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Prevalence of Intestinal Parasites Among Children of Marma Community, Kirikasamma Local Government Area, Jigawa State – Nigeria

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Abstract
Assessing the prevalence of intestinal parasites and potential risk factors in different localities is essential to enhance control strategies. The present study assessed the incidence of parasitic infestation in stool samples among four hundred randomly sampled school age children living along Marma Water Channel, Jigawa State. The study was carried out for a period of 12 months (January to December, 2023). Laboratory parasitic analysis was carried out using zinc sulphate ($ZnSO_4$) flotation technique as described by Ochei and Kolhatkar (2007). It revealed that seven (7) species of intestinal parasites from protozoa (35.66%) and helminthes (64.34%) were identified with an overall prevalence of 3.75%. Positive cases of individual parasites were Ascaris lumbricoides 17(73.91%), E. histolytica and S. intercalatum each with 2(8.69%) and hookworm and Balantidium. coli with 1(4.34%) each at Likori and Madachi respectively. However, Ascaris lumbricoides was the most prevalent helminth with 10(71.42%) in Likori and the least prevalence were hookworm and B. coli each with 1(4.34%) respectively. Infection rate was significantly higher ($p<0.05$) among male pupils 10(2.50) than female counterparts with 5(1.25). Also, high prevalence was recorded in pupils between 5–10years in the study areas. There was light infection among the subject examined without any alarming signs of parasitic infection. It is therefore recommended that periodic epidemiological investigation should be carried out in order to curtail the potential danger of these parasites to the inhabitants.

Keywords: prevalence, Intestinal parasites, *Ascaris lumbricoides,* Marma Water Channel, Jigawa State

INTRODUCTION
Infection with intestinal parasites is among the major public health issues in developing countries (WHO, 2019). Intestinal parasitic infections in children are highly prevalent in regions with limited or no access to safe drinking water, poor sanitation and substandard housing conditions (WHO, 2019). An estimate of 24% of the global population are infected with soil-transmitted helminth infections, of which more than 267 million preschool-age children, and over 568 million school-age children live in epidemic areas (WHO, 2019). Infections with intestinal parasites are becoming pandemic issue among children in the third

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world nations (Page *et al.*, 2018). The World Health Organization (WHO) estimated that 3.5 billion people worldwide are infected with some type of intestinal parasites and as many as 450 million infected persons are sick as a result, and children are most frequently infected (WHO, 2022).

Previous studies have shown that parasitic infections are more common in children and can hinder the growth and development of children of all ages (Living-Jamala *et al.,* 2018; Baye and Nakgari, 2020; Ahmadu *et al.*, 2022). The infections are highly prevalent among children in most prevalent countries, people are mostly infected through ingestion of infective stages (eggs, cyst,) or skin penetration by larvae stage of the parasites with contaminated soil, water, and undercooked meat, fish, or vegetables (Adewale *et al.*, 2019).

Poor personal hygiene and lack of clean water are the main causes of intestinal parasites which are manifested by diarrhoea, abdominal cramp, vomiting and weight loss which are more severe among children, under nourished and immune compromised patients than other group of population (Alamir *et al.*, 2013). Diarrhea is a predominant consequence of intestinal parasites. It is the leading cause of mortality and morbidity in children under five years. In addition, it can aggravate protein energy mal- nutrition, anaemia and other nutrient deficiencies (Amor *et al.*, 2016). Moreover, intestinal parasites have been associated with short and long term complications on children among which includes stunting, physical weakness, insufficient educational achievement, poor reproductive health, and low economic development (Kumurya *et al.*, 2011). Although many studies were carried out on the distribution pattern and prevalence of intestinal parasites in Northen Nigeria (Ahmed et al., 2022; Garba et al., 2023). There are many communities in the region including the study area, Marma water channel along Hadejia –Nguru Watland, for which data on parasitological information among children are scanty (Ibrahim et al., 2015). In view of the forgoing, this research was carried out to provide current information on the parasitic infection and their associated risk factors among school aged-children 0-15years in Marma Community, Kirikasamma Local Government Area, Jigawa State – Nigeria

MATERIALS AND METHODS

Description of the Study Area

Marma water channel is situated along the river Hadeja in Kirikassama Local Government Area, Jigawa State (Figure 1). It is located at latitude 12º30′00′′- 12 42′07′′ N and longitude 10º 14′24′′- 10º 23′00′′15º E. Marwa Community live along the water channel which contains muddy substratum and gently flowing, highly turbid with rich algal growth and macrophytes. Sandy- loam and clay – loam are the soil types of the area of which they are rich in nutrients and other minerals. The communities around the water channel depend basically on the water body as a source of livelihood by exploiting its abundant resources. The communities are largely fishers, farmers, merchants and public servants. The wetland surrounding the channel serves as roosting and foraging area for many resident and migratory bird species.

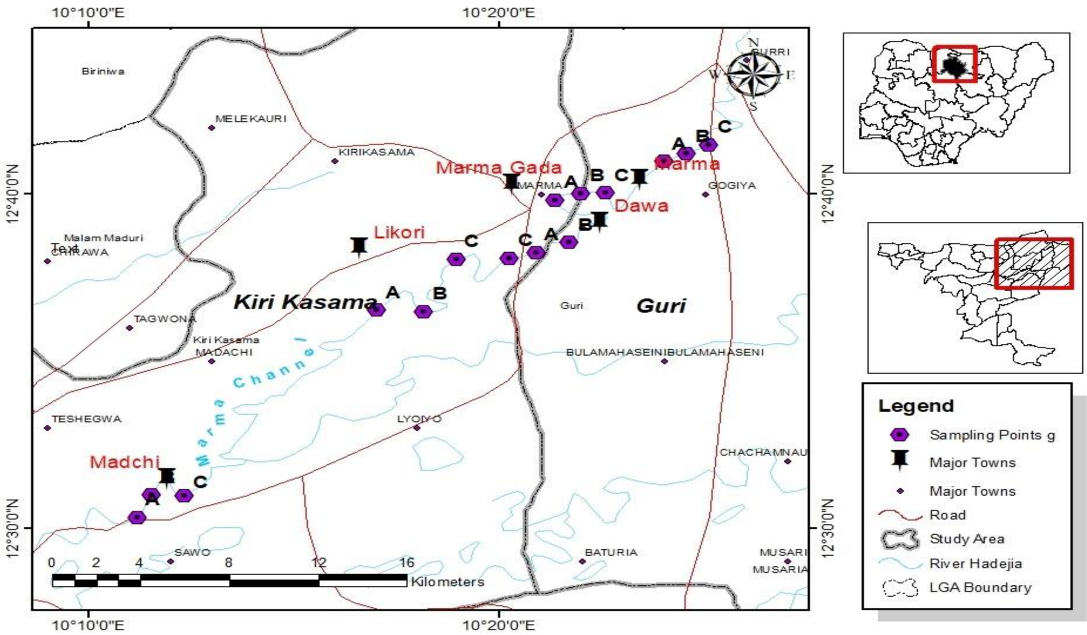

Figure 2.1 Map of the Study Area (Source: GIS Unit, Geography Department, Bayero University, Kano)

Sample Size Determination

Sample size was determined given by the formula:

$$N= \frac{(Z)2\ (p)\ (1-p)}{d2}$$

Where N = minimum sample size,

Z = value of standard which deviate at 95% confidence interval has found to be 1.96,

P = For the children stool samples, previous prevalence recorded of 54.8% by Yahaya *et al.* (2015) was used as follows:

d = difference between the true population rate and sample that can be tolerated, this is the absolute precision (in percentage) on either side of the population.

$$n = \frac{1.96^2(0.54)(1-0.54)}{0.05^2}$$

Therefore, the sample size is 380 Round up to 400

Ethical Approval

Ethical approval with Reference number (MOH/SEC/1.S/7071/V1/3V/1) was obtained from Jigawa State Ministry of Health prior to the commencement of the study.

Stool Sample Collection and Handling

School aged children stool samples were collected from the consented participants after filling the consent for using the method adopted by Morris *et al.* (1992). A total number of four hundred (400) children stool samples were collected from primary school aged children from each selected town in clean wide mouth screw container and labelled. The consented participants were directed to collect about 10gram of stool samples, how to collect the samples and delivered it within 2 hours. All the samples were analyzed within 24hours of collection (Morris *et al.,* 1992).

Stool Sample Processing

Each specimen was first examined macroscopically and its consistency or nature was recorded as either formed, semi-formed, semi-formed with blood, bloody-mucoid, loose or watery, as described by Cheesbrough (2009). Samples were analyzed fresh, in batches, as soon as they were received; none were preserved in the refrigerator or adding any preservative prior to processing, as this would kill larvae or motile parasites which may be present (Smith and Schad, 1990).

A single stool sample was obtained in labelled specimen containers from all consenting participants selected for the study. A direct saline mount of each sample was prepared and microscopically checked for the presence of the motile intestinal parasites. Lugol's iodine staining was done, after the stained concentrate was well mixed using a sterile Pasteur pipette. A drop was placed on a labelled clean dry slide and covered with a cover slip. The preparation was examined with microscope using the X10 objective lens and confirmed with X40 objectives lens for the presence of intestinal parasite (Cheesbrough, 2009).

Statistical Analyses

The overall prevalence of the parasitic infections in stool samples were expressed using chi-square tests. Significance difference was declared at 5% significance level ($P<0.05$).

RESULTS

Out of the 400 stool samples examined in the sampling sites, a total of 15(3.75%) were recorded positive with at least one of the intestinal parasites (Table 1). The results indicated that the prevalence of the intestinal parasites had a higher occurrence in males 10(2.50%) followed by females with 5(1.25%) and there was no significant association with sex between the sampling sites ($P>0.05$).

Table 1: Prevalence of parasitic infection in Stool samples according to gender of the respondents

Gender	Negative %	Positive %
Female	151(37.75)	5(1.25)
Male	234(58.50)	**10(2.50)**
Total	385(96.25)	15(3.75)

$\chi2 = 0.035$, df = 1, P= 0.850

The results in Table 2 revealed that the prevalence of the intestinal parasitic infection was statistically associated with age ($P>0.05$). The high rate of infection decreased with increase in age having 5-10years recorded 4 (1.00%) while 11-15years had 11(2.75%).

Table 2: Prevalence of parasitic infection in stool samples with respect to Age

Age	Negative %	Positive %
5 – 10	276(69.00)	**11(2.75)**
11 – 15	109(27.25)	4(1.00)
Total	385(96.23)	15(3.75)

$\chi2 = 2.41$, df = 2, P= 0.30

Table 3 indicates the mean monthly variation of parasitic infection among the subjects. It revealed that August had a higher prevalence rate of 5(1.25%) positive cases while 1(0.25%) was recorded in each in January, February, March, April, May, June, July, September, October and December with exception of November which 0(0.00%) case. The mean monthly prevalence was statistically significant ($P<0.05$).

Table 3: Monthly variation in the Prevalence of parasitic infection in Stool samples

Month	Negative %	Positive %	Total
January, 2023	39(9.75)	1(0.25)	
February	39(9.75)	1(0.25)	
March	39(9.75	1(0.25)	
April	40(0.00)	0(0.00)	
May	39(9.75)	1(0.25)	
June	39(9.75)	1(0.25)	
July	38(9.50)	2(0.50)	
August	**75(18.75)**	**5(1.25)**	
September	39(9.75)	1(0.25)	
October	39(9.75)	1(0.25)	
November	40(10.00)	0(0.00)	
December	39(9.75)	1(0.25)	
Total	385(96.25)	**15(3.75)**	

$\chi 2 = 5.541$, df = 8, P = 0.698

The positive cases of individual parasites were *Ascaris limbricoides* 17(73.91%), *E. histolytica* and *S. intercalatum* each with 2(8.69%) and hookworm and B. coli with 1(4.34%) each at Likori and Madachi respectively (Table 4). However, *Ascaris lumbricoides* was the most prevalent helminth with 10(71.42%) in Likori and the least prevalence were hookworm and B. coli each with 1(4.34%) respectively.

Table 4: Spatial Variation of Parasitic Infection in relation to Contact with Stool Samples (N=400) of Marma Water Channel, Jigawa State

Parasites	**Dawa**	**Marma**	**Madachi**	**Likori**	**Total**	%
Protozoans						
Entamoeba histolytica	0	1	0	1	2	8.69
Balantidiun coli	0	0	1	0	1	4.34
Nematodes						
Ascaris lumbricoides	**0**	**5**	**2**	**10**	**17**	**73.91**
Hook worm	0	0	0	1	1	4.34
Trematodes						
Schistosoma interculatum	0	0	0	2	2	8.69
Total	**0**	**6**	**3**	**14**	**23**	

$\chi 2 = 6.032$ df = 4 P = 0.05

Intestinal parasitic infection according to the sampling sites variation is presented in Table 5. Likori had a higher positive samples with 7(1.75%), followed by Madachi and Marma each with 4(1.00%) respectively. However, no parasitic infestation was recorded in Dawa sampling site.

Table 5: Prevalence of parasitic infection across towns in Stool samples

Percentage Prevalence	Dawa	Likori	Madachi	Marma
Negative %	100.00	93(23.25)	96(24.0)	96(24.0)
Positive %	0.00	**7(1.750)**	4.(1.00)	4(1.00)

$\chi 2 = 6.857$, DF= 1

DISCUSSION

Prevalence of intestinal parasites is attributed to availability of infected individuals, poor environmental sanitation, socio-economic, climatic and behavioral factors in the population (Samuel, 2015). A prevalence rate of 15 (3.75%) was recorded from the study population which lower 6.67% and 28.11% recorded by Ibrahim *et al.* (2016) and Adamu *et al.* (2022) in Duste Jigawa and Bauchi State respectively.

Higher prevalence rate was recorded in among male subject with 10(2.50%) compared with female with 5(1.25%). Higher prevalence in male than females is attributed to the poor environmental sanitation and frequent water contact by the males than the females in which they often engage in swimming, fishing and washing than females. Similar observation was reported by Amor *et al.* (2016) in school-aged children in a rural highland of north-western Ethiopia. Other factors that may have contributed to high prevalence of intestinal parasites among the children could be lack of proper system of refuse and human waste disposal in the community as reported by Joachin *et al.* 2015). This could lead to a vicious cycle of parasites re-infestation as these children come in contact with such waste water in their communities and on the playing ground.

Age of child 50-10 years were significantly associated with the parasites, which was in line with the finding previously reported by Kumurya *et al.* (2021). This might be due to lower age children are relatively less aware than the older age children to be exposed to various risk factors for intestinal parasites. It could also be due to the relatively limited resource and inadequate cares often given to children in a large family compared with the children in a small family. *Ascaris lumbricoides* was the most prevalent helminth with 10(71.42%) in Likori and the least prevalence were hookworm and B. coli each with 1(4.34%) respectively. The positive cases of individual parasites were *Ascaris limbricoides* with 17(73.91%), followed by *E. histolytica* and *S. intercalatum* each with 2(8.69%) respectively. A similar trend of was recorded by Baye and Kakgari (2020), who recorded *Ascaris lumbricoides* (22.7%). Regarding the parasite prevalences in the current study, the most common protozoon was *E. histolytica,* with a prevalence of 8.69%.This finding was consistent with those reported in other studies conducted by Ibrahim *et al.* (2015) and Hailu *et al.* (2021) who recorded *Ascaris lumbricoides* 11 (3.67%) and *Entamoeba histolytica* (18.1%) in open defecation in Ringim Jigawa State and among primary school children in Debre Berhan town, Northeast Ethiopia respectively. The children examined in these communities live in rural settings with poor sanitary and environmental conditions in addition to lack of portable drinking water. Most of the children examined obtain their drinking water from nearby streams, bore-hole and unprotected wells which is attributed for a higher prevalence of intestinal parasites in the sampling areas. Other factors that may have contributed to high prevalence of intestinal parasites among these school-age children could be lack of proper system of refuse and human waste disposal in the community and within the school premises. This could lead to a vicious cycle of parasites re-infestation as these children come in contact with such wastes in their communities and on the school's playing ground. Furthermore, poor hygienic habits such as irregular washing of hands with soap after defecation and eating unwashed food items like vegetables could have greatly accounted for the high incidence of intestinal parasitic infection among the subjects. The predominance of *A. lumbricoides* followed by *E. histolytica* showed a slight deviation from other reports in Nigeria by other researchers within the same ecological zone such as Abdullahi *et al.* (2015) and Ibrahim *et al.* (2015) in Birnin Kudu and Ringim in Jigawa State respectively.

However our data are in consonance with other findings in Nigeria (Alemu *et al.*, 2014; Abdullahi *et al.*, 2015, Garba *et al.* (2023). The ova of *A. lumbricoides* and hookworm withstand a high variety of adverse environmental conditions which could serve as an indication of water pollution in an area possibly because of indiscriminate defecation (24). A great majority of the children in these communities defecate in bushes and farmlands due to lack of or poor toilet facilities. Consequently during rainfall, their feces are washed into streams and rivers in which these children carry out recreational activities, and from which they drink. The findings is line with WHO (2017) who reported that several parts of Nigeria on intestinal parasite which identified intestinal parasitic infection among the vital public health issues. The high prevalence of *Ascaris lumbricodes* infection is attributed to unhygienic practices of the children and ability of the *A. lumbricodes* eggs to survive outside the host for long time. WHO (2019) who postulated that intestinal parasite infection will continue to prevail in Nigeria due to low level of living standard poor environmental sanitation and ignorance of health practices by the communities.

These reported disparities in the prevalence of parasitic infections among the different sampling sites might be explained by variation in family education, level of environmental sanitation and hygiene, habit and culture-related practice of the study subjects. Similar observation was reported by Ahmadu *et al.* (2022).

CONCLUSION

In conclusion, it is clear that the subjects were infected with intestinal parasites with light infection. The prevailing conditions indicates the need to embark on health education on prevention and control measures of human intestinal parasite. Relevant agencies should strengthen and support programs of providing free anti-helminthes drugs to Children. It is also recommended that conduct research on the efficiency of anti –helminthes and protozoa drugs used in treatment of intestinal parasites.

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