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PARASITOLOGICAL ASSESSMENT OF KNOWLEDGE, ATTITUDE, AND PRACTICE AND ITS PUBLIC HEALTH IMPACT AMONG RESIDENTS OF MARMA WATER CHANNEL, JIGAWA STATE, NORTH WESTERN NIGERIA

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ABSTRACT

Access to safe water, sanitation and hygiene is a basic necessity for human livelihood. However, adequate provision of portable water is a critical issue to most developing countries around the world including Nigeria. The present study assessed the Knowledge, attitudes and practices (KAP), water physicochemical conditions, incidence of parasitic infestation in water, samples among school age children living along Marma Water Channel, Jigawa State. The study was carried out for a period of 12 months. KAP and parasitic prevalence, were evaluated using standard procedure. Four hundred (400) randomly selected households living along the water Channel were interviewed using structured questionnaire from four communities Dawa, Madachi, Marma and Likori denoted as A, B, C and D. From the results, 70% participants were not aware of parasitic infections, 57.5% have been previously infected with intestinal parasites, 56.56% were not aware of the mode of transmission and 60.5% did not have knowledge on the prevention methods. In addition, 53.25% of the participants did not agree with intestinal parasitic infection as a serious illness and 64.75 % believed that playing in soil did not cause intestinal parasites. However, 59.75% opined that swimming/bathing in river water can cause intestinal parasitic infection. Only 42% occasionally eat under cooked fish, 56.75% had good habit of washing their hands before meal while Majority 84.25% did not participate in mass drug treatment for intestinal parasites. Seven (7) species of intestinal parasites were identified with an overall prevalence of 3.75%, 11.11% and 13.88% in stool, soil and water respectively. Site D had the highest parasites composition with *Entaemoeba histolytica* (23.21%), *Balantidiun coli* (14.80%), *I. multifilis* (1.78%), *Ascaris lumbricoides* (53.57%), hook worm (1.78%), strongyloides (1.78%) and *Schistosoma intercalatum* (3.57%) while site A recorded the least parasitic load of *Ascaris lumbricoides* (71.42%), hook worm (28.57%). It can be concluded that there was light infection among the respondents examined. Deficiency in knowledge, poor attitudes, and lack of sanitation practices, use of unsafe water sources, and open defecation, are routes of exposure to waterborne parasites that warrants strict control measures for improved sanitation. It was therefore recommended that periodic parasitological investigation should be

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carried out in order to curtail the potential danger to the future generation along the water channel in addition to public awareness to the nearby communities.

Keywords: Intestinal parasites, Marwa water channel, Knowledge, Attitude, Practice

INTRODUCTION

Marma water channel is one of the four tributaries of River Hadejia. The water channel covers a vast area with its flow affecting not only Kirikasamma LGA but also covers Hadejia, Birniwa, and Guri LGAs. Most of the discharges from river Hadejia are carried out by the Marma water channel into the non-returning Nguru Lake. This is due to sand and silt deposit in the river Hadejia, thereby causing blockage in all the three channels. Marma water channel is used for drinking, agricultural, and fishing activities, hence has been instrumental to the livelihood of inhabitants of Marma town in Kirikasamma Local Government Area, Jigawa State.

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 (Abera and Nibret, 2014). 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 (Tsegaye *et al.,* 2020). 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 (Uhuo, Odikamnoro and Ani, 2011).

Access to safe drinking water is compulsory to assure the required health conditions and the economic development of countries this has enhanced the worldwide investment in water systems construction and management to meet stringent water quality standards (Ayed *et al.*, 2018). Africa recorded the highest burden disease, where almost a quarter of the sub-Saharan people are lacking these commodities leading to an important prevalence of child mortality, particularly those less than five years of age, by infectious diarrhea, the fourth largest child killer in Africa (Squire and Ryan, 2017). The water and sediment quality are important measures because aquaculture activities influence water quality. Water quality parameters such as pH, temperature, salinity, dissolved oxygen, and biological oxygen demand (BOD) in the water are important to measure how polluted is the water caused by aquaculture activities and the effects of some land use such as agriculture and industries.

Intestinal parasitic infections are caused by a wide range of both helminth and protozoan species of varying importance and severity. Soil-transmitted helminths (STHs) include roundworm (*Ascaris lumbricoides*), whipworm (*Trichuris trichiura*) and hookworms (*Necator americanus* and *Ancylostoma duodenale*) (Huth *et al.,* 2021). Intestinal parasites are organisms that live in the gastrointestinal tract of most vertebrate animals and can cause morbidity and mortality (Lynne, 1999). Usually, intestinal parasite consists of helminthes and protozoa (Nzeyimana *et al.*, 2018). Helminthes are multicellular organisms in which their adult form cannot multiply in the human body. However, protozoa are unicellular organisms that can multiply inside the human body and may lead to serious infections developing (Curtis *et al.*, 2000).

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).

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 of green which meridian. Marma water channel covers a vast area in term of flow its effects affect not only Kirikassama Local Government, but it transcends Hadejia, Birniwa and Guri local government areas. River Hadejia has four tributaries, they are: Kafin Hausa, Burumgana, old Hadeja and Marma water channel. However, deposition of sand and silt in the river results in blockage, thereby reducing flows of the three (3) tributaries (Kafinhausa, Burumgana, and old Hadejia). Hence, only Marma channel now carries all the discharges from Hadejia River into the non-returning Nguru Lake (Bart, 2005). The channel is approximately 55km river channel and one the main channels in the Hadejia-Nguru Wetlands which discharges its water into the Ngurulake. It is about 30m wide, 3 to 3.5m maximum depth and is relatively fast flowing at about 0.8m/s (JWL 2005). In February, 2000, based on the ecological significance of this area, especially in terms of biodiversity, some part of the HNW, precisely, Nguru Lake and Marma Channel Complex has been designated as Nigeria's first Ramsar Site.

The three major tributaries of the water body are Kafinhausa, Burumgana, and old Hadejia which receives most of Hadejia and its surrounding's domestic waste water. Two distinct seasons are experienced annually wet and dry seasons with annual mean temperature of 31°C. The agro-metrological station of Hadejia indicates an estimated average rainfall as 411 mm during months of July and August. The rainy season period lasts from June to September and dry season runs from October to May. The water channel 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 (Saiyadi *et al.*, 2022).

Study Area and Settings

The selected study town are Marma (latitude 12°39'47''N - 12º42'07''N and longitude 10° 17'11''E - 10º 23'34''E), Likori, (12°23'44''N - 12º32'35''N and 10°25'51''E - 10º 31'34''E), Dawa (12°39'07''N - 12º39'45''N and 10°19'53''E - 8º 22'19''E), and Madachi (12°33'09''N - 12º39'21''N and longitude 10°14'24''E - 10º 22'31''E). Town selection was based on closeness to the water channel and human or biological activities such as fishing, farming, and cattle rearing. Also meeting was held with the local leaders of the proposed study sites from where the project was endorsed. The proposed areas were also characterized by high level of illiteracy, gender inequality and bias, lack of access to clean and safe water, inadequate toilet latrines and limited health facilities.

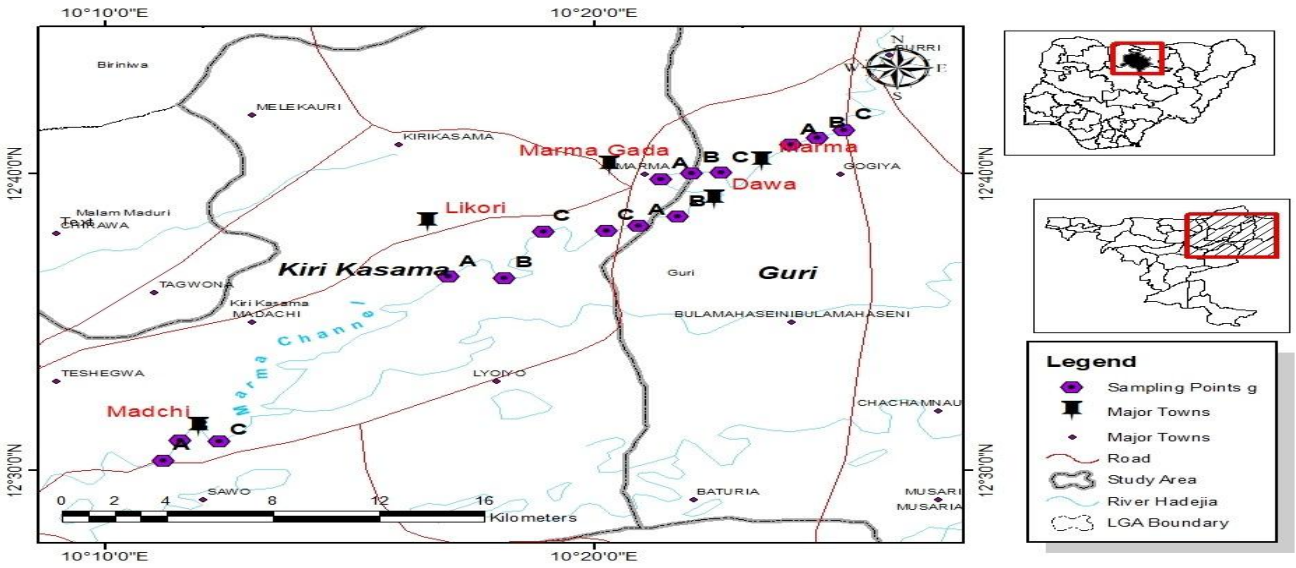


Figure 2.1 Map of the Study Area (Source: GIS Unit, Geography Department, Bayero University, Kano)

Sample Size Determination

The research involves assessment of several variable from the sampling stations which include knowledge attitude and practices (KAP), water, soil, children stool and fish samples.
For KAP, samples size was obtained using the formula described by Yamanne (1967) as follows:

$$n = \frac{N}{1+ N(e)^2}$$

Where;
n = Sample size
N = Number of people in the population
e = allowable error (5%)

Therefore, the sample size is 399

For water and soil samples, systematic sampling techniques was used by collecting samples in replica on monthly basis for period of twelve months.

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

n = 380, Round up to 400

For fish samples, using formula for sample size determination put forward by Lwanga and Lemeshow (1991):

Where:
Z = statistic level of confidence interval at 95% = 1.96
P = previous prevalence from other study
d = allowable error of 5%, (0.05)
q = 1 – P

For Fish samples a 22.4% previous prevalence according to Danyaro *et al.* (2019) was used.
Hence,

n = 267.1, Round up to 270

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.

Sample Collection and Handling

Data Collection for Knowledge, Attitude and Practice of the Participants (KAP)

The instrument used for data collection was a structured interviewer-administered questionnaire. The structured interviewer-administered questionnaires consisted of 4 sections (Appendix I –IV). The first section is dedicated to the socio-demographic parameters, the second section Assesses participants level of knowledge of intestinal parasite, the third section assesses attitude of participants towards risk of intestinal parasite and fourth section was to assess the practices for participants towards the management of their risk of intestinal parasite.

Water Samples Collection and Processing

The water were collected using the method adopted by (Noellie *et al.*, 2014). The water samples were collected from water channel of the selected towns; all samples were collected in the morning between the hours of 7:00am to 8:00am on the day of sampling. The water samples were collected from three (3) different sampling points A, B, and C. About 500ml of the water sample was collected in dark brown plastic bottles, kept in a cooling box and transported to the laboratory where they were analyzed for the presence of intestinal parasite (Noellie *et al.,* 2014). Upon arrival at the laboratory, the water samples were left to settle undisturbed for 24 hours at room temperature without addition of any reagents. The supernatant was then removed and the sediment was used for the microscopy analysis. The sediment was poured into centrifuge tube and centrifuged at 3000rpm for 5 minutes at room temperature and allowed to rest in test tube rack for 3 minutes. The supernatant was discarded leaving small amount of suspended sediment. A drop of suspended sediment was placed on a clean glass slide and iodine solution was added using Pasteur pipette. It was then covered with cover slip and examined under a microscope using X10 and X40 objectives lens (Anyanwu *et al.*, 2018).

Statistical Analyses

Statistical Package for the Social Science (SPSS) version 20.0 was used for data analyses. The means of the responses from KAP were presented using frequency and percentages. Spatial variation of physicochemical parameters were analysed using one- way analysis of variance (ANOVA). Seasonal variation were analysed using independent Student's T-test. The overall prevalence of the parasitic infections in stool, water and soil were expressed using chi-square tests.

RESULTS AND DISCUSSION

Results

Results for Knowledge, Attitude and Practice of the Participants (KAP)

During the study period, there was a total of 400 respondents in this study sampled from four communities, among which 59% were males while 41% were females. Socio-demographic characteristics with respect to age of the respondents ranged from 18 to above 56 years. Age range of 34-41 years at sampling site D (Likori) had the highest percentage of 68%, followed by C (Marma) with 25%, site B (Madachi) with 23% and 12% at Site A (Dawa) (Table 1). All the respondents were married (100%) with no divorced/widowed or single respondent from all the sampling sites. Occupation status of the respondents revealed that major occupations were farmers with 39.5%, followed by civil servants (24.75%), fishermen (11.25%), and traders who own their own business such as shops, wood cutters, vulcanizers

etc had 6.25%. Students and other has 3.25% and 1.75% respectively. With respect to duration for practice, 28.5% had been in their current job practice for 30–34 years, followed by 21% for those who practice for 20-24 years. For 10-14 years practice had 17.5%, 5-9 and 0-4 years each had 8.5% respectively.

Table 1: Socio-Demographic factors of the Respondents from the Sampling Communities

Variable	A (Dawa)	B (Madachi)	C (Marma)	D (Likori)	Total	Frequency (%)
Gender						
Male	68	**75**	64	71	278	**69.5**
Female	32	25	36	29	122	30.5
Age						
18-25yrs	12	2	0	0	14	3.50
26-33yrs	16	0	12	9	37	9.25
34-41yrs	18	23	25	**68**	134	**33.50**
42-47yrs	12	3	13	12	40	10.00
48-55yrs	30	36	36	0	102	25.50
Above 56yrs	12	36	14	11	73	18.25
Marital status						
Married	100	100	100	100	400	**100**
Divorced	0	0	0	0	0	0
Widowed	0	0	0	0	0	0
Separated	0	0	0	0	0	0
Occupation						
Fishermen	17	3	12	13	45	11.25
Farmer	30	37	49	42	**158**	**39.5**
Trader	22	0	3	0	25	6.25
Civil servant	23	51	0	25	99	24.75
Student	0	0	0	13	13	3.25
Others	18	9	36	**7**	70	1.75
Occupation						
Duration						
0-4	6	4	0	24	34	8.50
5-9	11	0	14	9	34	8.50
10-14	8	25	23	14	70	17.50
15-19	5	18	0	23	46	11.50
20-24	34	0	32	20	86	21.50
25-29	0	18	0	0	18	4.50
30-34	36	**35**	31	10	112	**28.50**

Knowledge level of intestinal parasites

Fourty one (41%) of the participants had previous knowledge on intestinal parasites while 59% were not aware of the disease (Table 2). With regards to his history of intestinal infection, 57.5% have been previously infected with intestinal parasites while 42.5% were not. A total of 216/400 (54%) participants answered they were not aware of defecation as a source of intestinal parasitic infection. Besides, 56.5% did not know the symptoms of intestinal parasitic infection while 43.5% of the subject are not aware of the symptoms. Exactly 61.5% of the subject admitted that they had exposure to sewage in their routine activities while 38.5% objected to this query. Mode of transmission of intestinal parasites

were not known by 56.56% of the participants while 43.5% had knowledge about transmission of intestinal parasites. Majority of the participants (60.5%) did not have knowledge on the prevention methods of intestinal parasites while 39.5% were aware of the prevention techniques.

Table 2: Features of level of Knowledge among the respondents towards Parasitic infection

Features	A (Dawa)	B (Madachi)	C (Marma)	D (Likori)	Total	Frequency (%)
Knowledge on Intestinal Parasites						
Yes	**74**	54	36	0	164	41
No	26	46	64	100	236	**59**
History of Intestinal infection						
Yes	46	**88**	58	38	230	**57.5**
No	54	12	42	62	170	42.5
Defecation as a source of Intestinal parasitic infection						
Yes	54	89	41	0	184	46
No	46	11	59	**100**	216	**54**
Symptoms of Intestinal Parasites						
Yes	56	73	25	15	141	35.25
No	44	27	75	**85**	259	**64.75**
Sewage exposure						
Yes	74	**94**	24	54	246	**61.5**
No	26	6	76	46	154	38.5
Mode of transmission of Intestinal Parasites						
Yes	60	70	22	22	174	43.5
No	40	30	**78**	**78**	226	**56.5**
Preventive measures of Intestinal Parasite						
Yes	36	72	42	8	158	39.5
No	64	28	58	**92**	242	**60.5**

Attitude of Respondents towards Parasitic infection

A total of 280 (70%) participants do not have disposition toward of parasitic infections generally. Exactly, 53.25% did not agree with intestinal parasitic infection as a serious illness and 64.75 % believed that playing in soil did not cause intestinal parasites (Table 3). Among the participants 200/400 (50%) of participants considered taking medication against intestinal parasitic infection as a nice idea while 50% negate the idea. Sixty two percentage 62.75% among the subject did not agree with taking traditional medication as effective treatment for intestinal parasites. In addition, 248/400 (62.00%) agreed that eating raw vegetables and fruits can cause intestinal parasites while 38% responded negatively. Some (59.75%) also opined that swimming/bathing in river water can cause intestinal parasitic infection.

Table 3: Attitude of Respondents towards Parasitic infection

Features	A (Dawa)	B (Madachi)	C (Marma)	D (Likori)	Total	Frequency (%)
Disposition towards parasitic infection						
Serious	30	54	36	0	120	30
Not serious	70	46	**64**	100	280	**70**
Traditional medication is effective to treat intestinal parasites						
Yes	24	23	59	43	149	37.50
No	76	**77**	41	57	251	**62.75**
Soil as a source of intestinal parasites						
Yes	72	29	25	15	141	35.25
No	28	71	75	**85**	259	**64.75**
Unwashed vegetables fruits as a source of intestinal parasites						
Yes	**92**	90	44	22	248	**62.00**
No	8	10	56	78	152	38.00
Swimming/bathing in river water as a source of intestinal parasites						
Yes	**88**	76	40	35	239	**59.75**
No	12	24	60	65	161	40.25

Preventive Practices against Intestinal Parasites

Most of the participants (42%) occasionally eat under cooked fish while majority 232/400(58%) did not. Majority of the participants (56.75%) had the good habit of washing their hands before meal. In addition, 70% of them attend health facilities if they experience abdominal discomfort and 51.25% complied by taking regular medications for intestinal parasitic infections. Among the participants 28.75% wash their clothes in the river and only 38.8% among them swim/bath in the river water. When asked about defecation around the river channel, only 36.25% of the participants were recorded to that habit. With regards to fetching river water for cooking/drinking, 16% of the respondents were occasionally involved. Majority of the respondents (84.25%) did not participate in mass drug campaign for intestinal parasites (Table 4).

Table 4: Practices of Participants Regarding Parasitic Infection

Features	A (Dawa)	B (Madachi)	C (Marma)	D (Likori)	Total	Frequency (%)
Eating under cooked fish						
Yes	50	61	21	36	168	42
No	50	39	**79**	64	232	**58**
Washing hands before meal						
Yes	57	52	**68**	50	227	**56.75**
No	43	48	32	50	173	43.25
Visiting health facility for abdominal discomfort						
Yes	62	61	72	**85**	280	**70**
No	38	39	28	15	120	30
Taking medications for intestinal infections						
Yes	42	42	**81**	40	205	**51.25**
No	58	58	19	60	195	48.75
Washing clothes in the river						
Yes	10	19	49	37	115	28.75
No	**90**	81	51	63	285	**71.25**
Swimming /bathing in the river						
Yes	25	25	39	64	153	38.8
No	**75**	**75**	61	36	247	**61.75**
defecating around the river						
Yes	36	39	16	54	145	36..25
No	**64**	61	84	46	255	**56.25**
Fetching of river water for cooking/drinking						
Yes	24	20	8	11	63	16
No	76	80	**92**	89	337	**84**
Participation in mass drug treatment for intestinal infections						
Yes	0	55	8	0	63	15.75
No	**100**	45	92	**100**	337	**84.25**

Parasitic Infectionin relation to contact with water and soil

Parasitic Infectionin relation to contact with water and soil samples of Dawa water channel is presented in Table 5, 6, and 7 respectively. Contact with soil had 5 parasites while water recorded 2 total number of parasites.

Table 5: Prevalence of Parasitic Infectionin relation to Contact with Water, Soil and Stool Samples of Dawa Water Channel

Parasites	Water	Soil	Total	Percentage
Ascaris lumbricoides	2	3	5	71.42
Hook worm	0	2	2	28.57
Total	**2**	**5**	**7**	100

Marma sampling sites had 6 parasites each in water and soil samples record the least with 4 parasites. A. *lumbricoides* had the highest infestation with 62.5% while 12.5% was recorded for hookworm samples (Table 6).

Table 6: Prevalence of Parasitic Infectionin relation to Contact with Water and Soil Samples of Marma Water Channel

Parasites	Water	Soil	Total	Percentage
Entamoeba histolytica	3	0	3	25
Ascaris lumbricoides	3	2	5	62.5
Hook worm	0	2	2	12.5
Total	**6**	**4**	**10**	**100**

Madachi sampling site recorded highest parasitic infestation in water with 16 total number parasites while soil each had 7 (Table 7).

Table 7: Prevalence of Parasitic Infectionin relation to Contact with Water and Soil Samples of Madachi Water Channel

Parasites	Water	Soil	Total	Percentage
Entamoeba histolytica	6	4	10	38.46
Balantidiun coli	0	0	0	3.84
Ascaris lumbricoides	10	3	13	57.69
Total	**16**	**7**	**23**	100

Likori had a higher positive sample of 31 parasites record in water and 10 in soil samples respectively (Table 8).

Table 8: Prevalence of Parasitic Infectionin relation to Contact with Water, Soil and Stool Samples Likori Water Channel

Parasites	Water	Soil	Total	Percentage
Entamoeba histolytica	12	0	12	23.21
Balantidiun coli	3	4	7	14.28
I. multifilis	1	0	1	1.78
Ascaris lumbricoides	15	5	20	53.57
Hook worm	0	0	1	1.78
Strongyloides	0	1	1	1.78
Total	**31**	**10**	56	100

DISCUSSION

As can be observed in Table 1, the respondents in this study had fair level of knowledge (30.0%) of intestinal parasites. The low level of knowledge recorded could be associated to the high incident of parasitic load examined in the study towns or due to non- frequent health talks within the communities where intestinal parasites are endemic Similar observation was recorded by Yaya *et al.* (2018). A contrary observation was recorded by Abe *et al.* (2016), Kakomo *et al.* (2022) where more than 85% expressed their awareness on intestinal parasites. Fewer participants 39.5% consented to seeking preventive methods for intestinal parasites while the majority 60.5% did not see it as a problem. A similar observation was recorded by Sridhar *et al.* (2020). This perspective of underestimating the impact of intestinal infection could stem from the neglect of continuous education and community sensitization as reported by Handan *et al.* (2023). The participants still lapses knowledge on the symptoms 56.5% and aetiology of intestinal parasites as a significant number of the participants 54% wrongly answered that feaces is not a source of intestinal parasites infection.

The study showed that the overall awareness on the degree of harmfulness of sewage exposure among respondents was satisfactory 61.5%, which was attributed to the occasional health education conducted over the years in the community (Danyaro, 2019). Despite good attitudes towards parasitic prevention, the behavioral practices of the participant for swimming/washing (38.5%), and defecating (36.0%) around the river channel were quite unsatisfactory. This assertion agrees with the work of Nur *et al.* (2022). Participants preferred to receive examinations and treatment (70%) when uncomfortable when attacked by the intestinal parasites as observed by Reddy *et al.* (2017). Respondents in the study area acknowledged the importance of washing hand before meal (56.75%) and using toilets rather than open defecation (56.75%). Most of them responded positively that waste could be breeding sites for flies and rodents, and animal wastes can cause health problems if not properly managed. However, they strongly disagree that children's feacal matter is free from diseases. Child feces are more hazardous to one's health than adult feaces (WHO, 2017). A previous study by Oguh*et al.* (2020) supported the notion that children's stool contain germs. Finding on this statement were consistent with a study in South-eastern Nigeria. Moreover, positive attitude can be seen towards action of washing hands after using the latrine. This was consistent with a study reported by Nur*et al.* (2022) and Handan *et al.* (2023) in Perak, Malaysia and Zaria, Nigeria respectively.

Parasitic species distribution in soil and water samples showed that Likori had the highest intestinal parasites (7) compared with other sampling sites (Dawa, 2; Marma, 3; Madachi, 3). Seven parasites (*E. histolytica, B. coli, I. multifilis, A. lumbricoides, Schistosoma intercalatum*, hookworm and strongyloides) were identified from Likori. High parasitic infestation is attributed to the prevailing habitat preference coupled with the nature of the soil composition, availability of intermediate host, organic matter in water channel and water physicochemical conditions. Similar observation was reported by Ibrahim *et al.* (2015). The highest prevalence of *Ascaris lumbricoides*, Strongyloides and *Entamoeba histolytica* is attributed to the level of personal and environmental hygiene, social habits and occupation. Large proportions of the subjects in the study area are farmers who had the habits of open defecation due to lack of toilets facilities in their houses (Arora and Arora, 2010). Irrigation have contributed to the spread of these parasites and changes in its distribution. Nematodesare transmitted by ingesting encysted eggs on watercress or other aquatic plants grown in water contaminated with faeces from infected animals. The availability and abundance of the host could be a factor responsible for the variations in the number parasites and levels of infections in the host. This observation is in line with the Taiwo and Adedomola (2021). Alireza *et al.* (2022) reported that poor hygieneand environmental conditions in lowlands and agricultural settings were related to the abundance of helminthes and protozoans in the study area.

The high abundance of *A. lumbricoides* followed by *Entamoeba histolytica* showed a slight deviation from other reports in Nigeria where hookworm infection was more predominant (Adewale *et al.*, 2018, Imam *et al.*, 2019; Rabiu*et al.*, 2024). However, the present research in consonance with other findings in Nigeria (Taiwo and Adedamola, 2021; Oluwafemi *et al.*, 2019). The ova of *A. lumbricoides* withstand wide variation of adverse environmental conditions which could serve as an indication of water contamination in the site, mainly due to indiscriminate defecation. Majority of children in the sampling area defecate in bushes and farmlands due to lack of or poor toilet facilities. Consequently, during rainfall, the feacal matter are washed into water channels in where these children carry out recreational activities, and from which they drink. 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 present study 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) (Joachin *et al.*, 2015). Other factors that may have contributed to high prevalence of intestinal parasites among 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.

The present finding is 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. 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. 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 Adamu *et al.* (2022).

Conclusion

The present study assessed the Knowledge, attitudes and practices (KAP), water physicochemical conditions, incidence of parasitic infestation in water and soil samples along Marma Water Channel, Jigawa State. The study was carried out for a period of 18 months (January, 2023 to June, 2024). KAP, Physicochemical conditions, parasitic prevalence, were evaluated using standard protocols. Four hundred (400) randomly selected households living along the water Channel were interviewed using structured questionnaire from four communities (Dawa, Madachi, Marma and Likori). From the results, 70% participants were not aware of parasitic infections, 57.5% have been previously infected with intestinal parasites, 56.56% were not aware of the mode of transmission and 60.5% did not have knowledge on the prevention methods. In addition, 53.25% of the participants did not agree with intestinal parasitic infection as a serious illness and 64.75 % believed that playing in soil did not cause intestinal parasites. However, 59.75% opined that swimming/bathing in river water can cause intestinal parasitic infection. Only 42% occasionally eat under cooked fish, 56.75% had good habit of washing their hands before meal while Majority 84.25% did not participate in mass drug treatment for intestinal parasites.

Seven (7) species of intestinal parasites from protozoa (35.66%) and helminthes (64.34%) were identified with an overall prevalence of 30.0% and 51.0% in soil and water respectively. *Ascaris lumbricoides* had the highest prevalence with among the subjects followed by *Balantidiun coli*, *Schistosoma interculatum* and Hook worm eggs each with, *Entaemoeba histolytica* while *I. multifilis* and strongyloides each had respectively.It can be concluded that there was light infection among the respondents examined**.** Deficiency in knowledge, poor attitudes, and lack of practices of sanitation and hygiene, use of unsafe water sources, and open defecation, are routes of exposure to waterborne parasites that warrants strict control measures for improved sanitation.

Recommendations

1. To eliminate parasitic infestations among the studied communities, new approaches should be considered and explored towards improving the water quality.
2. It was therefore recommended that periodic parasitological investigation should be carried out in order to curtail the potential danger to the future generation along the water channel in addition to public awareness to the nearby communities.
3. There should be increased environmental sanitation awareness by the communities along the bank of the water body to prevent contamination of this water resource and subsequent transmission of water-related diseases.

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