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## Socio-Environmental Predictors Associated with The Prevalence of Intestinal Parasites Among School-Aged Children in Nigeria

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### ABSTRACT

*This study determined the socio-environmental predictors associated with the prevalence of gastro-intestinal parasitism in Jega and Maiyama LGAs, Kebbi state was carried out between July and October 2017. A structured questionnaire was used to collect demographic information of the participants and a faecal sample was collected for laboratory analysis. Logistic regression was used to test the association between the infection and risk factors. A total of 400 school-aged children between the age of 5 and 13 years were examined, out of which 181(45.25%) were found positive. Entamoeba histolytica, hookworms and Ascaris lumbricoides were the most frequently encountered parasites with respective prevalence of 27.5%, 26.4% and 18.3% followed by Cryptosporidium parvum with prevalence of 6.5%. Logistic regression analysis indicates that, the infection was associated with: age of the pupils (Odds Ratio=1.53, 95% Confidence Interval= 1.014-2.318), gender (Odds Ratio=1.411 and 95% CI=0.950-2.094), source of drinking water (OR=1.689 and CI=1.124-2.537), toilet facilities (OR=1.238 and 1.169 for pit latrine and open field defecation respectively), Regular hands washing (OR=2.946, 95% CI=1.957-4.436), Lack of formal education (OR=0.944, 95% CI=0.615-1.449) and Farming occupation (OR=2.426, 95% CI=1.584-3.716). It was concluded that unhygienic behavioral variables, certain environmental and socio-economic factors predicted the presence of gastro-intestinal parasites in the areas.*

**Key words:** Intestinal parasites, socio-environmental factors, prevalence, Jega and Maiyama LGAs.

### INTRODUCTION

Intestinal parasites are parasites that can infect the gastro-intestinal tract of humans and other animals (Loukopoulos *et al.*, 2007). They can live throughout the body, but most prefer the intestinal wall. The two main types of intestinal parasites are helminthes and protozoa, but not all

helminthes and protozoa parasites are intestinal. The common intestinal protozoan parasites of human are *Entamoeba histolytica/dispar*, *Giardialamblia/intestinalis*, *Cryptosporidium pavumand* *Cyclospora species*. The medically important helminthes are nematodes (roundworms), cestodes (tape

worms) and trematodes (flukes) (WHO, 2000).

Intestinal parasites produce a variety of symptoms most of which manifest in gastro-intestinal complications and general weakness (WHO, 2017). Gastro-intestinal complication includes diarrhea, nausea, dysentery and abdominal pain. These have negative impacts on nutritional status, including decreased absorption of micronutrients, loss of appetite, weight loss, hepatomegaly, splenomegaly and intestinal blood loss that can often result in anemia. They may also cause mental and physical disability, growth retardation in children and skin irritation around the anus (Ashtiani *et al.*, 2011).

The most prevalent and important helminthes in developing countries are the soil-transmitted helminthes such as: *Ascaris lumbricoides*, *Trichuris trichiura*, hookworms and *Hymenolepis nana* (Bunza *et al.*, 2013). Children between ages of 3 to 13 years are more susceptible to *A. lumbricoides* infection than grown up individual. Thus, as age increases exposure to intestinal parasitic infection decreases possibly due to improved personal hygiene (Mohamed *et al.*, 2009).

The worldwide prevalence of intestinal infections caused by pathogenic protozoan species is also reported to be high (Petri and Singh, 1999). In Indonesia, Surtiastuti and Widiastuti (2011) recorded a total prevalence of 83.9% in the finger nails of food vendors.

The main transmission route for most intestinal parasites is fecal-oral either (Bunza and Abdullahi, 2013). Intestinal parasites can infect humans through food, water and environmental contamination. They are more prevalent among the poor, who are negatively affected by low socio-

economic conditions, poor personal and environmental hygiene, overcrowding and limited access to clean water (Amare *et al.*, 2007).

The role of intestinal parasites in causing morbidity and mortality and their pathogenesis differ from species to species. Similarly, the distribution and prevalence of various species of intestinal parasites also differ from region to region because of several environmental, social and geographical factors (Zahraa, 2010). Hence, study on the prevalence of various intestinal parasitic infections is a prerequisite not only for formulation of appropriate control strategies but also to predict risk for communities under consideration (Nasiri *et al.*, 2009).

Intestinal parasites are among the major contributors to the global disease burden but the non-acute nature of the infections has contributed to the perception of intestinal parasitic infections as being common but usually unimportant to the public health community (Absar *et al.*, 2010). Although several studies have been conducted on the distribution and prevalence of intestinal parasites in Nigeria, there are still several localities in the country including the study area, Jega and Maiyama LGAs, for which epidemiological information of gastro-intestinal parasitic infections are not available. This study provides current epidemiological information on the prevalence of human intestinal parasitic infections and their associated risk factors among primary school children in Jega and Maiyama LGAs.

The aim of this research is to identify the risk factors that contribute to the prevalence of

human gastro-intestinal parasitism among primary school pupils in Jega and Maiyama LGAs, Kebbi state.

## MATERIALS AND METHODS

This study was carried out in Jega and Maiyama local government areas of Kebbi state. Jega local government located at latitude 12.22° North and longitude 4.38° east. It has an area of 891 square kilometers and a population of 193,352 based on 2006 population and housing census figure. The LGA Headquarter is at Jega (Sulaiman, 2008). Maiyama local government area is located at latitude 13° north and longitude 5° east (Sulaiman, 2008).

The study population comprised of 400 primary school pupils. A total of 10 primary schools were randomly selected from Jega and Maiyama LGAs for this study and 40 pupils were selected from each of the ten primary schools selected in the study area. The pupils enrolled were within the ages of 4-13 years. A structured questionnaire was administered to obtain information on demographic data and risk factors of acquiring gastrointestinal parasites.

A total of 400 fecal samples were collected from 400 pupils (200 in Jega LGA and 200 Maiyama LGA). Each pupil enrolled into this study was given a sample collection bottle bearing serial number that was assigned to his/her name in the record book. The pupils were instructed on how to collect their stool sample into the containers between 7 and 10 am. The faecal samples collected was preserved in 10% formalin and transported to the Zoology Laboratory in the Department of biological sciences, Faculty of science and science education, Kebbi state

University of science and technology Aliero for analysis.

Fecal analysis was achieved by using formol-ether concentration technique. The formol-ether concentration technique was done by placing 2g of the faeces into a test tube containing 10ml of distilled water, this is then emulsified strain through a gauze-sieve into a centrifuge tube and centrifuged at approximately 2,500 r.p.m for 3minutes. The supernatant was decanted and 10% formol-saline was added to the tube containing sediments and mixed with a glass rod. About 3ml of di-ethyl ether was added to the mixture in the tube, corked and then shaken vigorously. The mixture was centrifuged again for two minutes at 2,000 r.p.m. after which, the fatty debris at the interface of the liquids was loosened, and the whole supernatant fluid together with the debris was poured away. A drop of Lugol's iodine solution was then added to the deposit at the bottom of the tube and shake. A drop of the content was pipette on a microscope glass slide and cover with a cover slip and examined under light microscope using the x10 objective lens (NCCL, 1997). intestinal parasites by Brook and Melvin (2001).

The data collected for this study was analyzed using the software INSTAT®. The prevalence of different intestinal parasites was calculated and express in percentages. Chi square test was used to test the association between the prevalence of infection and schools. Odds ratio (OR) was

used to determine the association between the risk factors and prevalence of infection.

**RESULTS**

Out of 400 primary school pupils between the ages of 5 and 13 years examined, 181 pupils representing 45.25% were found to be infected with gastro-intestinal tract parasites in Jega and Maiyama Local Government Areas of Kebbi State, (Table 1). Breakdown of result in relation to school showed that Gindi and Mungadi primary

schools had the highest prevalence of 21 (52.5%) each, followed by Dumbegu primary school 20(50.0%), Nasarawa and Giwa Tazo 19(47.5%) each, Muhammad Bello primary school 18(45.0%), Nizamiyya 17(42.5%), and UBE Maiyam 17(42.5%), Jega Model primary 16(40.0%), and Raudatus sunnah academy had the least prevalence with 13(30.0%). These differences among the Schools were however not significant (P = 0.785).

**Table.1:** Prevalence of intestinal Parasites in Ten Primary Schools in Jega and Maiyama Local Government Areas, Kebbi State.

Schools	No. examined	No. infected (%)	Chi-square	Df	P-value
Dumbegu	40	20(50.0%)	<b>5.540</b>	<b>9</b>	<b>0.785 n.s</b>
Gindi	40	21(52.5%)			
Giwa Tazo	40	19(47.5%)			
Jega Model	40	16(40.0%)			
Muh'd Bello	40	18(45.0%)			
Nasarawa	40	19(47.5%)			
Nizamiyyah	40	17(42.5%)			
Raudatus sunnah	40	13(32.5%)			
UBE Maiyama	40	17(42.5%)			
UBE Mungadi	40	21(52.5%)			
<b>TOTAL</b>	<b>400</b>	<b>181(45.25%)</b>			

n.s = not significant

Prevalence of intestinal parasitic infections according to type of toilet showed that individuals that use pit latrine and open field defecation had higher prevalence than those that use water closet. Those that responded they use pit latrine had 122 (47.1%) positive cases out of 259 respondents and 32(48.5%) out of 66 for refuse dump and open field defecation (figure 1).

The pupils that use pit latrines and open field defecation in their homes had higher prevalence and odds ratio values of

1.238 for pit latrine and 1.169 for bush/refuse dump showed association between the infection and the toilet system.

Those that use water system had 75 respondents with 27(36.0%) positive cases. Odds ratio values of 0.625 for water closet system of toilet did not showed significant association between toilet type and the infection. Thus, these types of toilet are safe, and prevent the transmission of intestinal parasites in community.

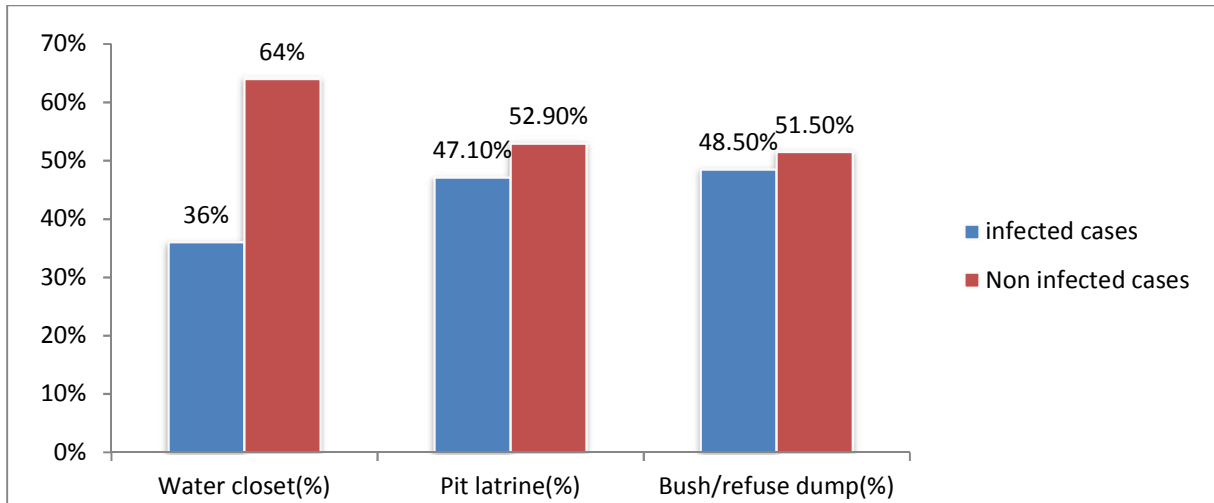


Figure 1: Prevalence of intestinal parasites in relation to toilet type.

Out of 223 pupils that responded they wash their hands with soap or ash after using toilet had only 75(33.6%) positive cases while those that do not wash their hands with soap or ash after toilet had high

prevalence of 106(59.9%) positive cases (table 2). An odds ratio value of 2.946 showed significant association between habit of washing hands after toilet and the transmission of intestinal parasites.

**Table 2:** Hand washing habit and prevalence of intestinal parasitic infection

Hand washing	No. Examined	No. infected (%)	Non-infected (%)	O. R	CI
No	177	106(59.9%)	71(40.1%)	2.946	1.957-4.436*
Yes	223	75(33.6%)	148(66.4%)		
<b>Total</b>	<b>400</b>	<b>181(45.25%)</b>	<b>219(54.75%)</b>		

\* Statistically significant.

Out of 151 pupils that who did not use their foot ware usually, 86(57.0%) were found positive, while in those that wear their foot ware usually 95(38.2%) out of 249

positive. Odds ratio value of 0.466 showed that there is no association between foot and prevalence of the infection (figure 2).

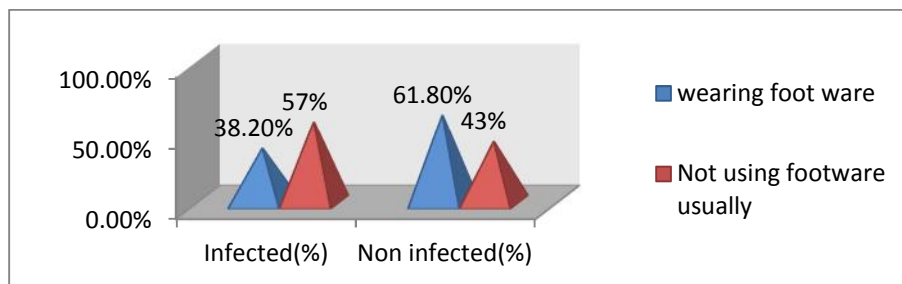


Figure 2: Prevalence of intestinal parasites in relation to the habit of walking bare footed.

A noticeable disparity was observed among various occupations, where prevalence varied from 33.8% - 59.8%. The prevalence of intestinal parasites in pupils whose parent's occupation is farming was 79(59.8%) out of 132. Prevalence of the parasites was low in pupils whose parent's occupation are civil servant and trading/business with total infected cases of 27(33.8%) and 75(39.9%) respectively (table .3). An odds ratio value of 2.426 showed that there is association between farming as occupation and the prevalence of the infection and the association is statistically significant (CI: 1.584-3.716). Whereas odds ratio value of 0.549 and 0.458 for civil servant and trading respectively showed no

association between the occupation and the infection.

Family income played significant role in determining prevalence among various income categories. Among the 109 pupils that said the monthly income of their parents is less than N18,500 have the high prevalence rate of 57(52.3%), while pupils from households with certain income had lower prevalence 124(42.6%) out of 291. Odds ratio value of 1.48 showed association between parent's income and prevalence of infection.

Level of education showed no significant influence on prevalence despite (O.R = 0.94) higher infection rate among illiterates (45.7%) than in those who had formal education (44.3%), (table.3).

**Table 3:** Socio-economic status of parents and infection of intestinal parasites

Socio economic	No. examined	No. infected (%)	Non-infected (%)	O. R	CI
<b>Occupation</b>					
Farming	132	79(59.8)	53(40.2)	2.426	1.584-
Trading/business	188	75(39.9)	133(60.1)	0.458	3.716*
Civil servant	80	27(33.8)	53(66.2)	0.549	0.306-
<b>total</b>	<b>400</b>	<b>181(45.25)</b>	<b>219(54.75)</b>		<b>0.688</b>
					0.329-
					0.917
<b>Monthly income</b>					
< N18,500	109	57(52.3)	52(47.7)	1.476	
>N18,500	291	124(42.6)	167(47.4)		
<b>Total</b>	<b>400</b>	<b>181(45.25)</b>	<b>219(54.75)</b>		<b>0.949-</b>
					<b>2.297</b>
<b>Level of edu.</b>					
Literate	122	54(44.3)	68(55.7)	0.944	
Illiterate	278	127(45.7)	151(54.3)		
<b>Total</b>	<b>400</b>	<b>181(45.25)</b>	<b>219(54.75)</b>		<b>0.615-1.449</b>

**DISCUSSION**

Over the course of this study, a total of 400 fecal samples from 400 primary school pupils (200 males and 200 females)

were collected and analyzed for the presence of eggs, cyst or larvae of gastro intestinal parasites and an overall prevalence of 45.25% was obtained. The prevalence was low

compared to findings by Damen *et al.*, (2011) with 80.9% in Konduga, Borno state and Egbuobi *et al.* (2013) with 64.1% in Akokwo Imo State. But the finding was similar to the finding of Danladi P. Audu (2015) with 45.2% in Bosso Local Government Area of Niger State.

However, the result of this finding was higher than that obtained by Frederick *et al.*, (2011) Benin city with 3.9% prevalence, Damen *et al.*, (2010) with 30.2% in Doi village Plateau State. The high prevalence of intestinal parasites in the areas could be due to favourable climate for the survival of the parasites, improper management of organic refuse, inadequate supply of clean water, poor drainages and use of dumping site for defecation might have contributed to this high prevalence.

Prevalence studies in relation to school showed that Gindi and Mungadi primary schools had the highest prevalence of 21 (52.5%) each. This outcome might be due to improper management of organic refuse and inadequate supply of clean water, poor drainages and use of dumping sites for defecation might have contributed to this high prevalence. Raudatus Sunnah academy had the least prevalence with 13(30.0%). These differences among the Schools were however not significant ( $P = 0.785$ ). This might be due to the same level of exposure to risk factors in the communities where the schools are located. It shows that the levels of hygiene in the schools might be the same.

The finding of this research shows an intimate association between patterns of infection and access to good water supply. Prevalence of intestinal parasitic infections according to water source showed that the prevalence was higher in the pupils who used wells as their source of drinking water

and least in those that used either borehole or pipe-borne water as source of drinking water. Out of a total of 152 pupils who indicated that, they use wells, 81(53.3%) tested positive for intestinal parasites. An odds ratio of 1.688 obtained for respondents that use wells showed association between the water source and the disease. This significant association between the infection and use of wells as sources of drinking water may be because shallow wells may be prone to contaminations. Also, some wells in the towns are dug close to pit latrine, and poor sanitation around the well enhances transmission of intestinal parasites.

Out of 205 respondents that use borehole, 83(40.5%) positive cases were recorded and from 43 respondents for pipe-borne water 17(39.5%) had positive cases. Odds ratio value of 0.770 and 0.673 for pupil using pipe-borne water and bore hole water results did not show significant association between the prevalence of the infection and the source of water. Lower prevalence recorded among those pupils using pipe-borne and borehole water as their sources of drinking water shows that these sources are safe (Absar *et al.*, 2010).

The highest prevalence of infection (48.5%) was recorded among subjects who defecated in the open bush. Comparable patterns have also been observed by earlier study like Danladi *et al.*, (2015) and Passi (2015). Prevalence of intestinal parasitic infections according to type of toilet showed that individuals that use pit latrine and open field defecation had higher prevalence than those that use water closet. Those that responded they use pit latrine had 122(47.1%) positive cases out of 259 respondents, and 32(48.5%) out of 66 for refuse dump and open field defecation. The pupils that use pit

latrines and open field defecation in their homes had higher prevalence and odds ratio values of 1.238 for pit latrine and 1.168 for bush/refuse dump showed association between the infection and the toilet system. Similar observations were made among those that use open field defecation toilet system by Uneke *et al.*, (2006). This could be due to poor sanitation which might encourage flies and cockroaches to spread cysts and eggs of intestinal parasites (Absar *et al.*, 2010).

Those that use water system had 75 respondents with 27(36.0%) positive cases. Odds ratio values of 0.623 for water closet system of toilet did not showed significant association between toilet type and the infection. Thus, these types of toilet are safe, and prevent the transmission of intestinal parasites in community. Contamination of the environment has a strong relationship with enteric parasitic infections.

In this study, washing hands with soap or ash after using toilet was significantly protective. Pupils who washed hands regularly after using toilet were less likely to be infected than those who only washed occasionally or do not wash at all. Out of 223 pupils that responded they wash their hands with soap or ash after using toilet had only 75(33.6%) positive cases while those that do not wash their hands with soap or ash after toilet had high prevalence of 106(59.9%) positive cases. Odds ratio value of 2.946 shows statistically significant association between washing hands after toilet and the transmission of intestinal parasites. It has been reported that the hands readily become contaminated after defecation even with the use of tissue paper (Passi, 2015). The human hands act as a common denominator in the transmission of

intestinal parasites regardless of route of transmission (Absar *et al.*, 2010).

Generally, transmission of some intestinal parasitic infection can be during outdoor play with no slippers or shoes on soil contaminated with faeces (Adeoye *et al.*, 2007). Out of 151 pupils that who did not use their foot ware usually, 86(57.0%) were found positive, while in those that wear their foot ware usually 95(38.2%) out of 249 positive. Odds ratio value of 0.466 showed that there is no association between foot and prevalence of the infection. Although there is no significant association between the infection and foot ware usage, the prevalence was high among the pupils that do not regularly wear their foot wares.

A noticeable disparity was observed among various occupations, where prevalence varied from 33.8% - 59.8%. The prevalence of intestinal parasites in pupils whose parent's occupation is farming was 79(59.8%) out of 132. Prevalence of the parasites was low in pupils whose parent's occupation are civil servant and trading/business with total infected cases of 27(33.8%) and 75(39.9%) respectively. An odds ratio value of 2.426 showed that there is association between farming as occupation and the prevalence of the infection and the association is statistically significant (CI: 1.584-3.716). Whereas odds ratio value of 0.549 and 0.458 for civil servant and trading respectively showed no association between the occupation and the infection.

Some occupational practices have been associated with enteric parasitic infections. Pupils whose parent's occupation is farming were significantly at risk for infection compared to other occupations tested in this study. Zoonotic exposures and other agricultural practices in some regions



are key factors for transmission. The use and recycling of wastes, household sewage, human and animal excreta in agriculture and aquaculture has a long history in many countries. Similar observation was made by Danladi, *et al.*, 2015.

Family income played significant role in determining prevalence among various income categories. Among the 109 pupils that said the monthly income of their parents is less than ₦18,500 have the high prevalence rate of 57(52.3%), while pupils from households with certain income had lower prevalence 124(42.6%) out of 291. Odds ratio value of 1.48 showed association between parent's income and prevalence of infection.

Level of education showed no significant influence on prevalence despite (O.R = 0.94) higher infection rate among illiterates (45.7%) than in those who had formal education (44.3%). However, the rate of prevalence was higher among the pupils who were from illiterate family background. This is because there was correlation of educational background with infection rates. Illiterates were more prone to infection than those who can read and write. It is often upheld by many that the well-educated are likely to practice personal hygiene better than those who have only low level of education or are illiterate.

## CONCLUSION

In conclusion, the prevalence of intestinal parasites in the two communities is associated to a significant extent with a few important variables of human behaviour, certain environmental and socio-demographic factors. Sustainable intervention measures should be implemented to reduce the burden of this

neglected disease, part of which should include health education, improved access to clean water and adequate sanitation. More studies are needed in this and other settings with similar epidemiological features to further evaluate these factors.

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