Global Scientific JOURNALS

GSJ: Volume 9, Issue 8, August 2021, Online: ISSN 2320-9186

www.globalscientificjournal.com

Intestinal parasitic infection and associated risk factors among school age children in Damaturu Metropolis, North-Eastern Nigeria, Yobe State

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Abstract

The aimed of the present study was to determine the prevalence and associated risk factors of intestinal parasitic infections among school age children in Damaturu Metropolis. Stool samples were collected from 150 children, between the age ranges of 0-12 years. The samples were transported to laboratory and subjected to formalin ethyl-acetate concentration technique. Parasites were identified microscopically using microscope. A total of seven different species of parasites (*G. lamblia, E. histolytica, A. lumbricoides, T. trichiuria, A. duodunale, S. stercoralis, H. nana*) were identified. The overall prevalence of infection was 13%. The most prevalent parasites species identified was *H. nana* (21%), followed by *T. trichiuria* (16%), *A. duodunale* (15%), *A. lumbricoides* (12%), *S. stercoralis* (12%), *G. lamblia* (10%), and *E. histolytica* (6%). A significant association between intestinal parasitics infection and sanitation and personal hygiene condition was observed ($P<0.005$). Based on the findings of the present study it is concludes that the presences of intestinal parasitic infection among children in Damaturu metropolis is potential threats to public health. Therefore is need for government agencies for regular deworming, education on personal hygiene, and environmental sanitation to both students and their parents shall be implemented to reduce the prevalence rate of intestinal parasitic infections in the study area.

Introduction

Intestinal parasitic worm infections are among the most common infections worldwide and affect the poorest and most deprived communities. Approximately two billion people (24% of the world's population) are infected with worm infections worldwide (World Health Organization, 2016). About 1.5 billion people in developing regions of sub-Sahara Africa, Asia and Americas are infected with intense worm infection that aggravates poverty, productivity, and socio-economic development (World Health Organization, 2012). The highest prevalence of worm infection is found among children between five to twelve years and usually those with deprived living resources (Gelaw et al., 2013). The health impacts of worm infection include abdominal pain, cholangitis, obstructive jaundice acute pancreatitis and hepatic abscess (Sheikh et al 2006; Wani et al., 2013), physical and mental impairment (Abate et al., 2013), central nervous system and ocular disorders and epilepsy, and death in more extreme cases (Mwanjali et al., 2013). School-age children are more susceptible to intestinal parasitic infections, because if the infections occur during a period of intense physical growth and rapid metabolism, it may result in increased nutritional needs which if not adequately met, growth may be impaired. During a period of intense learning, when children are infected, their learning capabilities may significantly diminish, thereby leading to compromise in their learning abilities in formative years. In a setting of continuous exposure to contaminated soil and water, children generally lack awareness of the need for good personal hygiene and enjoy playing with soil and water which may be contaminated.

In Nigeria, despite a thriving economy, intestinal worm infection is the major health problems among the poor and the deprived rural areas (Huat et al., 2012; Nasr et al., 2013b; Anuar et al., 2014). Prevalence of worm infection among the group is associated with poor socioeconomic, environmental and behavioral factors (Lim et al., 2009; Ngui et al., 2011; Ngui, et al., 2012; Anuar et al., 2014). The distribution and prevalence of various species of intestinal parasites differ from region to region. Although several studies have been conducted on the distribution and prevalence of intestinal parasites in Nigeria, there are still several localities/communities for which epidemiological information has not been established. This notion justifies new studies on intestinal parasitic infection more especially among children in

other areas of the country. This is to comprehend the distribution and epidemiology of intestinal parasites and provide baseline data on the occurrence of the gastro-intestinal parasites among school age children. The objective of the study was to determine the prevalence and predictors of intestinal worm infection among school children aged in Damaturu Metropolis.

Material and Methods

Study area

This study was conducted in Damaturu Metropolis, which is located between latitude 11^{o} 44' N to 11^{o} 45'N and longitude 11^{o} 56' E to 11^{o} 58' E. Damaturu is located in the semi-arid region of Nigeria with tropical continental climate. The climate is characterized by short wet season (June to August) and long dry season (October to May) with high temperature throughout the year. Annual rainfall is usually low, while evapotranspiration is high.

Study population and study design

This cross-sectional survey was carried out from November 2020 to April 2021 in Damaturu metropolis. Study population comprised of children between the ages of 0-12 years. 150 children were selected at random in Damaturu metropolis whose parents or guardians signed a written assent form.

Socio-demographic survey

A structured questionnaire was administered to obtain information on demographic data and risk factors of acquiring gastrointestinal parasites. Information such as gender, parent's educational status, parent's occupation, source of drinking water, availability of toilet facility, hand washing practice, and waste disposal system were recorded.

Stool sample collection

Capped containers with wide mouths were provided to each participant with detailed instructions regarding stool collection. Stool samples (one for each child) were collected in the early morning from participants. Immediately after collection, all specimens were labelled with a serial number and place of collection. The stool samples collected were preserved in 10% formalin transported in research laboratory of the Department of Biological Sciences, Yobe State University for investigation.

Laboratory analysis

The stool samples collected were analysed for the presences of cysts, eggs and larvae of parasites using formal-ether concentration techniques as described by Cheesbrough (2005). About 1g of faeces was placed into 4ml of 10% formalin solution with a rod or applicator stick in a screw cap bottle or tube. Another 3-4ml of 10% formalin solution was also added to the bottle and mixed by shaking or use of glass rod to mix the contents. The emulsified faeces were sieved using cotton gauze and the suspension collected into a beaker or centrifuge tubes. About 3-4ml of diethyl ether was then added to the suspension in the centrifuge tube, capped with glass stopper and shake for 1 minute. With a tissue or piece of cloth wrapped around the top of the tube, the stopper is loosen (considerable pressure might be built up inside the tube) and centrifuged immediately at 3,000 rpm. A stem of a plastic bulb pipette was used to loosen the layer of faecal debris from the side of the tube and the tube inverted to discard the ether, faecal debris and 10% formalin solution leaving behind only the sediment. The tube was returned to its upright position and allowed the fluid from the side of the tube to drain to the bottom. The bottom of the tube was then tapped to re-suspend and mix the sediment. A few drops of the sediments were transferred to a slide using a pipette and covered with a cover slip. The preparation was examined microscopically using ×10 objective with the condenser iris closed sufficiently to give good contrast. The ×40 objective was also going used to examine cysts. Lugol's iodine solution was added under the cover slip to assist in the identification of cysts. The eggs and larvae were photomicrograph using digital camera on a Heerburg Olympus Microscope.

Parasites identification

Identification of the parasites was carried out using the morphology of the cysts, eggs and larvae using Atlas of Medical Helminthology and Protozoology (Chiodini et al., 2005), Medical Parasitology (Arora and Arora, 2011).

Statistical analysis

All the analysis was performed using a graph prism (Version 23.5) and Microsoft excel worksheet (2010). The data generated were presented in tables and percentage (%). Non-parametric test (Chi-square test) was also used to determine the association between the prevalence of infection and demographic information of the participant. Probability values < 0.05 were considered significant.

Results

A total of 150 children from Damaturu Metropolis participated in this study, which produced a 100% response rate. Out of 150 children that participated in the study only 10 (7%) were between the age of 0-5 years, 102 (68%) children were between the age group of 5-8 years and 38 (35%) children were between the ages of 9-12 (25%). From the total of 150 children participated in the study, 55% of children were male and 45% were females. In terms of educational status of parents of children, 32% were found to attended formal education where as 55% attended informal education and only 13% did not attended any school. With regards to the occupation of the parents 26% are civil servant, 39% farmers, 28% business men, and only 7% (Table 1). The results in table 3 reveal that the overall prevalence was 13%. The most prevalent parasites indentified was *H. nana* with the prevalence of 21%, followed by *T. trichiuria* (16%), *A. duodunale* (15%), *A. lumbricoides* (12%), *S. stercoralis* (12%), *G. lamblia* (10%) *E. histolytica* (6%). About 50% of the participant uses borehole water as sources of drinking, 34% used water from river and 16% uses other sources such rain and well. With regard to presence or absence of toilet facility 65% have toilet facility in their houses, whereas 35% do not have toilet facility in their houses. 68% practice hand washing as personal hygiene practice and 32% do not practice hand washing as personal hygiene (Table 3). All the personal hygiene and sanitations practices (source of drinking water and hand washing practice) were significantly associated with intestinal parasitic infection ($P<0.05$), except the disposal system which show no any association with parasitic infection ($P> 0.05$) (Table 4).

Table 1: Socio-demographic characteristics of the children (n=150)

Socio-demographic variables	Frequency (n=150)	Percentage (%)
Age group (year)		
Least than 5	10	7%
5-8	102	68%
9-12	38	25%
Gender		
Male	82	55%
Female	68	45%
Parents Educations status		
Formal education	49	32%
Informal education	82	55%
No-education	19	13%
Parents occupation		
Civil servant	39	26%
Farming	58	39%
Business	42	28%
Others	11	7%

Table 2: Prevalence of intestinal parasites among children school age children in Damaturu Metropolis (n = 150)

Parasites species	Frequency (n=150)	Percentage (%)
Protozoan		
G. lamblia	15	10%
E. histolytica	09	6%
Helminths		
A. lumbricoides	18	12%
T. trichiuria	24	16%
A. duodunale	22	15%
S. stercoralis	18	12%
H. nana	32	21%
Overall prevalence		13%

Table 3: Sanitation and personal hygiene conditions of the participant (n = 150)

Sanitation and personal hygiene	Frequency (n=150)	Percentage (%)
Source of drinking water		
Water from borehole	76	50%
Water from river	51	34%
Other sources (rain, well etc)	24	16%
Availability of toilet facility		
Yes	98	65%
No	52	34%
Hand washing practice		
Yes	102	68%
No	48	32%
Waste disposal system		
Burning in opening field	40	27%
Burying in burrow pit	29	19%
Dispose in road side	69	46%
Others	12	8%

Table 4: Association between sanitation and personal hygiene condition of studied children and in relationship to parasitic infection

Sanitation and personal hygiene	Infection status		X^2	*P-value*
	Yes	No		
Source of drinking water				
Water from borehole	7 (37)	12 (63)	6.143	0.0463*
Water from river	6 (27)	16 (73)		
Other sources (rain, well etc)	9 (69)	4 (31)		
Availability of toilet facility				
Yes	2 (18)	9 (82)	5.490	0.0096**
No	8 (67)	4 (33)		
Hand washing practice				
Yes	5 (28)	13 (72)	9.764	0.0018**
No	11(85)	2 (15)		
Waste disposal system				
Burning in opening field	4 (36)	7 (64)	6.039	0.1097
Burying in burrow pit	9 (69)	4 (31)		
Dispose in road side	6 (50)	6 (50)		
Others	2 (20)	8 (80)		

Discussion

Gastro-intestinal parasitic infections are one of the major public health problems across the globe, mostly in developing countries. Children were bearing the brunt of infections (Gabbad & Elawad, 2015). In the present study the prevalence of intestinal parasitic infections among children who lived in Damaturu metropolis was 13%. The findings of this study have shown that the common gastro- intestinal parasites in children were protozoan (*G. lamblia, E. histolytica*), and helminthes (*A. lumbricoides, T. trichiuria, A. duodunale, S. stercoralis, H. nana*). High prevalence of helminthes parasites infections was observed among the children compared to protozoan parasites infection, However, this finding may be attributed to the different routes of helminthes parasites transmission that include both oral and dermal transmission compared with the protozoan parasites which single route for infection (fecal oral routes). Among the intestinal parasites identified, *H. nana* (21%) was found to be the most

prevalent parasite. The observed prevalence of *H. nana* is greater when compared with other in studies in Nigeria (Egbunu & Dada, 2016). The high prevalence of *H. nana* in this study may be attributed to lack of healthy water supply and open field defecation habits of some of the children and the autoinfection mode of transmission of the parasite (Jemaneh 2000). In the present study *T. trichiuria* was the second most prevalent parasites with infection rate of 16%, however, this finding is consistent with previous findings of a study conducted other countries of the world (Liao et al., 2016; Mehraj et al., 2008; Morales et al., 2019). *Trichuris trichuris*, the etiological agent of trichuriasis, globally, over 500 million cases of human Trichuriases were reported (Pullan et al., 2014). These cases are attributed to infections with *Trichuris trichiura*. Other helminths parasites found in the present study were *A. duodunale* (15%), *A. lumbricoides* (12%), *S. stercoralis* (12%). Incidence of *A. duodunale* infection found in the present study is directly related to exposure to soil where filariform larvae live in and penetrate human skin. Thus, poor personal hygiene and sanitation observed in some of children parent houses could increase the risk of hookworm infection as previously reported by Jiraanankul et al. (2011). The presence of Ascaris infection among the children could be attributed to the fact that the egg of *A. lumbricoides* can live for up to ten years in a warm, shaded, and moist environment, which could be the reason for their long-term infection (Shiferaw et al., 2021). Only two protozoan parasites that include *G. lamblia* (10%) *E. histolytica* (6%) were found in the present study. The presence these species infecting the children may be due to the consumption of unsafe water by some of children and it was well known the transmission routes of most intestinal protozoan parasites is through fecal oral routes. This result was in agreement with different re- searchers inside the country (Doni et al., 2015; Tsegaye et al., 2020).

According to our study sanitation practices and personal hygiene were positively associated with intestinal parasitic infection. The study further reveals that source of drinking water (P=0.0463) availability of toilet facility (P=0.0096), and hand washing practice (P=0.0018) were significantly associated with parasitic infection. These findings might be due to contamination of water and food with human waste during open field defecation. Lack of awareness about importance of hand washing practice after defecation can lead to easily contaminate people through food. Furthermore, open field defection could increase parasite infection. This result was consistent with studies conducted in other countries across the globe (Butera et al., 2019; Tsegaye et al., 2020). On the other hand there is no association was observed between the disposal system with parasitic infection (P=0.1097).

Conclusion

The findings of the present study have demonstrated presences of different intestinal parasitic infection among children in Damaturu metropolis and these pose a potential threat to public health in the study area. Therefore is need for Policy makers to give priority for personal hygiene and environmental sanitation. In addition, awareness creation should be enhanced on life style modification for prevention of intestinal parasite infections.

Acknowledgments

The authors wish acknowledges the financial support of Tertiary Education Trust (TET FUND) through Institution Based Research (IBR) Research of Yobe State University, Damaturu, Yobe State.

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