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Prevalence of human intestinal helminth parasites and enteric bacteria in school children in Ilesha motor park area of Akure, Akure-South local Government, Ondo state, Nigeria

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Abstract

Study was carried out to determine the prevalence of human intestinal helminth parasites and associated enteric bacteria among the school children in Ilesha Garage Area of Akure, Akure-South Local Government of Ondo State, Nigeria. A total of two hundred and fifty (250) stool samples were collected from both males and females. Parasitological and bacteriological examinations of the faecal samples were carried out using standard laboratory methods. Parasitological examination revealed the presence of Hookworm (15.6%), *Ascaris* (8.4%), *Strongyloides* (3.2%) and *Trichuris* (4.8%). The prevalence of single infection was higher (31.2%) than the co-infection of Hookworm and *Ascaris* (0.4%), and Hookworm *and Trichuris* (0.4%). Female children had significantly higher prevalence of intestinal helminth parasites (19.2%) and 19.6% enteric bacteria than male children (12.8%) human intestinal parasites and 16.8% enteric bacteria. Human intestinal helminth infection based on gender was significant ($P < 0.05$). children of age group 5-9 years had significantly higher prevalence of intestinal helminth parasites (13.2%) with the lowest bacterial load 2.8% ($P < 0.05$). children that use tap water had the highest prevalence of intestinal helminth parasites (22.4%). The children that use water closet toilet had the highest prevalence of parasites (16.8%). The prevalence of bacterial isolates from faecal samples are; *Escherichia coli* (20.4%), *Salmonella* spp (2.0%), *Shigella* spp (1.6%), *Staphylococcus aureus* (4.4%), *Streptococcus faecalis* (2.0%), *Proteus* spp (1.2%), *Klebsiella pneumoniae* (1.6%), *Enterobacter* spp (1.6%) *and Pseudomonas* spp (1.6%).

Keywords: Prevalence, Human, Intestinal, Helminth, Parasites, Enteric, Bacteria

Introduction

In developing countries, intestinal helminth parasites cause a significant morbidity and mortality. They cause intellectual, cognitive and growth retardation, prematurity and low birth weight among newborns to infected mothers (Pall *et al.*, 2007). It has been estimated that *Ascaris lumbricoides* can infect over a billion, *Trichuris trichiura* 795 million, and hookworms 740 million people (De Silva *et al.*, 2003). Human intestine are colonized by a large number of microorganisms, some of which are harmless or beneficial (normal flora) while some are pathogenic. The few of the enteric bacteria most often associated with disease in humans are: *Salmonella*, *Campylobacter*, *Escherichia coli* (pathogenic strains) and *Shigella* species (Saiman, 2004).

Generally, situations involving poor sanitation and unhygienic conditions promote transmission of human intestinal helminth parasites and enteric bacteria. Intestinal helminths are transmitted by the faecal-oral route; faecal-oral transmission involves the ingestion of food contaminated with eggs or larvae (some hookworms). Other worms such as Hookworms and *Strongyloides* have larvae that actively penetrate the skin (Markell *et al.,* 2006). The levels of infection in humans therefore depend on standards of hygiene and on the ways in which food is prepared Human infection with enteric bacteria is generally associated with consumption of faecal contaminated food or drinking of contaminated water. Inter-personal transmission also occurs where level of hygiene may be particularly poor, e.g. mental healthcare units and schools (Hellard *et al.,* 2000 and Prescott 2008). Food handlers may also play an important role in the transmission even though they rarely survive more than ten minutes on the hands except under the finger nails. Faulty plumbing and water systems may cause water borne transmission (Washington *et al.,* 2006). The intestinal helminth parasites may be common worldwide, however, the prevalence is higher in developing countries. Their frequency may be related to inadequate sanitation, water supply, healthcare, education and poverty (Ibrahim *et al.,* 2014).

Methodology

Study area

This study was carried out in Ilesha motor park area in Akure, Akure South Local Government Area of Ondo State, Nigeria. The area is located geographically at longitude of $7^0$25'N and latitude of $5^0$19'E. The inhabitants are mainly civil servants, traders, farmers and artisans. Wells and public boreholes are the major sources of water that the residents depend upon for domestic activities.

Study design

Informed and oral consent was obtained from the school principal and the parents during their following Parents Teacher Association meeting and participation by the children was voluntary. Parents were assured that information obtained will be treated with utmost confidentiality. Standard questionnaires were used to obtain information on age, sex, socio-economic and risk factors from every participant. The school teachers also helped in the collection of data for correct information from the students.

Sample collection

Sterile universal bottles were given to each participating student. They were instructed on how to place a few samples of their stool into the bottle. Stool samples were collected and preserved in 10% saline before taken to Microbiology laboratory of The Federal University of Technology, Akure (FUTA) for analysis. Stool samples were divided into two portions for parasitological examination bacteriological analysis. Stool samples that were not examined the same day were preserved. Preservation of stool samples was done to avoid the stool from decaying by adding 4 ml of 10% formalin to each sample of the first portion (for parasitological analysis) while 4 ml of normal saline was added to the second portion (for bacteriological analysis) and then stored in the refrigerator till the next day.

Parasitological examination of faecal samples

The Formol-ether concentration method (Cheesbrough, 2006) was adopted. About 2 g of faeces was emulsified in 7 ml of 10% formalin in a centrifuge tube, using a wooden spatula and was mixed thoroughly. The mixture was passed through a sieve (0.75 mm pore size) into a glass beaker. It was then placed in the centrifuge tube. Three milliliters (3 ml) of ether was added and shaken vigorously for at least 30 seconds. The tube was tightly closed and then centrifuged at 1500 rpm for 5 minutes. After the spinning of the stool sample, the debris and supernatant were separated by decanting. A Pasteur pipette was used to take 0.05 ml of the sediment and mounted on a clean grease-free microscope slide, covered with a cover slip and viewed under ×10 and ×40 objective lens of microscope for intestinal helminth parasites.

Bacteriological analysis of faecal samples

The faecal samples were cultured on differential and selective media for bacteria cultivation in order to isolate bacteria entero-pathogens and incubated overnight at 37^0C [10]. MacConkey and Eosin methylene blue (EMB) agar were used for the isolation of bacteria pathogens. The bacteria isolates were identified by standard biochemical tests in accordance with Cheesbrough, (2006).

All data obtained in the study were subjected to SPSS version 17.0, Chi-square, cross tabulation and general descriptive statistics were used to summarise the data obtained from the study at 95% confidence interval, $P < 0.05$ were considered to be significant.

Results

Of the 250 samples, the overall prevalence of human intestinal helminth present was (32.00%). The respective prevalence of human intestinal helminth parasites encountered are; Hookworm species (15.6%), *Ascaris* (8.4%), *Strongyloides* larvae (3.2%)

and *Trichuris* (4.8%).The association of enteric bacteria with human intestinal helminth parasites are hookworm species (10.8%), *Ascaris* (8.8%), *Strongyloides* larvae (4.8%) and *Trichuris* (7.6%) (Table 1).

Table 1: Overall prevalence of human intestinal helminth parasites and associated bacteria encountered

Helminth parasites encountered	**Number infected and prevalence (%)**	**Associated bacteria**
		Number infected and prevalence (%)
Hookworm species	39(15.6)	27(10.8)
Ascaris	21(8.4)	22(8.8)
Trichuris	12(4.8)	19(7.6)
Strongyloides larvae	8(3.2)	12(4.8)
Total	80(32.0)	80(32.0)

N = 250 (total number of children examined)

Table 2 shows the occurrence of bacterial isolates from faecal samples with the prevalence of each bacterium. *Escherichia coli* 51(20.4%), *Salmonella* spp 5(2.0%), *Shigella* spp 4 (1.6%), *Staphylococcus aureus* 11 (4.4%), *Streptococcus faecalis* 5 (2.0%), *Proteus spp* 3 (1.2%), *Klebsiella pneumoniae* 4 (1.6%), *Enterobacter* spp 4 (1.6%) and *Pseudomonas aeruginosa* 4 (1.6%). Prevalence of human intestinal helminth parasites and associated bacteria is not significant (P > 0.05).

Table 2: Prevalence of bacteria organisms isolated from faecal sample

Bacteria Isolates	**Number infected**	**Prevalence (%)**	**P-value**
E.coli	51	20.4	0.017
Salmonella spp	5	2.0	
Shigella spp	4	1.6	
Staphylococcus aureus	11	4.4	
Streptococcus faecalis	5	2.0	
Proteus spp	3	1.2	
Klebsiella pneumonia	4	1.6	
Enterobacter spp	4	1.6	
Pseudomonas spp	4	1.6	
Total	91	36.4	
	N= 250		P < 0.05

The Prevalence of co-infection between hookworm species, *Ascaris* and *Trichuris* were 0.4% respectively and single infection of human intestinal helminth parasites was 31.2% (Table 3).

Table 3: Prevalence of co-infection and single infection of human intestinal helminth parasites encountered

Parasites	**Number infected**	**Prevalence (%)**	**P-value**
Hookworm+*Ascaris*	1	0.4	0.265
Trichris+ Hookworm	1	0.4	
Single infection	78	31.2	
Total	80	32.0	

Table 4 shows the prevalence of human intestinal helminth parasites and enteric bacteria among children based on sex. Girls had significantly higher prevalence rate (19.2% for intestinal helminth parasites and 19.6% for enteric bacteria) than boys (12.8% for intestinal helminth parasites and 16.8% for enteric bacteria) There was significant difference ($P < 0.05$) in the sex related prevalence of enteric bacteria.

Table 4: Prevalence of human intestinal helminth parasites and enteric bacteria among children based on sex

Gender	No examined	No infected		Prevalence (%)		P-value
		Helminth parasite	Enteric bacteria	Helminth parasite	Enteric bacteria	
Male	127	32	42	12.8	16.8	0.002
Female	123	48	49	19.2	19.6	
Total	250	80	91	32.0	36.4	

$P < 0.05$

The age related prevalence of intestinal helminth and enteric bacteria (Table 5) show that of the sixty nine (69) children of age group 5-9 years that were examined, 33(13.2%) were infected with helminth parasites while 7(2.8%) were infected with bacteria; 29 (11.6%) were infected with helminth parasites while 59 (23.6%) were infected with bacteria. Of the 115 that were examined in age group 10-14 years; 18(7.2%) were infected with helminth parasites while 25 (10.0%) were infected with bacteria and of the 66 children examined in age group 15-19 years.

Table 5: Prevalence of human intestinal Helminth parasite and enteric bacteria among children based on age

Age (yrs)	No examined	No infected		Prevalence (%)		P-value
		Helminth parasite	Enteric bacteria	Helminth parasite	Enteric Bacteria	
5-9	69	33	7	13.2	2.8	0.000
10-14	115	29	59	11.6	23.6	
15-19	66	18	25	7.2	10.0	
Total	250	80	91	32.0	36.4	

$P < 0.05$

The children using tap water has significantly higher prevalence rate (22.4%) than the children using well water (9.6%) (Table 6).

Table 6: Prevalence based on source of water used

Source of water	No examined	No infected	Prevalence (%)	P- value
Well	83	24	9.6	0.461
Tap	167	56	22.4	
Total	250	80	32.0	

$P > 0.05$

Table 7 shows the predisposing factor to human intestinal helminth parasites based on toilet facilities. The children using pit latrine has d least prevalence rate (2.0%) and the rate of the ones using bush system are more prevalent (13.2%) while the ones using water closet has the highest prevalence rate (16.8%).

Table 7: Prevalence based on the toilet facilities used

Toilet facilities	No examined	No infected	Prevalence (%)	P-value
Bush	89	33	13.2	0.372
Pit latrine	19	5	2.0	
Water closet	142	42	16.8	
Total	250	80	32.0	

P > 0.05

Discussion

This study revealed high prevalence of human intestinal helminth parasite and enteric bacterial infections in the study area. The reason could also be due to personal hygiene and impoverished health services. This is in consonance with the reports of (Hotez *et al.*, 2005) who opined that human intestinal helminth parasite infections are more prevalent in the tropics which provide optimum conditions for their propagation, and are also closely correlated with ignorance, poor environmental sanitation.

The prevalence of intestinal helminth infecions observed in children age 5-9 years old is expected. This could probably be due to bad feeding habits, usually the consumption of foods from doubtful sources that are generally reservoirs of parasitic infections (Adeyeba and Akinlabi, 2002).

High prevalence of human intestinal helminth and enteric bacterial infections in female children than male children might be due to geophagous habits and exposure of the females to dirty or filthy environment. This agrees with the findings of Hotez *et al., (*2005) The relatively higher prevalence of infection recorded among students that use water closet compared to those that use pit latrines and bush may be attributed to the poor quality hygiene of the toilets, irregular supply of water to flush the toilets and the unacceptably higher numbers of persons per toilet (overcrowding). This observation is in line with that of Marieke *et al.*, (2014) who opined that water must be provided to ensure cleanliness of toilets.

High prevalence of helminth infection observed among students using tap water compared with those using types of other water sources in this study could be due to poor handling of tap and tap knobs with soiled hands. This study is in contrast to the study of Awasthi *et al.*, (2008) who reported that tap water is the safest source of drinking water and well water is more easily contaminated with soil and thereby more prone to have higher prevalence of human intestinal helminth infections.

The prevalence of co-infection of helminth parasite infections among the children was significantly low. This agrees with the study carried out by Brito *et al.*, (2006) who reported low prevalence of co-infection in urban centers. The nine enteric bacteria species (*Escherichia coli*, *Salmonella species*, *Shigella species*, *Streptococcus faecalis*, *Klebsiella pneumoniae*, *Staphylococcus aureus*, *Enterobacter spicies*, *Pseudomonas species* and *Proteus* species) that were encountered in these students is expected. *Escherichia coli* with a relatively high prevalence than others could be as a result that it is a normal flora of human intestinal tracts while the presence of other bacteria could be atributed to infection through contaminated foods and water. This observation agrees with the report of Ifeanyi *et al.*, (2010).

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