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Prevalence of Intestinal Schistosomiasis among School Children in Biu Local Government Area, Borno State, Nigeria

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Abstract

Intestinal schistosomiasis is one of the neglected tropical diseases caused by four species of the genus Schistosoma. The aim of this study was to determine the prevalence, knowledge and risk factors associated with intestinal schistosomiasis in the study area. A total number offour hundred and twenty (420) fecal samples were collected from the study participants in the three sampling locations; Tum, Buratai and Biu metropolis. Samples collected were examined using formal-ether concentration technique. Other information about the participants' knowledge on the disease and associated risk factors were obtained using a structured questionnaire. Three 3(0.7%) out of the entire samples examined were found with the eggs of Schistosoma mansoni and only age group 11-13years and 14-16years 1(0.7%) and 2(1.8%) has egg of Schistosoma mansoni in their fecal samples respectively. All the 3(1.6%) infected participants were male while no female 58 participant was infected with the parasite. Miringa had the highest prevalence of (1.9%) followed by Buratai(0.9%) and no infection in Biu metropolis. The difference in the prevalence rate between the age groups, sexes and locations of th eparticipants was statistically not significant. There was high level of ignorance and poor knowledge about the transmission, prevention and treatment of schistosomiasis among the participants. Other parasites encountered during the study were Ascaris lumbricoides (54%) Trichiuris trichiuria (33%), Giardia intestinalis (3%), Entamoeba histolytica (4%), Ancylostoma duodenale *(6%). During this study, Schistosomiasis was not endemic in the study area but other intestinal parasites. Therefore, there is need for stakeholders to educate the people on the effect of this parasite and treat the few infected individuals using praziquantel for schistosoma spp and other anthelmintic drugs for mass administration to avoid further escalation of the intestinal parasites in the area.*

Keywords: *Schistosoma mansoni*, Prevalence, Intestinal parasites, Participants, Borno

INTRODUCTION

Schistosomiasis is the most common disease that is transmitted by freshwater snail (Colley *et al.,* 2013). The disease affects about 252 million people worldwide [Global Burden of Disease (GBD), 2015] and estimates between 4,400 and 200,000 people die from it each year as reported by (Thétiot-Laurent, *et al.,* 2013). The disease is commonly found in Africa, as well as Asia and South America (GBD, 2015). in 202, **e**stimates show that at least 251.4 million people required preventive treatment for Schistosomiasis in 2021, out of which more than 75.3 million people were reported to have been treated (WHO, 2023). Lack of hygiene and certain play habits of school-aged children such as swimming or fishing in infested water make them especially

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vulnerable to the infection. Most human infections are caused by *Schistosoma mansoni, S. haematobium*, or *S. japonicum* [Center for Disease Control and Prevention (CDC), 2018] less commonly, *S. mekongi* and *S. intercalatum* can cause disease. All *Schistosoma* species affect intestine and liver with the exception of *Schistosoma haematobium* that affects urinary tracts (WHO, 2023). Safe and effective medication is available for the treatment of both urinary and intestinal Schistosomiasis. Praziquantel, a prescription medication, is taken for 1-2 days to treat infections caused by all Schistosoma species [Center for Disease Control and Prevention (CDC), 2018]

The disease is spread by contact with water that contains the parasites. These parasites are released from freshwater snails that have been infected. The disease is especially common among children in developing countries as they are more likely to play in infected water. Other high risk groups include farmers, fishermen and people using infected water for their daily chores. Diagnosis is by finding the eggs of the parasite in a person's urine in case of *S. haematobium* or stool in the case of other *Schistosoma species*. It can also be confirmed by finding antibodies against the disease in the blood (WHO, 2014).

Intestinal Schistosomiasis symptoms include abdominal pain, diarrhea, and blood in the stool (WHO, 2023). Advanced cases often manifest in liver enlargement, fluid accumulation in the peritoneal cavity, hypertension in abdominal blood vessels, and potential spleen enlargement, leading to further complications (CDC, 2018; WHO, 2023).The aim of this study was to determine the prevalence, knowledge and risk factors associated with intestinal Schistosomiasis in the study area with a view to creating database and awareness that can be used by the stakeholders in developing control strategies in the study area.

MATERIALS AND METHODS

Study Area

The research was carried out in the Biu Local Government Area of Borno State from August to October 2023.Biu LGA is situatedin the Borno South Senatorial Zone, Nigeria. Biu is among the largest towns in the region, positioned at approximately latitude 10° 36' 46.26" N and longitude 12° 11' 40.49" E. Nestled on the Biu plateau, the LGAboasts an average elevation of 626 meters above sea level (Britannica, 2009). Geographically, it falls within the Northern Guinea savannah and Sudan savannah regions, experiencing a semi-arid climate with an average temperature of 32˚C 32^{o}C (Kparmwang, *et al*., 1994; A`maza *et al*., 2007).. The area exhibits two distinct seasons dry and rainy and spans a landmass of about 3,423.86 km^{2}. The recorded human population stands at 175,760, according to the 2006 census, with Biu located 172 km from Maiduguri, the state capital which serves as the administrative headquarters. Other developed areas within the Local Government include Buratai, Garubula, Miringa, Madara-Girau, Yawi, and Gunda, among others. Biu is home to various tribes, with the Babur (Pabir) tribe being the most populous (Britannica, 2009. Agriculture holds significant economic importance in the region (Amaza *et al*., 2007). The predominant climate elements influencing the study area's climate and impacting the farming system are temperature and precipitation (rainfall). Biu experiences its highest precipitation levels in July, August, and September, with an average of 23 rainy days and 164 mm (6.5 inches) of precipitation per month (Britannica, 2009). Conversely, the driest months are January, February, and December, with an average of 0 mm (0.0 inches) of precipitation during these periods (Britannica, 2009).

Sample Size Determination
Simple random sampling technique was used to select participants individual from the study area. The sample size was determined by taking 50% expected prevalence and 95% confidence level using the formula described by Thrusfield (2007). Accordingly, a total of 384participants were employed for the conduct of the study
$N=(Z)^2 P (1-P)/d^2$.
Where:
n=required sample size,
d=desired absolute precision,
P_{exp}=expected prevalence.
$N = (1.96)^2 *0.5(1-0.5)/0.052=384$ participants

Sampling Techniques
Three developed areas were randomly selected for the purpose of this research and thirty five (35) fecal samples were collected every week for a period of 12 weeks from August- October, 2023. A total of four hundred and twenty (420) samples were collected from three selected areas namely; Biu metropolis, Buratai and Miringa.

Sample Collection
A wide mouthed, transparent specimen container labeled age, sex and location were given to each selected participants in the study area and a structural questionnaire to collect information on their knowledge about the disease. Prior to this,an introductory letter from the University was submitted to the management of the schools wherein participants were drawn from. Having selected the participants, orientation was given to them about the study. Samples collected from the participantswere transported immediately to the Biology Laboratory of Nigerian Army University Biu for laboratory analysis.

Laboratory Analysis
All collected fecal sampleswere analyzedusing formal-ether concentration techniquewith a view to identifying the eggs of *Schistosoma* sp., following the methods described by Cheeseborough (1998) and Ochei and Kolhathar (2007). Specifically, 1g of each stool sample was placed in a centrifuge tube with 7$cm^3$of 10% formal saline, and the mixture was emulsified and filtered through a coffee filter into another centrifuge tube. To this fecal suspension,3$cm^3$of diethyl ether was added, the tube covered with a stopper, and vigorously shaken before centrifugation at 3000 revolutions per minute for 3 minutes. Upon centrifugation, four distinct layersthat were formed; sediment, formal saline, fecal debris, and ether at the topmost layer. The fecal debris was discarded using an applicator stick, and the upper three layers were poured off without disturbing the sediment, which was then examined for the presence of parasite eggs. A drop of the deposit was pipette onto a clean microscope slide, covered with a clean cover slip to prevent air bubbles and floating, and mounted on the microscope stage. Examination for schistosomes ova was conducted using x10 and x40 objective lenses, following the key described by CDC (2013).

Data Analysis
Data obtained were analyzed in Microsoft Office Excel Version 2010.Simple percentage was employed to determine the pprevalence of Schistosomiasis in the study population. Chi-square test was employed to establish the relationships between two categorical variables. $P<0.05$ was used to determine the level of significance.

RESULTS

Out of 420 fecal samples examined during the study, 3(0.7%) were found with the eggs of *Schistosoma mansoni*. Out of the four different age groups, only age groups (11-13and 14-16years) had 1(0.7%) and 2(1.8%) eggs of *Schistosoma mansoni* in their fecal samples respectively. The other groups (5-7 and 8-9years) had no egg of the parasite. 3 (1.6%) male participants were positive with the eggs of the parasite while no female participant was infected with the parasite. Buratai and Miringa had 0.9% and 1.9% respectively while Biu metropolis has 0% prevalence rate. The difference in prevalence rate between the different age groups, sexes and location of the participants was not statistically significant (Table 1).

Information on associated risk factors with intestinal Schistosomiasis such as source of water, water contact activities and occupation of the parents showed that 49.8% of the participants 49.8% use well as their sources of water, 47.6% of the participants used borehole water while only 2.6% of the participants used stream/river (Table 2). Additionally, participants had farming (78%), hunting/ fishing (11%), swimming/bathing (25%) and washing (5%)as water contact activity (Table 2)

Results on the knowledge of the participants about intestinal Schistosomiasis indicate that 277 (66%) of the participants had not heard about intestinal Schistosomiasis and 109(26%) participants had no idea while only 34(8%) participants had heard about intestinal Schistosomiasis (Table 3). Participants (54.2%) had no idea of the diseases, participants (44.1%) heard about it from the parents/guardian, participants (0.5%) heard about it from media while participants (1.2 %) heard about it in their school (Table 3). Participants (99.5%) of the study had no idea about the causative agent of intestinal Schistosomiasis as only 2 participants (0.5%) believed insect is the causative agent of intestinal Schistosomiaisis (Table 3). Out of the participants, 41.7% had no idea on how intestinal Schistosomiasis is transmitted, 112 participants (26.7%) believed it is transmitted through contaminated food, 57 participants (13.6%) believed that the emergence of the disease is a sign of adulthood, 52 participants (12.4%) believed that the disease can be transmitted through bathing in infected water and 5.7% of the participants believed that the disease can be inherited. Out of the participants, 56%had no idea on how intestinal Schistosomiasis can be treated, 24.3% of the participants believed that it can be cured with time, 10.7% of the participants believed that the disease is not treatable at all while 9% of the participants believed the disease can be treated using drugs (Table 3).

Other parasites encountered during the study were *Ascaris lumbricoides* 36(54%), *Trichiuris trichiuria* 22(33%), *Giardia intestinalis* 2(3%), *Entamoeba histolytica* 3(4%), *Ancylostoma duodenale* 4(6%) as showed in table 4

Table 1: Prevalence of intestinal Schistosomiasis amongst the participants of the study

Variable	No. of Response (%)
Source of water	
Stream/river	11(2.6)
Borehole	200(47.6)
Well	209(49.8)
Water contact activities	
Swimming/bathing	25(6)
Washing	21(5)
Hunting/fishing	46(11)
Farming	328(78)
Occupations of Parents	
Trading	118(28)
Farming	159(38)
Civil servant	103(24.5)
Others	40(9.5)

Table 2: Factors associated with intestinal Schistosomiasis amongst the study participants

Parameter	Number Examined	Number Effected (%)	Degree of Freedom	Significance Value	Decision
Age					
5-7	88	0			Not significant
8-10	85	0			
11-13	135	1(0.7)	3	3.06	
14-16	112	2(1.8)			
Sub-total	420	**3(0.71)**			
Sex					Not significant
Male	183	3(1.6)			
Female	237	0	1	3.91	
Sub-total	420	**3(0.71)**			
Location					
Biu Metropolis	195	0			Not significant
Buratai	117	1(0.9)	2	0.01	
Miringa	108	2(1.9)			
Sub-total	420	**3(0.71)**			

Table 3: Knowledge of the study participants on intestinal Schistosomiasis

Variable	Categories	Response (%)
Heard about intestinal Schistosomiasis	Yes	34(8)
	No	277(66)
	No idea	109(26)
Where did you heard about it	School	5(1.2)
	Media	2(0.5)
	Parents /guardian	185(44.1)
	No idea	228(54.2)
Causative agent of intestinal Schistosomiasis	Parasitic worms	0
	Virus	0
	Insect	2(0.5)
	No idea	418(99.5)
Transmission of Intestinal Schistosomiasis	Hereditary	24(5.7)
	Adulthood	57(13.6)
	Contaminated Food	112(26.7)
	Bathing in infected water	52(12.4)
	No idea	175(41.7)
Treatment of Intestinal Schistosomiasis	Drugs	38(9)
	Not treatable	45(10.7)
	Will be cured with time	102(24.3)
	No idea	235(56)

Table 4: Other pathogens detected from the faeces of the participants during the study

Species	Prevalence (%)
Ascaris lumbricoides	36(54)
Trichiuris trichiuria	22(33)
Giardia intestinalis	2(3)
Entamoeba histolytica	3(4)
Ancylostoma duodenale	4(6)
Total	**67(100)**

DISCUSSION

Intestinal Schistosomiasis is one of the neglected tropical diseases caused by *Schistosoma mansoni* in African region (WHO, 2023). The study revealed an overall prevalence 0.7% of *Schistosoma mansoni* in the study area. This indicates low endemicity of the parasite in the area. This funding can be attributed to the presence of less open water bodies and no intermediate host of the parasite cited in the study area which enable the parasite to complete it life cycle. This finding agrees with the report of Usman *et al.* (2023a) in the study area, Usman *et al.* (2017) in Bauchi State and Okpala *et al*. (2004) in Jos who reported 0.5%, 0.15% and 0.67% respectively in their studies. The prevalence rate obtained in this study is lower compared to the findings of other researchers such as Damen *et al*. (2006) and Mustafa *et al*. (2020) who recorded 19.0% and 11.4% among students in a Local Government Area of Kaduna State and Wondo District in Ethiopia.

The age groups 5-7 years and 8-10years had no egg of the parasite only age group 11-13 years and 14-16years had. The different in prevalence rate between the different age groups of the students were statistically not significant. The prevalence rate of the disease in these age groups could be attributed to more exposure factors such as swimming, washing and bathing in an open water bodies than the lower age groups which are usually at home. These agreed

with the reports of the studies conducted by Biu *et al*. (2009) and Usman *et al.* (2016) in Konduga and Bauchi respectively.

Three 3 (1.6%) male students are positive with the egg of the parasite while no female student that was infected with the parasite. The differences in prevalence rate between the different sexes among the students were statistically not significant. Similar trends have been observed in many areas as earlier reported in many part of Africa such as Garba *et al. (*2010); Ahmed *et al*.(2012); Usman and Babeker (2017) in Niger, Sudan and Nigeria respectively. The high prevalence observed in males is due to the fact that males tend to go to the river on a regular basis to fetch water for domestic use, play or bath and even fishing unlike the females which visit open water bodies occasionally when male children are not at home to get water for domestic chores. However, traditions and religions of parents in this region make them to be more restricting on their female children than male which contribute to the higher prevalence in male than female participants.

Buratai and Miringa has 1(0.9%) and 2(1.9%) respectively while Biu metropolis has 0 prevalence rate. The different in prevalence rate between the different locations of the participants were statistically not significant. This pattern of infection of individuals in different location in the same study area had been recorded earlier in Ebonyi and Bauchi state Nigeria by Uneke *et al*. (2007) and Usman and Babeker (2017) respectively. The major factors that might be responsible for the high difference may be high level of ignorance, poor environmental sanitation, lack good social amenities and indiscriminate disposal of human wastes and animal waste close to open water bodies and availability of the snail vector in the area.

The three major risk factors associated with Schistosomiasis are source of water, water contact activities such swimming or bathing in an open water bodies and occupation of the parents such as fishing or farming. Results revealed that the people of this study had good water source, less water contact activities unless farming. Few of the participants involved in fishing but no species of the intermediate host was seen around the fishing area. This may also be part of the reason that can be attributable to very low prevalence rate of the parasite in the study area. Parents' occupation such as fishing, farming and laundry in rural area as been reported to play a crucial roles in the transmission of Schistosomiasis and mostly determined infection status of their children (Awosolu e*t al*., 2020). The results of this study have also revealed poor knowledge about the transmission, prevention and treatment of Schistosomiasis among the participants in the study area. This observation is similar to previous report of Salawu *et al.* (2023) in Oke-Awo Rural Community Ile -Ife, Southwestern Nigeria. Although, it is a common attitude of people to contaminate their open water bodies with the waste especially the rural residents that lack adequate knowledge about the life cycle of the parasite (Ogbonn *et al*., 2012) and other related effects of such. This attitude provides the opportunity for the parasite to complete their life cycle by getting *Schistosoma* in contact with the snail intermediate host, although the intermediate host *Biomphalaria* snails of *mansoni* was not seen in the study area.

Other parasites; *Ascaris lumbricoides* (54%), *Trichiuris trichiuria* (33%), *Giardia intestinalis* (3%), *Entamoeba histolytica* (4%), *Ancylostoma duodenal e*(6%) were detected in the faeces of the participants during the study. All these parasites were earlier detected and reported by Usman *et al*. (2017) in their study regarding prevalence of gastrointestinal parasites and associated risk factors among patients attending government hospitals in Bauchi State,

Nigeria. Also, Pauline and Chukwudi (2016) in their study intestinal helminth infections among primary school pupils in Nimo Community, Njikoka Local Government Area and Usman *et al*., (2023b) in their study on prevalence of gastrointestinal parasites on ruminant animals slaughtered in the study area reported different prevalence rate of this parasite with the present study. The difference witnessed and reported in these studies may be due to environmental exposure and geographical location. Opara *et al*. (2007) reported that, the prevalence of these helminths varies not only from one locality to the other, but also among individuals and socioeconomic status of Parents.

CONCLUSION

Results obtained in this study have indicated that intestinal Schistosomiasis is not endemic in the study area. However, there is need for stakeholders to educate people on the effect of this parasite and treat the few infected individual with the most acceptable drugs praziquantel. Also, mass administration of other anthelmintic drugs should be use to treat other intestinal parasite in the area to avoid further escalation of situation in the study area

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Conflict of Interest

None

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