0	0
Total	**60 (29.8)**	**12 (12.1)**	**72 (24.0)**

Table 4 shows the summary of the responses of the pupils to the questionnaires and the results of statistical analysis that showed the associations between helminthiasis and various factors. The responses were categorised into number of pupils that have the disease and those that did not have the disease.

Odds ratio greater than one indicate there were associations between each factor and prevalence of helminthiasis. Based on the general cleanliness of the pupils, those that appeared very dirty had odds ratio value of 3.70; that is, they were 3.70 times more likely to come down with the disease, while those that appeared neat and fairly neat but infected were 0.77 and 0.35 times more likely to come down with the disease. Responses on sources of water supply showed that those that use pipe-borne water and were infected had odds ratio value of 6.17, while those that use well-water and reservoirs had odds ratio values of 0.43 and 0.38 respectively. Based on type of toilet, those that use pit latrines had an odds ratio of 5.37 while those that use water system had an odds ratio of 0.00 (Table 4).

Discussion

The overall prevalence of gastrointestinal helminthiasis in the study-area was 24.0%. The results of this study showed that gastrointestinal helminthiasis infection was moderate in Batagarawa LGA of Katsina State as compared to other studies in Nigeria. These findings

Table 4: Effect of some factors on the prevalence of gastrointestinal helminthiasis of school pupils in Batagarawa L.G.A Katsina State, December 2010 to March 2011.

Factors: General cleanliness of pupils/personal hygiene	No. positive for parasites (%)	No. negative for parasites (%)	Odds ratio value (OR)	95% confidence inter (CI)
Good	6 (2.0)	63 (21.0)	0.77	0.32
Fair	12 (4.0)	163 (54.3)	0.35	0.08
Poor	12 (4.0)	44 (14.6)	3.70	5.38
Source of water				
Well	12 (4.0)	92 (30.6)	0.43	0.15
Pipe borne	6 (2.0)	108 (36.0)	6.17	11.76
Reservoir	12 (4.0)	35 (11.6)	0.38	0.09
Others	–	–	0.00	0.00
Toilet types				
Pit latrines	18 (6.0)	225 (75.0)	3.75	5.37
Water system (W/c)	12 (4.0)	40 (13.3)	0.00	0.00

are however closely related to those studies conducted in other parts in Nigeria by Luka *et al* (2000) in Lere LG of Kaduna State; Luka *et al* (2006) in Zaria, Kaduna State. Anosike *et al* (2006) in Jos, Plateau State and Obiukwu *et al* (2008) in Anambra State. Several other reports from other parts of tropical Africa have shown very high (>70%) infection rates of intestinal helminthes (Dada *et al* 1993). This could be due to their feeding habits, attitude of walking with bare feet and indiscriminate habits of defeacation (Adebisi, 2008; Kawo *et al* 2004).

Hookworm, *H. nana, S. mansoni* and *E. vermicularis* were the gastrointestinal helminthes recorded in this study. Hookworm had the highest prevalence of 30% this coincides with the prevalence recorded by Imandeh *et al* (2004) in Plateau State, Kawo *et al* (2004) in Kano State, Luka *et al* (2000, 2006) in Kaduna State and Onwuliri *et al* (1992) in Plateau State. The high prevalence of hookworm infection obtained in this study could be due to the poor eating habit of the individuals and indiscriminate way of defecation (Adebisi, 2008).

The higher prevalence of gastrointestinal helminthiasis obtained in males (29.9%) than females (12.1%) might be due to the fact that the ratio of male to female participant was about 1:2. Secondly, males are mostly involved in outdoor activities than females which make them become prone to infection. It was also observed that three of the four gastrointestinal helminth species were identified in the male pupils, while only two species were recorded in the female pupils.

The higher prevalence of gastrointestinal helminthiasis in age-groups 9-11 years (37.5%) might be due to the fact that individuals in this age-group were quite active, often in contact with the soil and are in the habit of eating with contaminated hands; they also spend more time in the rivers or ponds washing, fishing or playing.

The responses of the pupils to the questionnaires revealed that those that appeared dirty were more likely to come down with helminthiasis as compared to those whose general cleanliness was good. The prevalence of the disease based on the type of toilets used by the pupils, indicated that those pupils that use pit latrines were more likely to be infected (O.R = 3.75) than those that use water system (i.e. W/C) (OR = 0.00). The pupils might not wash their hands after using the toilet thereby facilitating transmission of gastrointestinal parasites (Abdullahi and Abdulazeez, 2000). The sources of water for drinking, bathing and household use also expose the pupils to infection (Gindiri *et al* 2000; Ndifon, 1991).

Studies of anthropometric indices of the pupils, showed that the prevalence of gastrointestinal helminthiasis in school children in relation to their Body Mass Index (BMI) showed that the high percentage of infected pupils were underweight and some had normal weight only a few were overweight. It has been postulated that a child with BMI below 18 is said to be underweight and this could be due to disease, malnutrition or eating disorders of which a high percentage of the study population falls into either of these categories. Furthermore, it has been reported that the frequency and severity of infectious disease is a significant factor in limiting child growth (Orr *et al* 2001; Mackey 2010). According to Mackey (2010), mid to moderate under nutrition and high infectious diseases in childhood contribute to small adult body size by diverting energy that would otherwise be used to fuel growth.

Based on the results of this study, it is recommended that active personal health education and public

enlightenment should be carried out in every school in the district. The methods of parasite transmission and preventive measures such as latrine usage, washing hands with soap before and after meals, should be incorporated into the school curriculum and full participation in control program by all school children must be emphasized, more wells and boreholes should be constructed in areas where there is inadequate water in order to provide safe and clean water to the populace and to reduce the frequency of contact with contaminated water.

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