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Intestinal parasitic infection associated with risk factors among school aged children in Girei, Adamawa state, Nigeria

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Infections with Intestinal helminths have long been recognized as a leading cause of morbidity and mortality in Sub-Saharan Africa. School-aged children are known to be particularly susceptible to illness caused by these pathogens. The goal of this study was to investigate the prevalence and risk factors of Intestinal helminthes among school-aged children in Girei Local Government Area. From January to February 2021, 384 randomly selected primary school children within the ages of 5 to 14 years from six primary schools participated in a cross-sectional survey primary school children within the ages of 5 to 14 years from six primary schools participated in a cross-sectional survey, A systematic questionnaire was designed and used to collect data on risk factors related to Intestinal parasitic infections from the children's caregivers. The Smear Method was used to analyse the stool samples. SPSS was used to analyze the data. Of the total 384 samples examined, helminths were found in 47.7% (183/384) of the cases. Others include: *Ascaris lumbricoides* 39.3%, hookworm in 30.6 %, *Trichuris trichiura* in 20.2% and coinfection 9.8 %. The severity of the infection ranged from mild to moderate. Failing to wash hands before eating (0.035, P<0.05), failure to wash fruits and vegetables before eating (0.04329; P<0.005), type of toilets used (0.00328; P<0.005), and the presence of faeces around home environment (0.00419; P<0.005) and not wearing of footwear (0.01529; P>0.005) were all significant risk factors for the infections. To eliminate Intestinal helminths in the area, preventive chemotherapy and adequate sanitation measures should be promoted.

Keywords: Intestinal helminths, Risk factors, *A. lumbricoides*, Hookworm and *T. Trichuris, Upheld advocated bolstered.*

1. Introduction

Intestinal helminths, also known as geo-helminths, are nematodes that are commonly taken for intestinal worms. Intestinal parasites are nematodes that infect humans when they come into contact with parasite parasite-invading eggs or larvae. Before becoming infective, immature stages (eggs) must be incubated in the soil. Humans are usually affected by ingesting infective forms of geo-helminths, which can be found in soil, raw fruits and vegetables, or unwashed hands (Kirwan *et al.* 2009). Roundworms (*Ascarislumbricoides*), whipworms (*Trichuristrichiura*), threadworms (*Strongyloidesstercoralis*), and hookworms are among them (Bethony et al., 2006).

These worms are especially common in areas with warm, humid temperatures, as well as poor sanitation and hygiene. In terms of epidemiology, it is well recognized that while people of all ages harbor worms, children in rural areas of tropical and subtropical areas have the highest prevalence (Bethony *et al.,* 2006). There is need to study the behavioural risk factor for high Intestinal helminths infection in children. Children are generally quite active, playing unsupervised with the earth and other items in their environment, leaving them exposed to these parasites. Schools are therefore strong target for control programs (Ojurongbe, 2014).

In Girei Local Government, Adamawa State, Nigeria, the knowledge of risk variables such as socio-demographic and socioeconomic features may have a significant impact in the spread and transmission of Intestinal helminths among school-aged children. Warm climates with plenty of moisture, a lack of personal or environmental cleanliness, sanitation, and education, going barefoot, and poor health or nutritional status

have all been linked to increased risk of Intestinal helminths infections (Usip &Ita, 2017).

Multiple socio-economic, cultural, physiological and behavioral parameters with illiteracy, poor hygiene and sanitation and above all bad governance influence infection with these worms (Crompton,2013). For reasons not well understood, compared with any other age group, preschool and school-aged children (including adolescents) tend to harbour the greatest number of intestinal worms and, as a result, experience stunting growth, diminished physical fitness as well as impaired memory and cognition (Crompton, 2013). Even mild to moderate-intensity helminth infections during childhood have been associated with under nutrition and reduced physical fitness (Mbuh & Nembu,2013). Epidemiological studies have shown that poor sanitary conditions such as open field defecation and fecal contamination of water bodies are important factors leading to infection with intestinal worms, while spread is due to lack of personal hygiene (Hung et al.2005).

Study on the risk factors associated with Intestinal helminths infections is of paramount importance for guiding policy makers in designing a more focused preventive approach to control the diseases. Therefore, the present study was undertaken to determine the prevalence and risk factors of Intestinal helminths infections and their associated determinants among schoolchildren in Girei Local Government of Adamawa State, Nigeria.

2. Materials and Methods

2.1 Sample collection

Between March and June 2021, 384 school-aged children were checked for Intestinal helminths in six primary schools in Girei local government, with 46.1 percent of the children being male and 53.9 percent being female.

2.2 Study area

The study was undertaken in Girei, one of the local government units in Adamawa State. The research region is located between 90 11' and 90 39' (latitude) and 120 21' and 120 49' (longitude) (Adebayo & Tukur, 1999). The climate is tropical wet and dry, and the region is part of the Northern Guinea Savannah Zone. The dry season lasts for at least five months (November-March), while the rainy season lasts from April to October. The average yearly rainfall is 700mm. The Study area is bordered on the north by Song Local Government Area, on the east by Fufore, and on the south and west by Yola and Demsa respectively. The entire land mass of the area is approximately 2,186 square kilometers.

2.3 The population

The area has a total population of 199,589 people, according to housing and population census data. There are 159671 children over the age of five and 39918 children under the age of five in all of the schools, totaling 85 schools with 25352 students (Federal Ministry of Education, 2020).

2.4 Sample size

The sample size was drawn from the population of school age children attending primary schools in Girei local government area. Because there has been no published information on the prevalence of Intestinal helminths infections in the study area, the sample size for this study was approximated using a 50% prevalence. The formula for calculating sample size was used (Naig et al., 2007). For cities with a population of more than 10 thousand people;

For population >10,000

$$n = \frac{z^2 p(1-p)}{d^2}$$

Where

n= minimum sample size

z= value- value of standard normal distribution-from confidence level table for 95%

p = prevalence of disease (50%)

d=the maximum allowable deviation or error of the estimate we use 95% confidence level on the standard normal distribution table, thus z=1.96

The population proportion of the phenomenon by previous studies=50%, Margin of error = ±5%

$$n = \frac{1.96^2 0.5(0.5)}{0.05^2}$$

n=384

Therefore, three hundred and eight-four (384) participants was chosen to participate in the study.

2.5 Sampling procedure

For this study, a multi-stage sampling strategy was used, comprising the use of purposive sampling to choose six schools from the population of schools in Girei, with the goal of meeting the study's objectives. The sample size is proportionately allocated depending on the specified school populations using a stratified sampling procedure. Simple random selection was used to assign sample numbers to the six schools selected from the 10 wards. The stratified random sampling technique is used to determine the number of participants proportionately across the primary schools considered in the study.

2.6 Parasitological technique

The pupils were asked to get fresh stool. On two consecutive days, every child who had been chosen in the sampling period delivered a fresh stool sample. The fresh stool samples were promptly transported to the Modibbo Adama University Laboratory in a cold box at a temperature of 10°C for analysis. The presence of egg and counts of Intestinal helminths in specific quantities were determined using the smear method.

The collected faecal samples, was taken to the laboratory for examination. An applicator stick will be used to collect about a pin-head size of the properly mixed stool sample and dropped on a microscopic slide which has a drop of normal saline on it. This will be emulsified properly, then covered with a cover slip and be examined under the microscope using low power objective x10 for the detection of helminths ova or larvae. A slides smear of the samples was examined under a microscope at a magnification of 40 for one hour. For hookworm, the slides were inspected right away, while eggs for *Ascarislumbricoides, Trichuristrichiura*, and hookworm were studied 60 minutes later. Quality control was accomplished through a systematic random examination in the schools while collecting the stool samples, and the slides that were randomly drawn were examined by qualified and trained personnel using smear technique's standard operating procedures and double reading of the slides by a qualified microscopist. Each participant was given a structured demographic questionnaire as regard to information about name, sex, age, location, educational qualification and to assess the possible risk factors of the children.

2.7 Data analysis

SPSS version 26 was used to enter and evaluate the data. Using descriptive techniques, the prevalence of helminthic infections was determined. Chi-square was used to determine the association between helminthic infection and risk factors. When the P-value was less than 0.05, the association was considered statistically significant, and when the P-value was greater than 0.05, a risk factor was not statistically significantly related with the helminthic infection.

3. Results and Discussion

The helminthic infection was found in 183 of the school-aged children examined in Girei's six primary schools (47.7%). Out of the 83 students tested at Lamido Lawal Primary School, 39 (10.2%) were positive, while 30 (7.8%) of the 62 students tested at Sangere Primary School were positive. Out of the 76 students tested at Sabongari primary school, 37 (9.6%) were positive. Out of the 40 students surveyed at Bakalchi Primary School, 20 (5.2%) were infected. Out of the 56 students checked at Bakari Hamidu Primary School, 26 (6.8%) were infected. Out of the 69 students screened at Wuro Madi Primary School, 31 (8.1 percent) were infected. The prevalence of helminths infection was found to be 47.7% among the pupils in the Study area (183 out of the 384). The highest prevalence was found among students in Lamido Lawal primary Schools (10.1%), while the lowest was found in Bakalchi Primary School (5.2%).

Ascarislumbricoides, Trichuristrichiura, and hookworm eggs were found in the faeces samples, with prevalences of 39.3 percent, 20.2 percent and 30.6 percent, respectively. Single specie infection accounted for 90.2 percent of the infected cases; the remaining cases are double infections with 9.8%. Of these double infection parasites *A. lumbricoides* and hookworms accounted for 6%, *A. lumbricoides* and *T. trichiura* 2.7 percent while hookworms and *T. trichiura* accounted for 1.6 percent more than doubled.

The results showed that in terms of gender the infection pattern by gender, 98 (55.3%) of the 177 males evaluated were infected, whereas 85 (41.06%) of the 207 females checked were infected. Male pupils had a higher rate of intestinal helminths infection than female pupils. The change in prevalence, however, was not statistically significant ($P > 0.05$). In terms of age group, 90 (44.4 percent) infections occurred in the under 5-year age group, 77 (50.9 percent) in the 6 to 9 year age group, and 66 (46.2 percent) in the (10-14) year age group.

3.1 Prevalence of intestinal helminths infection in relation to associated risk factors

Table 4.2 shows the prevalence of intestinal helminths infection in relation to the source of water supply. 133 (34.6%) of the 272 children who indicated that their main source of water was a shallow well were infected, while 50 out of 112 (13.0%) of the children who indicated their main source of water was a stream were infected; the prevalence was thus not significantly different ($P > 0.05$). When it came to sanitation (type of toilet facilities used), 4.5 percent of the pupils who used water closet were infected with at least one helminth species. In contrast, 13.5 percent of individuals who used a pit latrine were infected and 28.6 percent of those who used open defecation were infected, which was a significantly different ($P<0.05$).

70 (18.2%) of the 135 children whose parents were farmers were infected, whereas 31 (8.0%) of the 65 children whose parents were civil servants

were infected. 50 (13%) of the 131 children whose parents were traders were infected, as were 32 (8.3%) of the 53 infants whose parents were artisans. The prevalence did not differ significantly across the major occupational groups (P>0.05), according to statistical analysis.

Table 1: Prevalence of soil transmitted helminths in relation to associated risk factors

Risk factors		Total Exam	No. inf	Prevalence %	P value
Sources of water supply	Well	272	133	34.60	0.448
	Stream	112	50	13.00	
Types of toilet	Open defection	211	110	28.60	0.00326
	Water closed	71	21	4.5	
	Pit lartrine	102	52	13.5	
	Farmers	135	70	18.20	
Parent occupation	Civil servant	65	31	8.00%	0.02775
	Trader	131	50	13.00%	
	Artisan	53	32	8.30%	
Presence of faeces around the home	Yes	148	90	23.40%	0.00043
	No	236	93	24.20%	
Presence of faeces around school	Yes	113	60	15.60%	0.1680
	No	271	123	32.00%	
Total		**384**	**183**	**47.7%**	

Source: SPSS version 23

Table 2: Prevalence of intestinal helminths infection in relation to personal hygiene and knowledge of parasitic worm

Parameters	Number examined	Number infected	Prevalence	P-value
Washing of hands before eating				
Sometimes	120	53	13.80%	
Yes	50	29	7.60%	0.2350
No	214	101	26.30%	
Washing of fruits/vegetable before eating				
Yes	90	37	9.60%	
Sometimes	74	49	12.80%	0.01592
No	220	97	25.20%	
Foot wear				
Sometimes	239	109	28.40%	0.3018
Always	145	74	19.30%	
Heard of Parasitic worms				
No	281	124	32.20%	0.0222
Yes	103	59	15.50%	

Source: SPSS version 23

Table 1 shows that 90 (or 23.4 percent) of 148 children living in a faeces-infested environment were infected with at least one helminth infection. Only 93 (24.2 percent) of the 236 individuals evaluated were affected of those who do not live in a faeces-infested environment. According to statistical analysis, the prevalence of intestinal helminth infection differed considerably (P<0.05) depending on the level of faecal contamination in the environment. Similarly, only 123 (32.0 percent) of the 271 children were exposed to a faecally contaminated school environment were infected, whereas 60 (15.6 percent) of the 113 children who indicated no exposure to a faecally polluted school environment were infected. In contrast to the home environment, this tendency was not significantly different (p > 0.05).

3.2 Prevalence of intestinal helminth infection in relation to personal hygiene and knowledge of parasitic worms.

The prevalence of hand-washing habits is seen in Table 2. Infection rates were lowest (7.6%) among children who reported regularly washing their hands before meals and highest among those who indicated they do not wash their hands before eating, with 101 (26.3%) of 214pupils washing their hands before eating. However, the difference

in prevalence was not statistically significant (p> 0.05).

Similarly, pupils who always wash their fruits before eating them had the lowest incidence (9.6%), whereas those who do not wash their fruits before eating them had a greater prevalence (25.2%). In addition, the difference in prevalence was statistically significant ($p < 0.05$).

The majority of the pupils (281) stated they had never heard of parasitic worm previously, while 103 claimed they had heard of it before. 124 (32.2%) of those who never previously heard of the parasitic worm were infected, whereas 59 (15.5%) of those who had heard of it were infected. The difference between the two groups was statistically significant ($p > 0.05$). Furthermore, with regard to the wearing of footwear, most of the pupils (239) stated they sometimes wear their foot wears, while 145 claimed they always put on their foot wears. 109 (28.4%) of those who sometimes put on their footwear were infected, whereas 74 (19.3%) of those who always put on their foot wears were infected. The difference between the two groups was not statistically significant ($p > 0.05$).

Various authors from different parts of the country have documented incidences of intestinal helminthiasis due to the triad of *A. lumbricoides*, hookworms, and *T. trichiura* as seen in the studies (Asaolu et al., 1991; Ugbomoiko and Ofoezie, 2006; and Olaniran et al., 2015).

According to the data, the overall prevalence of the three intestinal helminths infection in the study area was (47.7%). Contrarily, this prevalence was higher than that observed by AdouBryn, et al. (2001) in Ivory Coast and Sammy, et al. (2011), in the Ashanti region of Ghana who had prevalence of 10.4%, and 11.2% respectively. Also a research on intestinal helminths protozoa among children under the age of five years conducted in Webuye, Kenya, the overall prevalence of STHs was reported to be 52.3 percent (Behnke et al., 2000). These variations in prevalence were identified to be due to differences in altitude, climatic conditions, environmental sanitation, socio-economic and educational status of parents and study subjects, and previous control efforts. The findings were similar to a recent report of 46.3 percent prevalence in school children (aged 3-14 years) in Ile-Ife, Southwest Nigeria, based on a study of soil-transmitted helminth infections in school children (aged 3-14 years) (Ojurongbe et al., 2014). Also, in agreement with finding of Olaniran *et al.,* (2015) who reported an overall prevalence of 42.7%.

On the contrary, the prevalence in this study was lower than in earlier studies conducted in other African locations. In research on intestinal helminths protozoa among children under the age of five years conducted in Webuye, Kenya, the overall prevalence of STHs was reported to be 52.3 percent (Behnke et al., 2000). According to Amaechi et al., (2013), 75.7 percent of school pupils in some rural villages of Abia state, Nigeria, have helminthiasis. Intestinal helminthiasis was found to be prevalent in 77 percent of school students in Nigerian riverine villages, according to Upkai and Ugwu (2007).

The high prevalence rate (47.7%) of intestinal helminths infection among primary school students found could be ascribed to the children's carelessness and unclean habits at home and at school. The increased incidence could also be attributed to the lack of sanitation facilities in these schools. There were no good toilet facilities in any of the schools that were chosen. As a result, when the children are at school, they defecate in the open field. Thus, as this investigation indicated, the school environment was contaminated with geohelminths ova. Because children spend a significant amount of time at school, the school environment has a significant impact on their health and well-being.

In this study, the most common combination of soil transmitted helminths is Ascaris and hookworms, which agrees with the findings of Onuoha et al. (2010) and Alli et al. (2011). They reported that among school children in Enugu and Oyo States, respectively, but differs from the findings of Oyewole et al. (2007), who found a high prevalence of *Ascaris* and *T. trichiura* co-infection in Ondo State, Nigeria.

With increasing age, the prevalence of *Ascaris* increased: 9 (12.5%), 6-9 (20.8%), and 10 (20.8%). (22.2 percent). Although there was no statistically significant difference in the prevalence of STH infections across all age groups ($p > 0.05$), the highest prevalence was found in the 6- to 9-year-olds, which could be due to a lack of awareness of personal hygiene measures, a lack of knowledge about the mode of parasite transmission, and a high rate of exposure to risk factors. Given that children are growing more active as they get older, the gradual increase in prevalence of infection with age for intestinal helminths infection gives an indicator of the children's exposure patterns. As a result, health education on intestinal helminths infection transmission and encouraging children to wear shoes could be beneficial.

In this study, the type of toilet used was found to be strongly related to the prevalence of intestinal helminths infection. children who utilized open defecation exhibited a higher prevalence of intestinal helminths infection than those who did not. Some of the respondents' behaviour of open field defecation could be related to poverty and

their parents' inability to construct a latrine or water closet toilets. Intestinal helminth infections have been linked to improper human waste disposal, implying that members of the public are at risk of infection with these helminths, particularly in areas where open field defecation is frequent. (World Health Organization, 2016). Ali et al. (2011) found comparable results in 1204 primary school children in Kaduna state.

Another major aspect defining risk factors predisposing pupils to intestinal helminths infection is their parents' socioeconomic level. The rate of infection was shown to be affected by occupation. Children of farmers were the ones who got the infection the most. Farmers maintain animals and farm around their homes. In most cases, these creatures were not under control, and their faeces contaminated the ground. The majority of farmers use animal waste as manure, which can lead to an increase in soil contamination with intestinal helminths ova, which can lead to an increase in infection prevalence. This finding is consistent with the findings of Kirwan et al. (2009), who found that children of farmers have a larger burden of *A. lumbricoides* than children whose parents were not farmers.

Intestinal helminths infection was shown to be more common in children who had human/animal faeces in their home environment than in children who did not have human/animal faeces in their home environment. This was most likely due to faeces contamination of the soil. In other research, similar agents were found to be responsible for the transmission of helminth parasites (Bundy et al., 2003). The strong link between the presence of human/animal faeces in the neighborhood of residences is cause for concern, and suggests that frequent environmental cleanliness and inspection are required in the research region.

In the research area, the prevalence of intestinal helminths infection is primarily due to streams and rivers, which were the primary sources of water for the population. Because water is required for essential health habits such as washing, cleaning, drinking, and cooking, a lack of clean water in the research location was a prominent factor linked to intestinal helminths infection.

The rate of soil contamination of the school compounds was determined to be 23.3 percent in this investigation. The total outcome was comparable to Cassenote et al., (2014) and Ntonifor et al., (2016), but lower than Horiuchi et al., (2016). *Ascarislumbricoides, Trichuria, and hookworms* were the three helminth species found, with *A. lumbricoides* being the most abundant. *A. lumbricoides* eggs are resistant to extreme environmental circumstances, which could explain their widespread distribution and high abundance as well as their high prevalence throughout age groups.

4. Conclusion

This study reveals an overall comparatively high prevalence and moderate burden of infection indicating that the deworming campaign is proving ineffective. The results of the risk factor analysis suggest that improving environmental hygiene and health education would be important for effective control of intestinal parasitic infections. All the helminth species identified were linked to the soil therefore, there is need for an integrated control program while continuing the periodic deworming programs, enhancing the socio-economic status, supplying safe water for drinking and promoting health education in order to bring lasting impact on transmission of intestinal helminthic infections.

Data Availability

Data are available from the corresponding author upon request.

Ethical Approval

The permission of the individual school authorities was obtained using a letter of introduction from the Head of Department of Zoology, Modibbo Adama University of Technology, Yola. Permission to carry out the investigation was issued to Girei Local Government Education Board while informed consent of the parents and teachers of the participating pupils was obtained after explaining the objectives of the study at a Parent Teacher Association executive meeting in the study area. Letter seeking permission to collect stool samples was given to the head teachers of the chosen schools. The purpose of the study shall be explained to the participants, parents and their teachers, the consented children in each class of each selected schools was randomly included in the study.

Consent

An informed consent form was signed by each participant’s parents/guardians, and assent was given by the participants, children aged between 5 and 14 years. All study participants who were found with any intestinal worm were treated with albendazole and levamisole for those with intestinal helminths infection as stated by WHO guidelines.

Conflict of Interest

The author declares that there is no conflict of interest.

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