Bima Journal of Science and Technology, Vol. 8(2) June, 2024 ISSN: 2536-6041

DOI: 10.56892/bima.v8i2.656

Evaluation of Gastrointestinal Parasitic Infection Among Primary School Pupils in Lokoja, Kogi State, Nigeria

Saleh R., Audu P. A. and Ngwamah J. S.

Department of Zoology, Federal University Lokoja, PMB 1154, Lokoja, Kogi State, Nigeria

ABSTRACT

Intestinal parasites are parasites that populate the gastrointestinal tract, they are mainly protozoans and helminthes. The Gastrointestinal parasitic infection was evaluated among primary school children in Lokoja metropolis Kogi State, Nigeria. The study was carried out in twenty (20) randomly selected primary schools. A total of 332 stool samples obtained from primary school age children comprising 182 males and 150 females, aged between 4->12 years were examined microscopically for gastrointestinal parasites. Out of the 332 samples examined, 121 (35.83%) were positive for intestinal parasites. 11 species of the intestinal parasites were encountered. Hookworm infection was the most prevalence (10.84%) followed by *Fasciola hepatica* (8.70%), *Ascaris lumbricoides, and Entamoeba histotolytica with* 3.61% each. *Strongyloides stercoralis, Taenia saginata, Enterobius vermicularis* and *Diphyllobotrium latum,* has 2.71%, 1.81%, 1.51% and 1.2% respectively. *Trichuris trichiura, Balantidium coli* and *Schistosoma* spp recorded the least prevalence with 0.90% each. The result of the study has shown that intestinal parasites were prevalent in the study area, and for this reason, control measures, such as chemotherapy, provision of adequate sanitary facilities, portable drinking water, improved personal hygiene and health education should be the focus of the community, government and non-governmental organizations.

Keywords: Evaluation, current status, Gastrointestinal, school-aged children, Lokoja

INTRODUCTION

Intestinal parasites are parasites that populate the gastro-intestinal tract, typically protozoa and helminthes are the two major types of intestinal parasites (Bolaji *et al*., 2023). The severity of intestinal parasitic infections have a profound impact on public, affecting approximately one-third of the world population causing high mortality rate mostly in children (WHO, 2017). In Nigeria, a considerable amount of human and animal wastes are discharged into the soil daily leading to seepage with pathogenic organisms which includes cysts, eggs and larvae of these parasites (Udensi *et al*., 2015). High prevalence of infections associated with intestinal parasites can be attributed to poverty, poor environmental hygiene and inadequacies in medical services (Nxasana *et al*., 2013; Odu, *et al*., 2011). Faecal contamination of food and water are the major routes of transmission of gastrointestinal parasite to human via faecal-oral routes (Magaji and Magaju 2021). Intestinal parasitic diseases were the leading cause of morbidity in many parts of Nigeria and is considered as one of the top five diseases in the country that is of public health concern (WHO, 2017). Intestinal parasites are the leading cause of diarrhea which is transmitted faeco-orally when contaminated food and water are been consumed (Omalu *et al.,* 2013). Some of them are also contacted when walking bear footed on contaminated soil (e.g., hookworms), and working in contaminated water surfaces (schistosomiasis). The current paper is to evaluate the status of Gastrointestinal parasitic infection among primary school pupils in Lokoja, Kogi State.

MATERIALS AND METHODS

Study Area

The study was conducted in both the public and private primary schools in Lokoja, Kogi State. Lokoja lies about 7.8023° North of

DOI: 10.56892/bima.v8i2.656

the equator and 6.7333° East of the Meridian. It is about 165 km Southwest of Abuja as the crow flies, and 390 km Northeast of Lagos by same measure. Residential districts are of varying density, and the city has various suburbs such as Felele, Adankolo, Otokiti and Ganaja. The town is situated in the tropical Wet and Dry savanna climate zone of Nigeria, and temperature remains hot all year round. The highest temperature is usually recorded in the afternoon. Lokoja rose to fame due to its location at the confluence of the two great waterways in West Africa the Niger and Benue Rivers (CENSUS, 2006).

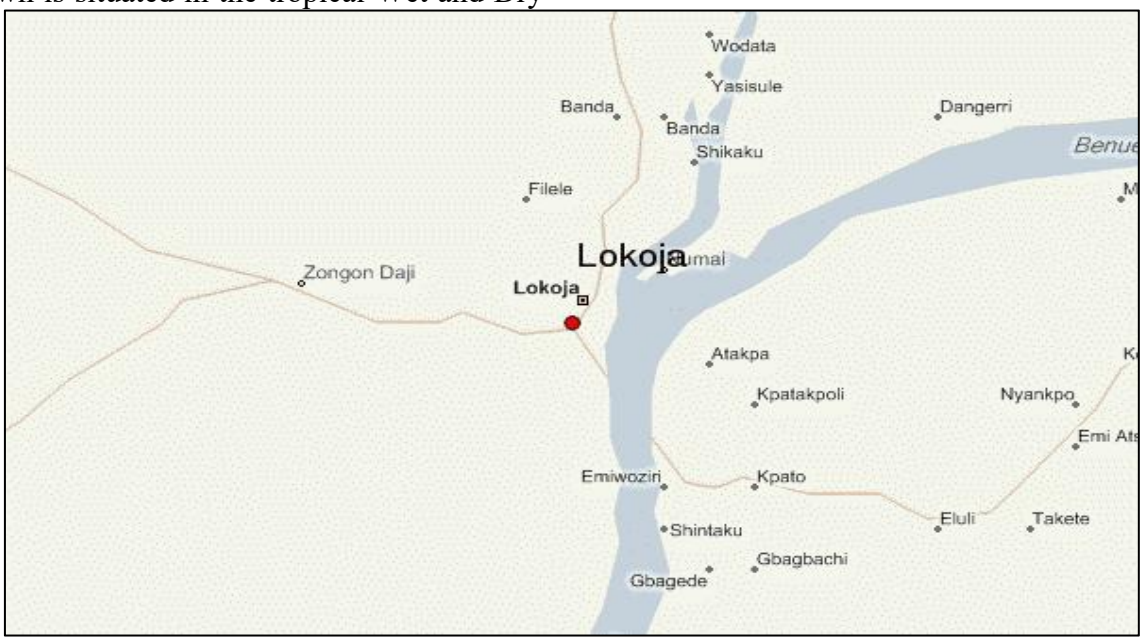

Figure 1: Map of Lokoja

Source: Alabi (2019).

Determination of Sample Size

The sample size of the study was determined using a single population formula for cross population study

$N=z^2p\ (1-p)\ /d^2$, the value obtained was 332.

Study Population

The study was carried out in some randomly selected primary schools in Lokoja, between November 2021-February 2022 (dry season), and July-October 2022 (Rainy season). Twenty (20) schools were selected using a stratified random sampling. Using a simple random sampling the children comprised of both sexes and different ages, ranging from 4 to >12 years that were selected. During sampling 1 and 2 was written on a piece of paper, stool samples were collected from those who chose 1. A total of 332 stool samples were collected.

Examination of Pupils

Ethical clearance was issued by the state ministry of health, pre-sampling visits were made to the schools during which an introduction letter and the ethical clearance were taken along to various schools and the objectives of the study was fully explained to the various school authorities in order to get their co-operation. The randomly selected children were provided questionnaires and letters, seeking the consent and co-operation of parents. After the consent of their parents, each child was given a clean polythene bag, labeled sterile stool container, and a pair of nylon hand gloves. The specimen bottles were labelled accordingly. The questionnaire demanded for the students' socio-demographic information, Parent's Occupation and level

DOI: 10.56892/bima.v8i2.656

of education, Source of Water Supply, Type of Toilet and hand washing habits.

Collection of Stool Samples

The stool sample was collected with the assistance of the school nanny during school hours, where about 1ml of 10% formalin (for preservation) was added on each sample before the school closing time, the stools were collected from the schools after the school hours, each stool sample container was placed inside a black polyethene bag. The samples and the completed questionnaires were brought to the Biology Laboratory, Federal University Lokoja for analysis.

Parasitological Examinations:

Three (3) different methods were used for this study to ensure that all possible intestinal parasites (helminths and protozoans) are identified.

Direct Smear

One (1) gram of the stool sample was mixed with the normal saline using a glass rod to obtain a thin smear. Large particles were removed and then a cover slip was placed on the smeared slide. A drop of Lugols iodine was added to the edge of the cover slip so as to allow gradual diffusion into the saline mount. The slide was then examined under light microscope for presence of parasites egg, cysts or larvae, using x 10 objective lens. Then x 40 objective lens was used for closer examination (Sloss, 1978).

Sedimentation

Formal-ether concentration method was used, as described by Cheesbrough (2009). where about one (1) gram of the stool was taken and emulsified in 4ml of 10% formalin, it was mixed and sieved with a cotton gauze into a test tube, 4ml of formalin was added along with 3ml of di-ethyl ether and corked with a cotton wool and centrifuged for 5 minutes at 3000 revolution per minute (rpm), the supernatant was discarded and the sediment was taking using a dropper to a clean glass slide where a drop of luggols iodine was added and observed under a light microscope at 10x and 40x magnification.

Floatation

About two (2) grams of the stool was taken and emulsify in normal saline, which was strained through a cotton gauze into a test tube, more of the normal saline was added to filled the tube to the extreme end, where a clean cover slip was placed on the tube and allowed to stand for 30 minutes. Luggul's iodine was dropped on a clean glass slide and the cover slip was placed on the iodine point and viewed under a microscope at 10x and 40x magnification (WHO, 2019).

Statistical Analysis:

The data obtained in this study were subjected to one-way Anova, using SPPS version 2020 package. The prevalence of gastrointestinal parasites was calculated and expressed as percentage of n/N where n is the number of children infected and N is the total number of the children examined. Chi Square was also used to compare the infection rate among age, sex and different socioeconomic status.

RESULTS

The current study has revealed that out of the total of 332 pupils examined, 121(36.4%) were found infected with different species of intestinal parasites. Eleven species of gastrointestinal parasites were identified, where the highest infection recorded was Hookworm with the prevalence of (10.84%), other species of parasites encountered were: *Fasciola hepatica* (8.70%), *Ascaris lumbricoides,* and *Entomoeba histolytica* with 3.61% each. *Strongyloides stercoralis* (2.71%), *Taenia saginata* (1.81%), *Enterobius vermicularis* (1.51%), *Diphyllobotrium latum* (1.2%), *Trichuris trichiura, Balantidium coli* and *Schistosoma* spp recorded the least prevalence with 0.90% each (Figure 1).

Bima Journal of Science and Technology, Vol. 8(2) June, 2024 ISSN: 2536-6041

DOI: 10.56892/bima.v8i2.656

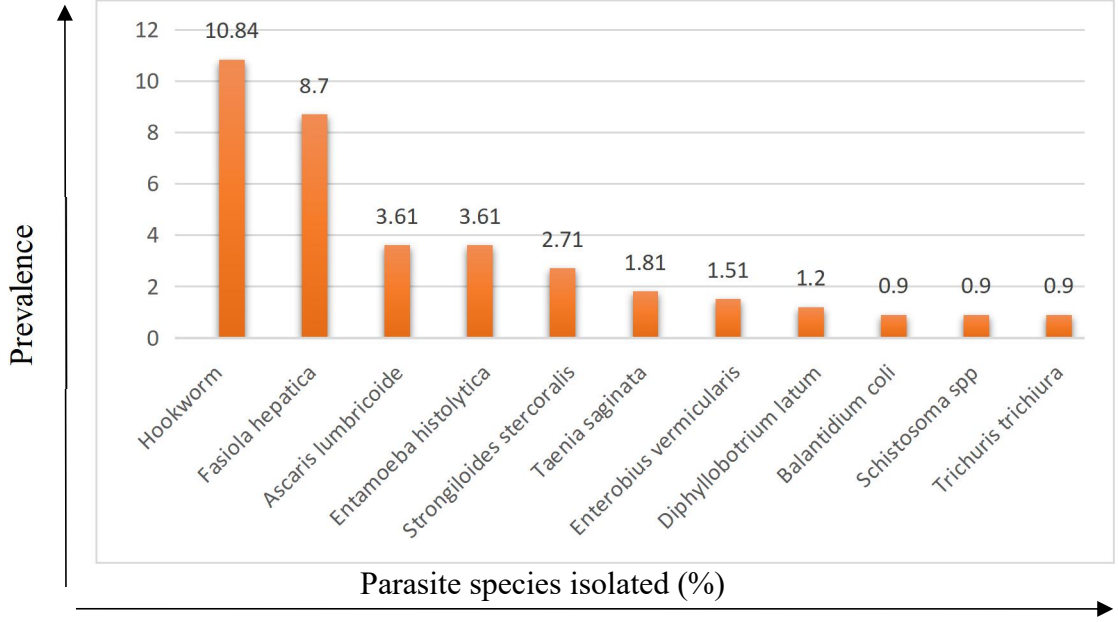

Figure 2: Distribution of Gastrointestinal Parasites Among primary school-aged children in Lokoja

Prevalence of gastrointestinal parasites among primary school-aged children in Lokoja by sex

The distribution of parasites species with respect to sex groups has shown that males recorded higher prevalence of *F. hepatica* (22), hookworm (21), *A. lumbricoides* (10), *E. histolytica* (9), *S. stercoralis* (7), *T. sagina* (4), *E. vermicularies, and T. trichuira* (3 each) while females recorded higher prevalence only in *Schistosoma spp. and B.coli* with 2 and 3 respectively. The differences were significant (P<0.05). (Table 1).

Table 1: Distribution of gastrointestinal parasites among primary school-aged children by Sex

Parasitic Species	**Males N=86(71.1%)**	**Females 35(28.9%)**	**Total 121(100%)**	**X^2**	**P.value**
Hookworm	21(17.44)	14(11.6)	35(28.9)	11.342	18.307
F. hepatica	22(18.2)	7(5.8)	29(24)		
A. lumbricoides	10(8.3)	2(1.7)	12(9.9)		
E. histolytica	9(7.4)	3(2.5	12(9.9)		
S. stercoralis	7(5.8)	2(1.7)	09(7.4)		
T. saginata	4(3.3)	2(1.7)	6(5)		
E. vermicularies	3(2.5)	2(1.7)	5(4.1)		
D. latum	2(1.7)	2(1.7	04(3.3)		
B.coli	1(0.8)	2(1.7)	03(2.5)		
T. trichuira	3(2.5	0	03(2.5)		
Shistosoma spp.	1(0.82)	2(1.6)	03(2.5)		
Total	**86**	**35**	**121**		

Distribution of Intestinal Parasites among Primary School-Aged Children in the Study Area by Age

Among the four different age groups of pupils used for this study, the highest rate of parasitosis was seen in 7-9 years (16.57%) followed by 10-12years (15.36%). The age group up to 4years was least infected (Table 2).

DOI: 10.56892/bima.v8i2.656

Table 2: Distribution of gastrointestinal parasites among primary school-age children by Age

Intestinal parasites	4years (n=83)	5-6years (n=83)	7-9 years (n=83)	10-12years (n=83)	Total [n (%)] 332(100%)
Helminths	**3**	**8**	**49**	**43**	**106(31.32)**
Hookworm	0	3	19	13	35(10.54)
F. hepatica	0	0	13	16	29(8.73)
A. lumbricoides	0	0	7	5	12(3.61)
S. stercoralis	0	2	2	5	9(2.71)
T. saginata	0	0	4	2	6(1.8)
E. vermicularies	1	2	1	1	5(1.5)
D. latum	0	0	3	1	4(1.2)
T. trichuira	2	1	0	0	3(0.9)
Shistosoma spp	0	0	0	3	3(0.9
Protozoa	**0**	**2**	**6**	**8**	**15(4.51)**
E. histolytica	0	2	4	6	12(3.61)
B. coli	0	0	2	2	3(0.9)
Total	**3(0.9)**	**12(3.61)**	**55(16.57)**	**51(15.36)**	**121(36.14)**

Assessment of Risk factors for Gastrointestinal Parasitic Infection

The result depicts strong relationship between sociodemographic and parasitic infection in the study area. The result recorded high infection rate in male 86(47.25) as compared to their female counterpart 35(20). Children with good hand-washing habit recorded low infection rate (31.15) than those that lack this habit (44.38). The result also showed that source of drinking water plays a major role in transmission of so many infectious diseases. The result showed high prevalence in those that are taking well water (72.5), followed by vended water (52.63). Parents' occupation of the pupils also displayed different prevalent rates that were associated with intestinal parasitic infection. Children of farmers (61.42) proved to be the most affected group, followed by children of fishermen (45.00). The result showed children of traders (25.45) as the least infected group. In all the associated risk factors observed during this study, parents' educational status; with (64% of uneducated, 37.73% for primary education, 31.58% for secondary education and 38.46% for tertiary education 61.42%) was the only risk factor that showed no statistically difference ($p>0.05$) within them.

Table 3: Association of Parasitosis with Risk Factors

S/No	Factors	Sample (N=332)	Positive number (n=121)	Chi-square(X^2) value	P. value
	Gender				
1	Male	182 (54.82)	86 (47.25)	12.99	3.841
	Female	150 (45.18)	35 (20.00)		
2	Study site				
	Private school	166 (50.00)	47 (29.00)	6.110	3.841
	Public school	166 (50.00)	74 (44.57)		
3	Toilet facility (at home)				
	Yes	228 (68.67)	55 (24.12)	30.720	3.841
	No	104 (31.33)	66 (49.62)		
4	Hand washing				
	Yes	199 (59.93)	62 (31.15)	3.856	3.841
	No	133 (40.06	59 (44.38)		
5	Drinking water source				
	Borehole	51 (15.36)	23 (43.40)	25.532	7.815

DOI: 10.56892/bima.v8i2.656

	Well	40 (12.04)	29 (72.5)		
	Sachet pure water	193 (58.13)	48 (24.87)		
	Vended water	38 (11.33)	20 (52.63)		
6	Parent's Occupation				
	Faming	70(21.08)	43 (61.42)	16.65	7.815
	Civil servant	132(39.75)	50 (37.88)		
	Trading	110(33.13)	28 (25.45)		
	Fishing	20(6.02)	9 (45.00)		
7	Parent's Level of Education				
	Un educated	37(11.33)	21 (64.52)	0.251	7.815
	Primary	53(15.96)	20 (37.73)		
	Secondary	190(57.23)	60 (31.58)		
	Tertiary	52(15.66)	20 (38.46)		

DISCUSSION

The spread of gastrointestinal parasites majorly depends on the sanitary hygiene, sociodemographic setting and climatic condition of the community (Magaji and Magaju, 2021). The distribution of the intestinal parasitic infection is determined by multiple factors existing in the community like occupation, hygienic condition, educational status, source of drinking water, toilet facility system and months of the year (Jaran, 2016). The current study attempted to determine some potential risk factors associated with the high prevalence of parasitosis within young children of primary school going age. In this study more than one third (36. 4%) of the study population was found to be infected with intestinal parasites. This finding is in agreement with the report of some researchers (Sah *et al*., 2013; Gupta *et al*., 2020) with 31.5%, and 33% respectively within the country and around the world. While some researchers reported low infection rates (Ihejirika *et al.,* 2019; Abah and Arene, 2015; Hajissa *et al*., 2022; Gbonhinbor *et al.,* 2022) with 16%, 27.66%, 25.8% and 23.9% respectively. Prevalent rate among school age children from different parts of the country and outside showed high infection rates (Eboh *et al.,* 2022; Mbanugo *et al.,* 2015) with 50% and 44.71% respectively. This might be due to the season of the study and geographical region of the study.

The incidence of helminthes parasites is higher than that of the protozoan parasites (31.32% and (4.51%) respectively. This is contrary to the report of the previous studies that reported more cases of protozoa than helminthic parasites (Tandukar *et al.,* 2013; Al-mekhafi *et al.,* 2023) with 13.6% and 31% ;33% and 50.4% for helminths and protozoans respectively which could be due to seasonal variation during the study and/or geographical region of the study.

In this study, hookworm was the most prevalent parasite 10.54% (35/332). Globally, hookworm infection is highly associated with poor sanitation level that has to do with open defecation and constant habit of working bear footed (WHO, 2017). This finding is in agreement with high prevalence of hookworm infection that was observed by other researchers, in their different study site both within and outside the country. As reported by Egboubi *et al.* (2013) in Akokwo Imo State, Damen *et al.* (2011) in Doi village Plateau State, Luka *et al.* (2000) in Lere, Kaduna State, Houmsuo *et al.* (2010) in Makurdi, Benue State, and Coulibaly *et al.* (2012) in different settings of Cote d' Ivore. The high prevalence of hookworm recorded in this study may be due to favourable climatic conditions for the development of the infective stage and rate of exposure to risk factors.

DOI: 10.56892/bima.v8i2.656

The current study showed that the prevalence of intestinal parasites is higher among male children 71.1% than female children 28.9%, this is in line with the report by Udensi *et al.* (2015); Magaji and Magaju (2021) with 53. 9% and 48.1%, 57.6% and 42.4% for male and female respectively, but the current report differs from the report by Okpala *et al.* (2014); Usip and Esiet (2015) that reported higher parasitic infection rates among female than male with 13.6% and 11.8%, 31.7% and 22.1% for female and male children respectively.

Among the four different age groups of children used for this study, the highest prevalence rate of parasitosis was seen in 6-<9 years with (16.57%) followed by 9->12years with (15.36%). The age group <4-5years was least infected (0.9%), the difference was significant ($p<0.05$). This study was similar to the result obtained by Igbodika *et al.* (2014) with the age group 9-11 recorded highest prevalence of 84.67%. But differs from the result obtained by Magaji and Magaju (2021) that showed children of age group 11-13 years recorded the highest prevalence (45.5%) of intestinal parasites. Where the survey revealed that the increase in the infection rate as the age increases may be due to not paying much attention to the public health awareness of the danger of intestinal parasites as the child grow older while the low prevalence rate among the younger pupils could be due to more attention paid by the parents, the younger ones stay more in the house and are well taking cared by the parents, Shuaibu *et al.* (2018).

The result of the current study also shows that children with poor toilet facilities have higher prevalence that those with good toilet facilities with 49.62% and 24.12% respectively, which is in line the report by Magaji and Magaju (2021), which showed that pupils that use pit latrines and open field defecation in their homes had higher prevalence. Similar observations were made among those that use open field defecation toilet system by Uneke *et al.* (2006). which could be due to poor sanitation which might encourage flies and cockroaches to spread cysts and eggs of intestinal parasites (Absar *et al.,* 2010). But Shuaibu *et al.* (2018) found the prevalence of intestinal parasites to be highest (12.26%) among pupils who uses flush toilet facilities regularly than other types of toilet facilities, where the pupils who uses pit toilet facilities with prevalence of 11.06%. However, pupils who uses other toilet facilities such Bush and buckets recorded zero prevalence. Which could be due to the types of the food they eat.

In this study, children with poor hand-washing habit before eating and after defecation harbors higher prevalence of 44.38% than those with good hand washing habit 31.15%. The result is in agreement with the report of by Tandukar *et al.* (2013) where high (47.5) association of the infection were in children with improper personal hygiene such as hand washing, nail cutting and improper food safety practices among others.

Sources of drinking water is also an important risk factors for the transmission of intestinal parasites in this study. The results obtained showed high prevalence among pupils that drink well water 72.5%, followed by those who takes vended water 52.63%, the least intestinal parasitic infection was observed in those that takes sachet water 24.87%. The result agrees with the report by El-monir *et al.* (2021) that showed drinking water from improved sources plays a good role in reducing the transmission of intestinal parasites.

Parents' occupation also played a role as a risk factor for intestinal parasites in this study. It was revealed that the pupils whose parents are farmers had the highest prevalence 61.42%, followed by children of fisher men 45%. The least infected pupils were children of traders 25.45%.

DOI: 10.56892/bima.v8i2.656

Educational status of parents is also considered as one of the risk factors. The result of the present study shows that pupils whose parents are not educated prove to have the highest infection rate 64.52%. The outcome of this research is in agreement with similar report by some researchers (Radwan *et al.,*2019; Nematian *et al.,*2004; Curtale *et al.,* 1998), that shows strong significant relationship between mother's level of education and parasitic infection.

Parental educational background like most other host factors significantly influence the prevalence of intestinal parasitic infection. This is because the highest infection rate was recorded among pupils whose parents had post primary school qualification than those with lower educational qualification during the period of the study by Babatunde *et al.* (2018).

Among the potential risk factors explored using univariate analysis, parents' level of education, hand washing practices before eating and after defecation, drinking water source, showed statistically significant difference ($P<0.05$) between the distribution of the parasites and the risk factors.

CONCLUSION

The study had revealed prevalence of gastrointestinal parasites among primary school children in Lokoja, Kogi state. Despite the low prevalence of intestinal parasites found in the study area, the public health concern should be considered. This is because intestinal parasitic infection hampers physical economic and mental development and leads to poor academic performance in school children. Of the factors considered to have influenced the prevalence, personal hygiene, sources of water and socio-economic status contributed to the prevalence of the parasites. The most common intestinal parasite encountered was Hookworm (10.54). This finding is a pointer to the poor hygienic standard of the environment.

Recommendation

Following recommendations are suggested:

Environmental Health personnels should go around the communities to ensure that surrounding of residential areas and schools are kept clean and educating the pupils.

Open defecation and inadequate disposal of human waste should be discouraged among school children.

Provision of adequate social amenities like water, toilets etc. that will better the lives of children.

For a better understanding of the problem of gastrointestinal parasites in Lokoja and Kogi at large, and for more reliable data to consolidate the results, further research is needed which should involve most of the schools in Kogi State in general and seasonal variations should also be considered.

REFERENCES

Absar, A., Joseph, R. R. and Khalid, M. I. (2010). The global war against intestinal parasites-should we use a holistic approach? *International Journal of infectious Diseases,* 14: pg 732-738.

Alabi, M. O. (2019). Determinants of Informal Settlement Expansion in Sub-Saharan African Cities: The Case of Lokoja, Nigeria

AL-Mekhlafi, A. M., Al-Moyed, K. A., Al-Shamahy, H. A., Al-Haddad, A. M., Al-Ankoshy, A. A. M., and Al-Shamahi, E. H. (2023). Prevalence of intestinal protozoa, helminthes, and coccidian infections among primary school children in Thala'a district at Amran governorate, Yemen. *Universal Journal of Pharmaceutical Research*, *8*(3), 6.

Babatunde, S. K., Adedayo, M. R., Ajiboye, A. E., Sunday, O., & Ameen, N. (2013). Soil-transmitted helminth infections among school children in rural

DOI: 10.56892/bima.v8i2.656

communities of Moro Local Government Area, Kwara State, Nigeria. *African Journal of microbiology research*, *7*(45), 5148-5153.

Bolaji, O. S., Adeyeba, O. A., Ridwan, Q. O., Adekunle, O. C., Ajayi, A. A., Adeyemo, A. T., ... and Akinleye, C. A. (2023). Unveiling the Hidden Dangers: Investigating Intestinal Parasites and Enteric Bacteria in Ogbomoso's Most Consumed Fruits and Vegetables. *Alexandria Journal of Veterinary Sciences*, *78*(1).

CENSUS Nigeria, 2006.

Coulibaly, J. T., Furst, T., Silue, K. D., Knopp, S., Hauri, D., Quattra, M., Utzinger, J., N'goran, E. K. (2012). Intestinal parasitic infections in schoolchildren in different settings of Cote d' Ivore: effect of diagnostic approach and implications. *Journal of Parasites and Vectors*. 3.25.5(135).

Curtale, F., Nabil, M., Wakeel, A. E., Shamy, M. Y., & Team, B. S. (1998). Anaemia and intestinal parasitic infections among school age children in Behera Governorate, Egypt. *Journal of tropical pediatrics*, *44*(6), 323-328.

Damen, J. G., Luka. J., Biwan, E. I. and Lugos, M. (2011). Prevalence of intestinal parasites among pupils in rural North Eastern, Nigeria. *Niger medical Journal*, 52:4-6.

Eboh, O. J., Okaka, C. E., and Onuoha, T. (2022). Prevalence of gastrointestinal parasites among school children in Delta State, Nigeria. *Lond J Res Sci: Nat Formal*, *22*(8), 53-60.

Egbuobi, R .C, Dike-Ndudim, J.N., Nwagbaraocha, M.A. and Nnodim, J.K. (2013). Intestinal parasitic infection among pupils in Umuezeaga autonomous community, Akokwa in Ideato North Local Government Area, Imo State, Nigeria. *International Research on Medical Sciences*. 1(1): 005-009.

Elmonir, W., Elaadli, H., Amer, A., El-Sharkawy, H., Bessat, M., Mahmoud, S. F., ... & El-Tras, W. F. (2021). Prevalence of intestinal parasitic infections and their associated risk factors among preschool and school children in Egypt. *Plos one*, *16*(9).

Gbonhinbor, J., Abah, A. E., and Awi-Waadu, G. (2022). Prevalence of intestinal parasitic infection and associated risk factors among primary school-aged children (5-15 years) in Southern Nigeria. *International Journal of Infection*, *9*(3), 12-21.

Gupta, R., Rayamajhee, B., Sherchan, S. P., Rai, G., Mukhiya, R. K., Khanal, B., & Rai, S. K. (2020). Prevalence of intestinal parasitosis and associated risk factors among school children of Saptari district, Nepal: a cross-sectional study. *Tropical medicine and health*, *48*(1), 1-9.

Hajissa, K., Islam, MA, Sangyang, A.M. (2022). Prevalence of Intestinal Protozoan Parasites among School aged Children in Africa: Systemic Review and Meta-analysis. *PLoS Neglected Tropical Diseases* 16(2): 1-20.

Houmsou, R. S., Amuta, E. U. and Olusi, T. A. (2010). Prevalence of intestinal parasites among primary school children in Makurdi, Benue State-Nigeria. *The International Journal of Infectious Diseases*. 8(1), 80-86.

Igbodika, M., O Ekesiobi, A., & I Emmy-Egbe, I. (2014). Prevalence of intestinal parasites among school children in a rural community of Anambra State, Nigeria. *American Academic & Scholarly Research Journal*, *6*(4).

Ihejirika, O. C., Nwaorgu, O. C., Ebirim, C. I., and Nwokeji, C. M. (2019). Effects of intestinal parasitic infections on nutritional status of primary children in Imo State Nigeria. *The Pan African Medical Journal*, 33 (4), 313-349

DOI: 10.56892/bima.v8i2.656

Jaran, A. S. (2016). Prevalence and seasonal variation of human intestinal parasites in patients attending hospital with abdominal symptoms in northern Jordan. *EMHJ-Eastern Mediterranean Health Journal*, *22*(10), 756-760.

Luka, S. A., Ajogi, I., and Umoh, J. U. (2000). Helminthosis among primary school children in Lere local government area Kaduna State, Nigeria. *Nigerian Journal of Parasitology*, *21*(1), 109-116.

M. Cheesbrough,(2009). *District Laboratory Practice in Tropical Countries,* Second Edition, (London: Cambridge University Press, 2005), 198-199.

Mbanugo, Chioma, U., J. I., & Nwachukwu, E. (2015). Prevalence of intestinal helminthes parasite in stools of nursery and primary schools pupils in Uga, Anambra State, Nigeria. *Sky Journal of Microbiology Research*, *3*(1), 006-010.

Magaji, P. J., & MAGAJU, J. (2021). The prevalence of gastrointestinal parasites among primary school children in Kagarko local government area, Kaduna State, Nigeria. *American Journal of Health, Medicine and Nursing Practice*, *6*(1), 1-17.

Nematian, J., Nematian, E., Gholamrezanezhad, A., & Asgari, A. A. (2004). Prevalence of intestinal parasitic infections and their relation with socio-economic factors and hygienic habits in Tehran primary school students. *Acta tropica*, *92*(3), 179-186.

Nxasana, N., Babak, Bhat, V.G. and Vasaikar, S.D. (2013). Prevalence of intestinal parasites in primary school children of mthatha, Eastern cape province , South Africa. *Annals of medical and health sciences Research,* **3**(4): 511-516.

Odu, N. N., Okonko, I. O. and Erhi, O. (2011). Study of Neglected tropical diseases (NTDs): Gastro Intestinal Helminths among school children in Port Harcourt, Rivers State, Nigeria. *Report and Opinion,* 3(9): 6-16.

Omalu, I. C., Paul, S., Adeniran, L. A., Hassan, S. C., Pam, V. A., Eke, S. S., & Eze, G. C. (2013). Assessment of the level of gastrointestinal parasites infection among food vendors in Minna, North central Nigeria. *Annual Research & Review in Biology*, 705-713.

Okpala, H. O., Josiah, S. J., Oranekwulu, M. U. and Ovic, E. G. (2014). Prevalence of intestinal parasites among children in Daycare Centres in Esan West Local Government Area, Edo State, Nigeria, *Asian Journal of Medical Sciences* 6(4): 34-39

Radwan I. A., Abbass, M. M., Rady, D., , , El Moshy, S., AbuBakr, N., Ramadan, M., ... & Al Jawaldeh, A. (2019). The occurrence of periodontal diseases and its correlation with different risk factors among a convenient sample of adult Egyptian population: a cross-sectional study. *F1000Research*, *8*.

Sloss, W.M. and Kemp, L.R. (1978). Veterinary *Clinical Parasitology: Vol.1 , Helminths.*

Black well scientific publications, Oxford. Pp. 4 – 22.

Shuaibu, I., Umar, Y. A., & Chanding, A. Y. (2018). Prevalence and Associated Risk Factors of Gastro–Intestinal Parasites among Primary School Pupils in Ilorin East Local Government Area, Kwara State, Nigeria. *Researchers World*, *9*(4), 137-144.

Tandukar S, Ansari S, Adhikari N, Shrestha A, Gautam J, Sharma B, Rajbhandari D, Gautam S, Nepal HP, Sherchand JB. Intestinal parasitosis in school children of Lalitpur district of Nepal (2013). BMC Res Notes. 2013;6(1):449.

Udensi, J.U., Mgbemene, I.C., Emeka-Nwabunnia, I., Ugochukwu, M.G. and Awurum, I.N. (2015). Prevalence of intestinal parasites among primary school children in three geopolitical

DOI: 10.56892/bima.v8i2.656

zones of imo state, Nigeria. *Science Journal of public health,* **5**(3): 25- 28

Ukpai, O. M., & Ezeike, A. C. (2002). The prevalence of urinary schistisomiasis among primary school children in Aguata LGA, Anambra state, Nigeria. *Nigerian Journal of Parasitology*, *23*(1), 139-144.

Usip L.P.E and Mathew E. (2015). The Prevalence of Intestinal Helminths and the efficacy of Antihelminthic (pyrantel) drug among primary school children in Obot Akara, Obot Akara Local Government Area. Akwa Ibom State, Nigeria. People *Journal of Public health and Management* 3(3): 46-55.

WHO (2017). Intestinal Worms. www.who.int.worms_ epide…. Accessed 18 march 2022.

World Health Organization. (2019). Bench aids for the diagnosis of intestinal parasites.