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Magaji, Peter John1

Magaji, J. Y.2

1Department of biological Sciences, University of Abuja, Ngeria.

E-mail : [Magaji\_pj@yahoo.com](mailto:Magaji_pj@yahoo.com)

2Department of Geography and Environmental Management, University of Abuja, Nigeria.

E-mail: [johnmagaji6@gmail.com](mailto:johnmagaji6@gmail.com%20)

**ABSTRACT**

**Purpose:** The purpose of this study was to of investigate the prevalence of gastrointestinal parasites among school children in Kagarko Local Government Area of Kaduna State.

**Methodology:** Random sampling was adopted in selecting a sample of five schools with a population of 235 pupils was used for the study. The instrument for the study was the questionnaire used to elicit in information on the risk factors. Also 50 pupils were randomly selected, 10 each from the five selected schools for the stool investigations. The saline/iodine wet mouth procedure was used in the analysis of the stool samples.

**Findings:** Results showed that poor sanitary conditions, inadequate potable water supply, lack of personal hygiene education and lack of de-worming of children enhanced the spread of intestinal parasitic infection. An overall prevalence of 66% was recorded. A total of 6 species of intestinal parasites were recorded in this study. This includes Hookworm, Entamoeba histolytica, Ascaris lumbricoides, Strongyloides stercoralis, Schistosoma mansoni, and Entamoeba coli respective prevalence rates of 33.3%, 24.2%, 18.2%, 12.1%, 9.1% and 3.0%. The highest prevalence of 27.3% was recorded in Kutaho, followed by Kushe and Jere with 21.2% each while the least prevalence of 12.1% as recorded in Kagarko. The 11-13 years age group had the highest prevalence of (45.5%), followed by the 8-10 years age group (36.4%), and then the 14 years and above with the least (6.1%). Sex-specific prevalence was higher in males (57.6%) than females (42.4%).

**Recommendations:** The results suggests that Children should be taught on regular personal hygiene. There is also need for Public Health Education on personal hygiene practices in the communities, large scale de-worming campaigns in all primary schools in the area and the host communities.

**Key words:** *Infection,**Personal hygiene,**Environmental sanitation****,*** *deworming, poverty**and water*

**INTRODUCTION**

Intestinal parasites are among the most common infections diseases worldwide [1,2,3] and the most common Neglected Tropical Diseases which continues to cause significant morbidity in Nigeria and in less developed tropical and subtropical countries [4]. In endemic countries, gastro-intestinal infections are most prevalent in rural communities, periurban settings and urban storm [5]. Helminths infection is a major health problem of children from rural areas of developing countries and it is an important cause of morbidity in school Age children especially primary school pupils who harbour the highest intensity of worm infection [6,7].

These infections are regarded as a serious public health problem, as they can cause iron deficiency anemia, growth retardation in children and other physical and mental health conditions [8,9,10,11,12]. The high prevalence of these infections is closely correlated with poverty, poor environnemental hygiene and impoverished health services [13,14,15].

The public health importance of gastrointestinal tract parasites is due to their high morbidity in school children and women during their child-bearing years. Children are the most affected due to the heavy infections they harbour and because of their vulnerability to nutritional deficiencies [16].

The prevalence of intestinal parasites among preschool and school children were 17.7% in Riyadh, Saudi Arabia [17], 52.8% in an urban slum of Karachi, Pakistan (15), 19.6% in Zambia [18], and 30% in Khartoum, Sudan [19]. In Ethiopia its prevalence varies from area to area; in Wondo Genet 85.1% [20], Aynalem village, Tigray 48.1% [21], Debre Birhan referral Hospital 17.4% [22], Adare and millennium health center in Hawassa 26.6% [23], Wonji Shoa Sugar Estate 24.3% [24]. Intestinal parasitic infection accounts for a global health burden in developing countries mainly due to fecal contamin­ation of water and food, climatic, environmental, and socio-cultural factors enhancing parasitic transmission [25,26,27]. In urbanized countries, protozoan parasites infection is in contrast to helminths. Amoebiasis is one of the most important reasons for death from parasitic diseases wide-reaching with its impact on people of de­veloping countries [28].

The disease is most prevalent among the lower social groups and in children whose parents are farmers that are likely to come in contact with the contaminated soils. This practice encourages the transmission of the parasites through penetration of the infective larvae present in the soil, and through direct or indirect feacal-oral transmission [29]. Infections are mainly transmitted via ingestion of water, soil or food contaminated by faeces containing the cysts of protozoans or eggs/larvae of helminths [30].

Parasites are one of the most common causative agents of diarrhea, weight loss, abdominal pain, nausea, vomiting, lack of appetite, abdominal distention and iron deficiency anemia [31]. Furthermore, chronic intestinal parasitic infections have become the subject of speculation and investigation in relation to the spreading and severity of other infectious diseases such as human immunodeficiency virus (HIV) and leprosy [32].

In Kagarko Local Government Area, there is scarcity of water especially during the dry season. Their major sources of water are the streams, wells, and a very insignificant number of boreholes located in few settlements. Unavailability of clean and safe drinking water, highly populated density, inappropriate disposal of waste, noncompliance with health standards, lack of adequate washing of food substances (vegetables and fruits), and consumption of improperly cooked meat lead to high prevalence of intestinal parasites [33,34,35,36]. Younger children are predisposed to heavy infections with intestinal parasites because of having not fully developed immune systems and also habitually they play in feacal contaminated soil [36].

There is also scarcity of information regarding the prevalence of intestinal parasites and associated factors in Kagarko Local Government Area. It is against this background therefore, this study was set to assess the prevalence of intestinal parasitic infections among Primary schools children in Kagarko Local Government. This could help with information to overcome the existing limitations and decrease the mortality in primary school children.

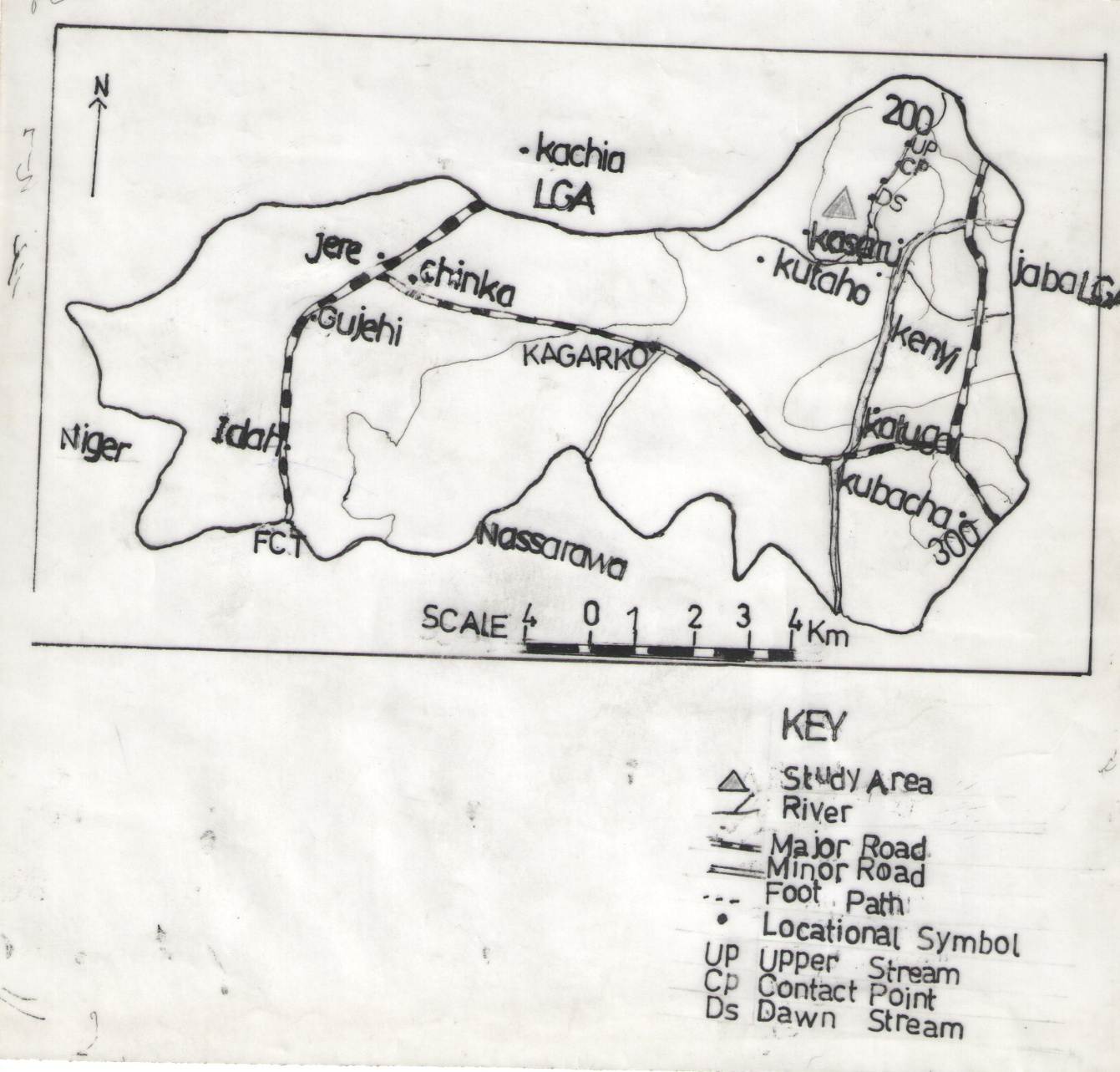
The distribution and prevalence of various species of intestinal parasites differ from region to region because of several environnemental, social and geographical and other factors. Mal-absorption, diarrhea, impaired work capacity, and reduced growth rate due to intestinal parasitic infections constitute important health and social problems. These infections are more prevalent among the poor segments of the population and intimately linked with low economic level, poor personal and environnemental sanitation, and overcrowding, limited access to clean water, tropical climate and low altitude [37,38,39,40]. According to the World Health Organisation, over 270 million pre-school and over 600 million of school children live in areas where the parasites are intensively transmitted [41].

It is against this background that this study was undertaken to determine the prevalence of intestinal parasites and infection patterns among school children in Kagarko Local Government Area of Kaduna state, Nigeria. To investigate their age and sex-specific prevalence of intestinal parasitic infection in children, and to examine the implication of these to the educational development of School Children in the Area.

**MATERIALS AND METHODS**

**The Study Area**

The study area is Kagarko Local Government Area, Kaduna State, it was created in 1996. It is one of the twenty-three (23) local governments in Kaduna state. It is located at the south-western part of the state, lying between lat. 9o35’N and 9o08’N and long. 7o6’E and 80o 00’E, at the boundary of the middle belt of Nigeria and covers a land mass of 4400km2 (Figure 1).



**Figure 1: Map of Kagarko Local Government Area of Kaduna State.**

Source:Adopted from Magaji, [42].

## Sources of data

The sources of data used for this study comprises of both Primary and Secondary sources of data. The Primary sources include the stool samples collected from the school children and the questionnaire administration, while the secondary data source includes published and unpublished materials, journal related articles, text books, internet, among others.

**Sample Size and sampling procedures**

The study population comprised of 614 pupils from 11 primary schools. The enrolled pupils were within the ages of 5-13 years. The sampled population was determined by adopting the [43] model for sample size determination, where a sample size of 235 was obtained.

The List of all the pupils was compiled in all the selected schools. The first pupil in each selected school was selected at random and the subsequent once were systematically selected until the required number was obtained. The selected pupils were served with the questionnaire to obtain information on their demographic data and risk factors of acquiring gastrointestinal parasites (name of school, sex, age, parents’ occupation, source of drinking water, water contact activities, type of latrine, administration of deworming tablets, and history of blood in the stool).

**Sample Collection and analysis**

The faecal samples were collected from 50 pupils, 10 pupils from each selected primary school (Kutaho, Kubacha, Kushe, Kagarko and Jere), and due to limited finance. Prior to the collection of the samples, written permission from Local Government Education Secretary, through the Headmasters, School-based Management Committee. Consent of their Parents and the Pupils were obtained after being briefed on the importance of the study.

The stool samples were collected from the selected primary schools. All participating children were supplied with a clean labeled plastic universal bottle with screw cap with a plastic spatula each. Prior to collection, pupils were instructed on how to collect the samples, as described by Egwuari [44]. The faecal samples collected were preserved in 10% formalin and transported to Biological Sciences Laboratory, University of Abuja, where they were analysed.

**Laboratory Analyses of stool Samples and Parasite Identification**

The samples were analysed for the cysts, eggs and larvae of parasites using Direct Saline/Iodine Wet Mouth Procedure. A stool sample was collected with an applicator stick and placed in a small area on a clean microscope slide. All gross fibers and particles were removed. Immediately before the specimen dries, 1 or 2 drop of saline was added with a pipette and then mixed with the tip of the pipette.

The specimen was then covered with a cover slip. (Air bubbles were avoided by drawing one edge of the cover slip slightly into the suspension and lowering it almost to the slide before letting it fall. The mount should be just thick enough that newspaper print can be read through the slide). If desired the cover slip(s) can be sealed using petroleum jelly and Paraffin oil or other suitable sealing preparations. Sealing the cover slip keeps organisms from moving when using oil immersion objectives and prevents the preparation from drying out.

The specimen was examined with the low power objective (10x) and low light. The examination started at one corner of the smear and systematically successive adjacent swaths with the low power microscope. Low power examination includes entire area of 22mm by 22mm cover slip preparation (both saline and iodine).

When a parasite like object comes into view, it was more closely examined and identified under high power (40x) objective. High dry power examination should include at least one third of the cover slip area (both saline and iodine).

Identification of the parasites was done using the morphology of the cysts, eggs and larvae using Atlas of Medical Helminthology and Protozoology (Chiodini *et al*., 2005), Medical Parasitology [45].

**Data Analysis**

The data were analysed using the SPSS. The prevalence of different intestinal parasites were calculated and expressed in percentages. Odds ratio (OR) was used to determine the association between the risk factors and prevalence of infection. When Odds ratio (OR) is less than one (< 1), it means that there is no association between the risk factors and the prevalence of the infection. But when Odds ratio (OR) is greater than one (>1), it then means that there is association between the risk factors and the prevalence of the infection. If the lower limit of 95% confidence interval (CI) is (< 1) then the association is not significant but if the lower limit of 95% confidence interval (CI) is (>1) then the association is significant.

**RESULTS AND DISCUSSIONS**

**DEMOGRAPHIC CHARACTERISTICS OF PUPILS**

The pupils’ demographic characteristics were elicited through the questionnaire, this was with the view to compare with the laboratory analysis in order to ascertain the possible causative variables of the gastrointestinal infections and their responses are presented below:-

**Table 1: Parents’ Level of Education**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Level of Education | Father | | Mother | |
| Freq. | Percent | Freq. | Percent |
| No Formal Education | 101 | 43.0 | 111 | 47.2 |
| Primary Education | 91 | 38.7 | 78 | 33.2 |
| Secondary Education | 16 | 6.8 | 36 | 15.3 |
| Tertiary Education | 27 | 11.5 | 10 | 4.3 |
| Total | 235 | 100 | 235 | 100 |

Source: Field Survey, 2019

Table 1 shows that 43% and 47.2% of their fathers and mothers respectively had no formal education, about 33% of both parents had primary education, a very negligible number, had secondary education. 11.5% of their fathers had tertiary education, while only 4.3% of the mothers had tertiary education. This is probably due to their ideology of not sponsoring females’ education after primary education.

**Table 2: Parents’ Occupation**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Occupation | Father | | Mother | |
| Freq. | Percent | Freq. | Percent |
| Farmer | 121 | 51.5 | 73 | 31.1 |
| Civil servant | 82 | 34.9 | 34 | 14.5 |
| Businessmen/women | 32 | 13.6 | 82 | 34.9 |
| Housewife | - | - | 46 | 19.6 |
| Total | 235 | 100 | 235 | 100.0 |

Source: Field Survey, 2019

Results in table 2 showed that 51.5% and 31.1% of their father and mother respectively are farmers. 34.9% and 14.5% respectively are civil servants, while 13.6% and 34.9 are business men and women respectively. Whereas, I9% of the women are mere housewives.

**Table 3: The Source(s) of drinking water in the respondents ward.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Source of Water | Home | | School | |
| Freq. | Percent | Freq. | Percent |
| Pipe-borne | - | - | - | - |
| Well | 43 | 18.3 | 129 | 54.9 |
| Stream | 46 | 19.6 | - | - |
| Borehole | 42 | 17.9 | 106 | 45.1 |
| Rainfall | 104 | 44.3 | - | - |
| Total | 235 | 100.0 | 235 | 100.0 |

Source: Field Survey, 2019

Table 3 revealed that there was no pipe born water in the local government as a whole even though the Gurara dam water that was been transferred to Abuja was constructed there. All of them used wells, streams and some with boreholes at home, whereas, wells and boreholes in the schools.

**Figure 1: Types of latrine system used**

Source: Field Survey, 2020

In order to find out the availability and types of toilets in the school environment, analysis showed that 36.6%, indicated that they use water closet, 32.3% indicated that they use pit latrine, while 11.1% used bush for toilets and 20% use others not specified.

**Figure 2: Frequency of children’s deworming**.

Source: Field Survey, 2020

Ideally, children need to be dewormed every six months, but analysis showed that 41% deworm 3-6 months, 21% deworm once every year, 12% occasionally deworm while 26% do not deworm at all (Figure 2).

**Table 4: Children washing their hands before and After Eating and visitation to stream to fish or swim.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Washing of hands before  and after eating. | | Visiting stream to  fish/swim | |
| Frequency | Percent | Frequency | Percent |
| Always | 94 | 40.0 | 74 | 31.5 |
| Occasionally | 34 | 14.5 | 41 | 17.4 |
| Sometimes | 84 | 35.7 | 54 | 23.0 |
| Barely | 23 | 9.8 | 66 | 28.1 |
| Total | 235 | 100.0 | 235 | 100.0 |

Source: Field Survey, (2020)

Majority of the causes of gastrointestinal infections is as a results of water, sanitation and hygiene. The children were asked if they do wash their hand before and after eating. Their responses in Table 4 revealed that 40% always wash their hand before and after eating, 35.5% sometimes wash their hand before and after eating, while 14.5% and 9.8% occasionally and barely wash their hand before and after eating.

They were also asked if they do go to streams to either fish, swim or both. Their responses revealed that 31.5% always go to streams to either fish, swim or both, 23% sometimes go to streams to either Fish, Swim or both, while 17.4% and 28.1% occasionally and barely go to streams to either fish, swim or both.

**Figure 3: History of Blood in the respondents Stool.**

Source: Field Survey, 2019

Further investigation on the history of blood in their stools was made and their results in Figure 3 showed that 66% of the children indicated that they have cases of blood in their stools, while 34% said they never have such cases.

**PREVALENCE OF GASTROINTESTINAL PARASITES AMONG SCHOOL CHILDREN IN KAGARKO LOCAL GOVERNMENT AREA**

The ten sampled pupils from each selected schools were used for this study, making a total of 50 children. The results of the analysis are presented in Table 5.

**Table 5: Prevalence of Gastro-intestinal Parasites among the Children in the study area.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **School** | **No. of samples** | **Results of analysis** | | **Percentage affected** |
| **Positive** | **Negative** |
| Jere | 10 | 7 | 3 | 70 |
| Kagarko | 10 | 4 | 6 | 40 |
| Kubacha | 10 | 6 | 4 | 60 |
| Kushe | 10 | 7 | 3 | 70 |
| Kutaho | 10 | 9 | 1 | 90 |
| **Sectional Total** | **50** | **33** | **17** | **66** |

Source: Field and Lab. Analysis, (2020)

Results in Table 5 revealed that, out of the 50 pupils examined from the selected schools, 33 pupils representing 66% of them were found to be infected with gastrointestinal parasites, the order of the prevalence showed that LEA Primary school Kutaho had the highest prevalence of 90%, followed by Kushe and Jere who had 70% each, Kubacha 60%, and Kagarko had the least prevalence with 40%. This results confirmed that there is poor level of environmental health and personal hygiene among the children.

**SPECIES-SPECIFIC PREVALENCE**

**Table 6: Species-specific prevalence of gastrointestinal parasites among the Selected children.**

|  |  |  |
| --- | --- | --- |
| Parasite | Frequency | Percent |
| Hookwarm | 11 | 33.3 |
| *Entamoeba histolytica* | 8 | 24.2 |
| *Ascaris lumbricoides* | 6 | 18.2 |
| *Strongyloides stercoralis* | 4 | 12.1 |
| *Schistosoma mansoni* | 3 | 9.1 |
| *Entamoeba coli* | 1 | 3.1 |
| Total | 33 | 100 |

Source: Field and lab. Analysis, (2020)

Table 6 presents the species of parasites identified during the laboratory analysis. Six species of parasites were identified and recorded as follows:- Hookworm was recorded in 11 children representing 33.3%, followed by *Entamoeba histolytica* 8 children (24.2%), *Ascaris lumbricoides* 6 children (18.2%), *Strongyloides stercoralis* 4 children (12.1%), *Schistosoma mansoni* 3 children (9.1%) and *Entamoeba coli* 1 child (3%).

**PREVALENCE OF INTESTINAL PARASITES BY AGE OF CHILDREN**

**Table 7: Age-specific prevalence of intestinal Parasites among the children**

|  |  |  |
| --- | --- | --- |
| Age | Frequency | Percent |
| (5-7) years | 4 | 12.1 |
| (8-10) years | 12 | 36.4 |
| (11-13) years | 15 | 45.5 |
| 14 years & above | 2 | 6.1 |
| Total | 33 | 100 |

Source: Field Survey, 2019

Age-specific prevalence of parasites showed that children who are between the age group (5-7) years had 4 respondents representing 12.1% of the infected children, (8-10) years had 12 respondents, representing 36.4% of the infected, while (11-13) years had 15 respondents, representing 45.5% of the infected 14 years and above had only 2 respondents representing 6.1% of the infected children. That is to say, over 80% of the children in the age range of (4-9) years are mostly infected by parasites (Table 7).

**PREVALENCE OF INTESTINAL PARASITES IN RELATION TO SEX**

**Table 8: Sex-specific prevalence of Intestinal Parasites among the children.**

|  |  |  |
| --- | --- | --- |
| Sex | Frequency | Percent |
| Male | 19 | 57.6 |
| Female | 14 | 42.4 |
| Total | 33 | 100 |

Source: Field Survey, 2019

The prevalence of the parasites among the 50 sampled children shows that males are 57.6% who were screen to be positive, while females’ respondents are 42.4% that were infected. (Table 8).

**DISCUSSION OF RESULTS**

This study revealed that the overall prevalence of gastrointestinal infection in the study area obtained is 66%. The prevalence was low compared to the findings of [34] in Konduga, Borno that had 80.9%, but close to the findings of [46] in Akokwo, Imo State that recorded 64.1% of prevalence. However the result of this finding was higher than that obtained by [16] with 56.8% in Lere, Kaduna State, [47] with 58.5% in Markudi, Benue State, [48] in Bosso, Niger State, [49] with 30.8% in Katsina, [34] with 30.2% in Doi village Plateau State. The high prevalence of intestinal parasites in schools in Kagarko Local Government Area could probably be due to poor environmental sanitation, inadequate and clean water sources, and partly due to favourable climate that favours the survival of the parasites.

The prevalence of each parasite encountered from the schools showed that hookworm recorded highest in all the schools. This was followed by *E. histolytica*, *A. lumbricoides*, *Strongyloides stercoralis, Schistosoma mansoni* and the least was *Entomoeba coli*. High prevalence of hookworm infection was also observed by other researchers, [49] in Katsina, [46] in Akokwo Imo State, [34] in Doi village Plateau State, [16] in Lere, Kaduna State, [47] in Makurdi, Benue State, [50] in Mbaukwu, Anambra State, and [51] 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. Prevalence of *Entamoeba histolytica* and *Ascaris lumbricoides* could be due to lack of proper sanitation. Inadequate clean drinking water, Poor standards of personal hygiene and inadequate health education promote the spread of such parasites. Some of the parasites have high fecundity rate which may last long and in many places where sanitation and safe garbage disposal are non-existence, the environment becomes thoroughly contaminated and infection is difficult to avoid [52]. The pupils with cases of bloody stool infections may be caused by intestinal parasites such as *Entamoeba histolytica*, Hookworm, *Schistosoma mansoni* and *Strongyloides stercolaris.*

The pupils between age group of 11-13 years were observed to have the highest prevalence rate. Followed (8-10) years while the least is 14 years and above had least prevalence. This may be due to their level of exposure to the risk factors. This could be due to the fact that children between the of age group (11-13) years are mostly engaged in playing with contaminated soil, frequent visits to the streams and poor personal hygiene among others.

Prevalence base on Sex shows that male pupils were more infected compared to the females. The reason may be due to the fact that males are more engaged in extracurricular activities such as recreational activities and games. The lower prevalence in females may be due to cultural practices, which require females to be indoors most of the time while males take part in many outdoor activities. [53, 54] made similar observations in South Eastern Nigeria.

The 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 [53]. This could be due to poor sanitation which might encourage flies and cockroaches to spread cysts and eggs of intestinal parasites [55].

The pupils that indicated not taking de-worming tablets were more infected than those that took it and those that took dewormers yearly were more infected compared to those that took within 6 and 3 months intervals. This shows the association between the infection and use of anthelminthic. Positive cases recorded in those that were de-wormed may be due to re-infection after treatment. [34] made such observations in Doi village in Plateau State, Nigeria. Chemotherapy is the best way of reducing the worm burden but there was a conflict of results in Northern Bangladesh where chemotherapeutic intervention was found not to have significant long-term impact. Improved living standards, environmental sanitation, agricultural and industrial hygiene can contribute to the success of the use of chemotherapy [55].

**CONCLUSION**

This study revealed that there is high prevalence of gastrointestinal parasites among primary school children in Kagarko Local Government Area of Kaduna State. This was attributed to inadequate potable water, poor environmental sanitation, poor personal hygiene, un availability of good toilets systems, above all it was observed that the prevalence is also associated with the level of education, and level of poverty of their parents among others.

**RECOMMENDATIONS**

Base on the findings of this study, it was recommended that environmental sanitation should be enforced, there should be large-scale de-worming campaigns in all the primary schools and the host communities. The Local Government should provide good water system for the schools and the host communities at large.

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