IJAAR PUBLISHING®

International Journal of Research in Education and Sustainable Development | ISSN: 2782-7666
Vol. 3, Issue 11 (November, 2023) | www.ijaar.org/ijresd

IMPACT OF INTESTINAL PARASITIC INFECTIONS ON NUTRITIONAL STATUS OF RURAL AND URBAN PRIMARY SCHOOLS CHILDREN IN NASSARAWA LOCAL GOVERNMENT, KANO STATE, NIGERIA

[1]Zaharau Ahmad Salisu; [*1]Musa Ahmed Abubakar and [2]Umar Shittu

[1]Department of Science Laboratory Technology, Kano State Polytechnic, Kano State, Nigeria
[2]Department of Biology,Isa Kaita College of Education Dutsin-ma, Katsina State, Nigeria

**Corresponding author's e-mail: aamusakanopoly@gmail.com, +2348061619400*

ABSTRACT: Background and Objectives: *Intestinal parasitic infections are highly prevalent in developing countries, contributing to high incidence of malnutrition and morbidity. This study was aimed to determine the Nutritional status and prevalence of intestinal parasitic infections and their association with nutritional status of children in Nassarawa Local Government Area, Kano State Nigeria.*

Methodology: *Six primary schools were selected for this study and 120 feacal samples from primary school pupils (60 rural and 60 urban) aged 5-13 years were collected and examined for intestinal parasites using standard laboratory techniques. Nutritional status was also determined based on Body Mass Index (BMI) for age.*

Results: *The major intestinal parasites identified in all samples from school children were E. histolytica, G. lamblia, T. trichiura, S. mansoni, E. vermicularis, H. nana, F. hepatica and T. saginata. With G. lamblia having the highest prevalence rate of 27.9% ($P<0.05$). Thus, intestinal parasitic infections were prevalent among the primary school children in Nassarawa Local Government, with G. lamblia 19(27.9%) and T. saginata 11(5%) constituting over 50% of the infections. Ages 8 to 10 years and 11 to 13 years had the higher prevalence rate of infections with 26(47.3%) and 15(45.5%), respectively. Pupils aged 8-10 in rural or densely populated areas were found to be underweight due to severe malnutrition. The study also showed that, females also were more infested than males with 32(53.3%) and 22(36.7%), respectively. Finally, among all the potential viable risk factors investigated, pupils from rural community school had the highest level of risk factors that could easily result to parasitic infection.*

Conclusion and Health implication: *Kano State is among the Nigerian states with the highest burden of tropical disease and infections. This study evaluated some essential information that will support the planning and implementation of the State's ongoing efforts for the control of intestinal parasitic infections. Therefore, it is recommended that regular deworming exercise with anti-helminthic products will improve the nutritional health status of the children while early diagnosis, personal hygiene and health campaign programme in rural areas will impact the knowledge of good hygiene on people.*

Keywords: *Intestinal parasites, Nutritional status, Primary school children, Rural-urban.*

30/11/2023
Salisu, A.Z, Abubakar, A.M. & Shittu, U. (2023). Impact of Intestinal Parasitic Infections on Nutritional Status of Rural and Urban Primary Schools Children in Nassarawa Local Government, Kano State, Nigeria. *International Journal of Research in Education and Sustainable Development*, 3(11), 1-17.

INTRODUCTION

Intestinal parasitic infections are highly prevalent in developing countries, contributing to high incidence of malnutrition and morbidity. Intestinal parasites are attributed to low socio-economic, educational and poor hygienic status of the people. They are often spread by poor hygiene related to faeces, contact with animals or poorly cooked food containing parasites (Jaiswal *et al.,* 2014; Oyeniran *et al.,* 2014). In Nigeria, these parasites have continued to prevail because of low standard of living, poor environmental sanitation overcrowding and ignorance of simple health promoting factors (Oyeniran *et al.,* 2014). School children in many developing countries including Nigeria harbor the most intense infections with intestinal parasites.

Intestinal parasitic infections has estimated to affect about 3.5 billion people globally and caused morbidity in approximately 450 million people (WHO, 2000b) Records show that a global estimate of 162 million under-five years old children are documented to be stunted, 99 million underweight and 51 million wasted (WHO, 2012). A silent emergency already exists in Nigeria, as the country has extremely poor nutritional indices: stunting 37%, underweight 29% and wasting 18% (NDHS, 2013).

Diarrhea is the second leading cause of death among children under five in Nigeria after malaria (UNICEF/WHO, 2009a). *E. histolytica*, *G. lamblia*, *N. americanus*, *A. doudenale*, hookworm, ascariasis and trichuriasis are the other common intestinal parasitic infections in Benue State, Nigeria (Amuta *et al.,* 2013). The incidence of the disease varies greatly with seasons and a child's age; the youngest children are most vulnerable, due to poor environmental sanitation and contamination of water (UNICEF/WHO, 2009). Malnutrition and intestinal parasitic infections are common public health problems of children in Nigeria. These parasitic infections have detrimental impact on host nutritional status in several ways, they can depress appetite and food intake, compete for micronutrients, or blood loss resulting in the loss of iron, diarrhea, vomiting, dehydration, weight loss and growth retardation, fever, school attendance, physical activity and cognitive performance of school age children (Stolzfus*et al.,* 1997;Hadidjaja*et al.,* 2014; Nokes and Bundy, 2015).

Intestinal parasitic infections (IPI) are global health problems causing clinical illness in 450million inhabitants in developing countries (Quihui *et al*., 2006; Eleni, 2012). Parasites found in the intestine can be categorized into two major taxonomic groups; Protozoa (amoebae, flagellates, ciliates, sporozoans, and coccidia and Helminths which include the Platyhelminthes or flatworms (cestodes, trematodes) and the Nemathelminthes (Nematoda or roundworms) (Garcia, 2016; Mwenji, 2010; Stephenson *et al.,* 2000; Eleni, 2012; Adekunle, 2015; WHO, 1991).

The major intestinal parasites of global public health concern are the protozoan species. Protozoan parasites can cause a wide range of different diseases. Some of the most commonly known include malaria, which is caused by a parasite from the Plasmodium genus, and amoebic dysentery, which is an intestinal inflammation caused by the amoeba *Entamoeba histolytica*. There are four types of protozoan parasites that are classified according to the way they move; **amoebae, flagellates, ciliates, and Sporozoa**(Garcia and Bruckner, 1997; Christine, 2015). *Entamoeba histolytica* that causes amoebiasis, *Giardia lamblia* which causes giardiasis, *Isospora belli* causing coccidiosis and *Cryptosporidium parvum* causing cryptosporidiosis, *Sarcocystis hominis* causing diarrhoea, *Trichomonashominis* causing diarrhoea, and *Balantidium coli* causing balantidiasis.

Intestinal helminths of importance to man are *Enterobius vermicularis* (pinworm) which causes entrobiasis, soil-transmitted helminths (STH) – *Ascaris lumbricoides* (roundworm) causes ascariasis, *Trichuris trichiura* (whipworm) causes trichuriasis, *Necator americanus* causes necatoriasis, *Ancylostoma duodenale* (hookworm) causes ancylostomiasis, *Strongyloides stercoralis* (threadworm) causes strongyloidiasis which all belongs to the Nematoda. The trematode include *Fasciolopsis buski* causes fasciolopsiasis, *Heterophyes heterophyes* causes heterophiasis. *Schistosoma mansoni*is also the trematode that causes the most significant intestinal infection in man. Cestodiasis is a common name for intestinal infections caused by cestodes; such cestodes include *Taenia saginata, Taeniasolium* cause a disease called taeniasis and *Diphyllobothriumlatum causes* diphyllobothriasis (WHO, 2000b; Mwenji, 2010; Eleni, 2012).

School children in many developing countries including Nigeria harbor the most intense infections with intestinal parasites. The adverse effects of intestinal parasites among children are diverse and alarming. Infection with intestinal parasites infections have detrimental effects on the survival of affected individuals' appetite, physical fitness, school attendance, and cognitive performance of school age.The re-inforcement programme and better sanitation hygienic education in the school would decrease the infection rate among the school children (Eleni, 2012; Jaiswal *et al.,* 2014). Thus, the study on the nutritional status and prevalence of intestinal parasitic infections among primary school children is a pre-requisite not only for formulation of appropriate control strategies, but also the data are important to predict risk for communities under consideration and improving the sanitation hygienic education and system in primary schools.

3.0 MATERIALS AND METHODS

3.1 Materials needed for the study

Stool sample, Sample container (wide and screw copped), Compound microscope, Microscopic slides (clean grease free), Centrifuge machine, Test tubes, Applicator stick/glass rod, Cover slips, Hand gloves, Zinc sulphate powder, Lughole's iodine, Formal saline, Eosin, Distilled water, Pasteur pipette and Atlas.

3.2 Methodology

3.2.1 Description of the Study Site

The research study was carried out in Nassarawa Local Government (LGA) of Kano State, Nigeria. Nassarawa LGA lies geographically on latitude $11^{0}58'37N$ and $8\ ^{0}33'44E$. It has an area of $34km^2$ and a population of 596,669 according to the National Population report (2006). The local Government has an area extent of $34km^2$. It is bounded to the North by Fagge and Ungogo local governments, to the South by Tarauni and to the West by Kano Municipal local government. It has about eleven (11) council wards, namely; Giginyu, Kawaji, Dakata, Tudun Wada, Tudun Murtala, Gama, Gawuna, Gwagwarwa, Hotoron-kudu, Hotoron-Arewa and Kaura-Goje.

3.2.2 Subjects of the Research

For this study, six (6) council wards from Nassarawa LGA were selected which includes; Dakata, Gama, Gawuna, Hotoro-North, Kawaji and Giginyu. Six (6) primary schools were selected one from each council ward, namely; Dakata special primary school, Gama special primary school, Gawuna science and technical primary school, Hotoro north primary school, Kawaji 'Yankaba primary school, and Magwan model primary school. The schools in the

selected council wards were clustered into urban and rural primary schools. Entirely, 120 children both boys and girls ranging from ages of 6-12 years were randomly selected (60 each from rural and urban areas). Figure 1 shows a map of the study area in Nassarawa LGA, Kano Sate-Nigeria. All students (males and females) from primary 1-6 in the selected schools, who are volunteers to participate have completed and signed the consent forms through their parents.

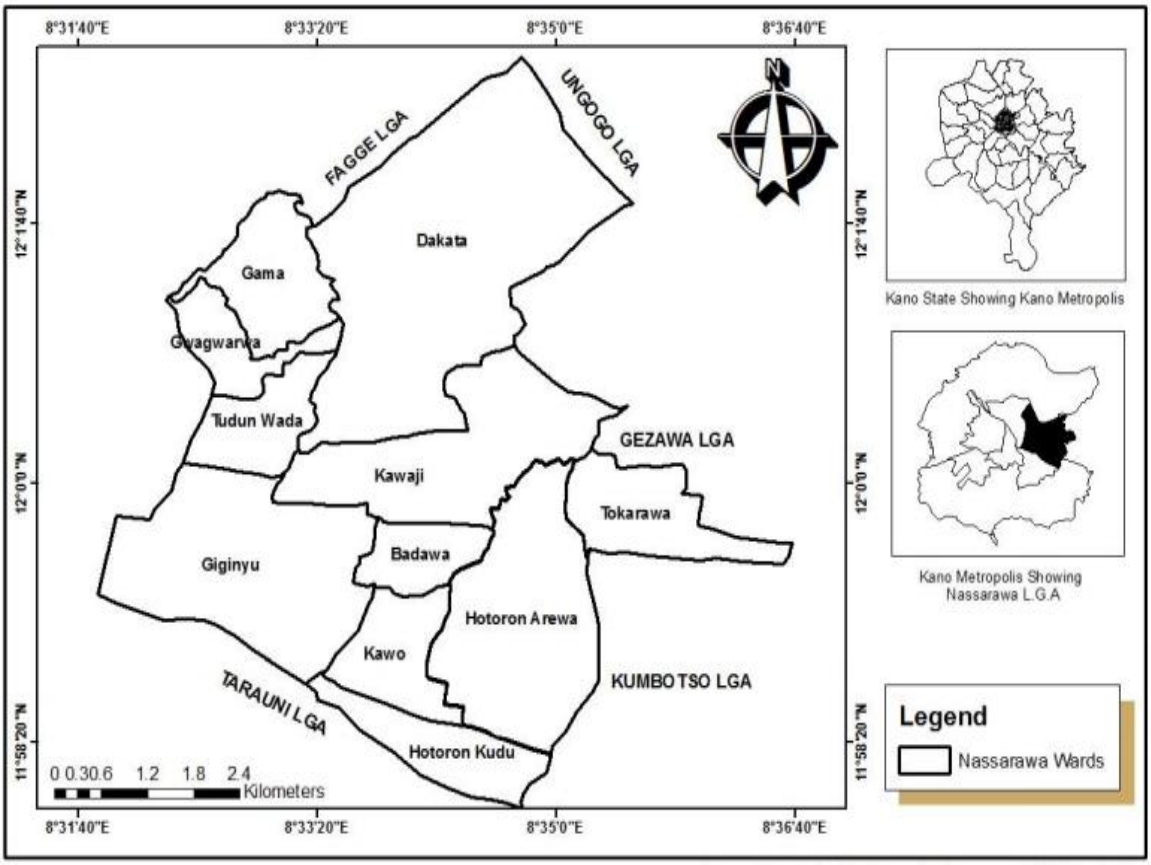


Fig. 1: Map of the study area (Source: Cartography Lab., Geography Department, Bayero University Kano, 2013)

3.2.3 Questionnaire administration /Data collection

Based on the possible risk factors, a questionnaire was developed. The questionnaire included information such as age, sex, hands washing habit, source of drinking water, toilet type, and history of treatment for intestinal parasites. Questionnaires were interpreted to participants in their local dialect (Hausa language) and were assisted in completing them. Each questionnaire was assigned a number that corresponds to the number assigned to participant's stool sample collected.

3.2.4 Ethical clearance

Before the commencement of the research, permission was granted from the headmasters of all the schools including the pupil's parents/guardian. Approval of the study protocol or ethical clearance by the Kano State Ministry of Health's ethical committee was requested.

3.2.5 Anthropometric measurement

Anthropometric measurement such as height and weight was taken as described by WHO, (1995). Digital floor scale was used to measure participant's weight; height was measured with a wall mounted stadiometer while nutritional status was determined based on Body Mass Index (BMI) for age (Moussa *et al.*, 2011; CDC, 2012).

$$\text{Where: } \mathbf{BMI} = \frac{\mathbf{Weight\ (Kg)}}{\mathbf{Height\ (m^2)}}$$

3.2.6 Sample Collection

Stool samples were collected, the children were given a dried clean, leak proof; screw capped, labeled the containers along with brief instructions on how to collect the stool. From each student, about 5g of fresh stool was collected. Only a single morning stool sample was collected, ensuring that no urine, water, soil or other possible contaminants get into the container (Mwenji, 2010; Eleni, 2012; Gelaw *et al*., 2013).

3.2.7 Parasitological examination

All stool samples were observed each for the following parameters and recorded.

- Colour of the specimen.
- Consistency, i.e. whether formed, semiformed, unformed, watery.
- Presence of blood, mucus, and pus.
- Whether the specimen contains worms, e.g. *A. lumbricoides* (large roundworm), *E. vermicularis* (threadworm) or tapeworm segments, e.g. *T. solium, T. saginata.*

3.2.7.1 Microscopic examination of stool sample

In the preparation of slide for the stool analysis, the slide was contained saline and iodine preparations at both edges of the slide for each sample. Using a piece of stick, a small amount of specimen to include blood and mucus were placed on one end of a slide. Without adding saline, it was covered with cover glass and using a tissue, it was then pressed gently on the cover glass to make a *thin preparation.*A drop of eosin reagent was placed on the other end of the slide. A small amount of the specimen was mixed with the eosin and covered with a cover glass.The preparations were examined immediately microscopically, first using the X10 objective sufficiently to give good contrast and X40 objective to identify motile trophozoites, e.g. *E. histolytica* amoebae or *G. lamblia* flagellates.

3.2.7.2 Examination of semi-formed and formed stool samples

A drop of fresh physiological saline was placed on one end of a slide and a drop of iodine on the other end. Using a piece of stick a small amount of specimen, about 2 mg, was mixed with the saline and a similar amount with the iodine. A smooth thin preparation was made. Each preparation was covered with a cover glass.Systematically the entire saline preparation was examined for larvae, ciliates, helminth eggs, cysts, and oocysts using X10 objective sufficiently to give good contrast and X40 objective to assist in the detection and identification of eggs, cysts, and oocysts.

3.2.8 Floatation Technique (Zinc Sulphate)

The 15ml test tube was filled to about one quarter full with the zinc sulphate solution. An estimated 1 gram of faeces (or 2ml if a fluid specimen) using a stick, it was then emulsified into the solution.The tube was filled with the zinc sulphate solution and mixed well. The fecal suspension was strained to remove the large fecal particles.The suspension was returned to the tube. The tube was kept stand in a completely vertical position in a rack. Using a Pasteur pipette, further solution was added to ensure the tube is filled to the brim. A completely clean (grease-free) cover glass was carefully placed on top of the tube. Avoid trapping of air bubbles is very necessary to ensure accuracy. It was then left undisturbed for 30-45 minutes to give time for the cysts and eggs to float. The cover glass was lifted carefully from the tube by a straight pull upwards. The cover glass face was finally placed downwards on a slide. The entire preparation was examined microscopically using X10 objective and then X40, a drop of iodine was run under the cover glass to identify the cysts. (Cheesbrough, 1998).

3.2.9 Data Analysis

Data generated were analyzed using statistical package for social scientist (SPSS) version 20. Descriptive statistics was used to present frequency distribution, and prevalence of intestinal parasitic infection. Chi-square test, analysis of variance and correlation analysis were used to test association between Body Mass Index and parasitic infection. P-values less than 0.05 were considered statistically significant.

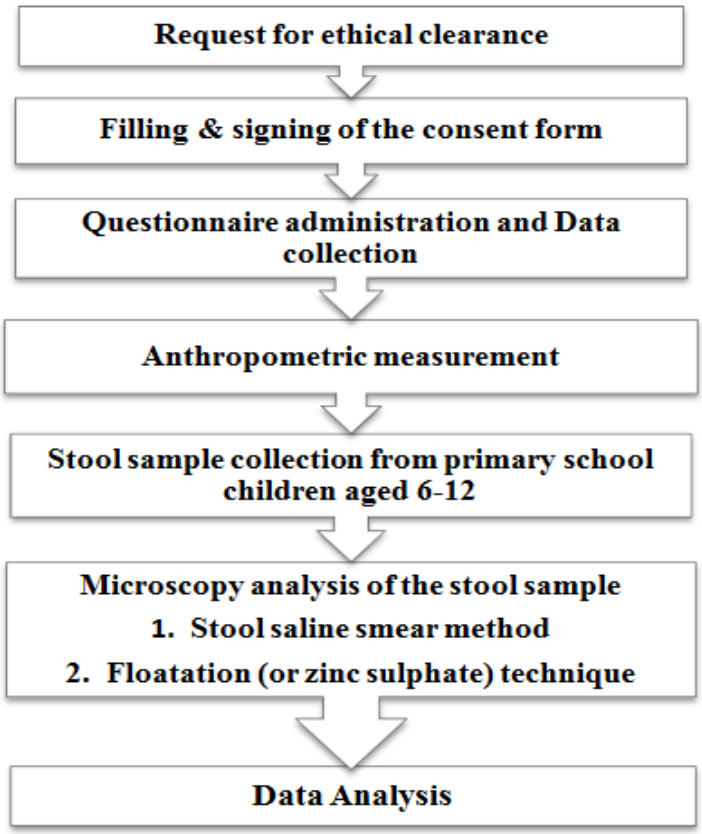


Fig 2: Flow-Chart of the Research

RESULTS AND DISCUSSION

Based on the experimental findings, the results presented below is the data for 120 primary school pupils (60 rural and 60 urban) who volunteer stool samples and their anthropometric data for nutritional status were obtained. There were 30 males and 30 females for rural areasand 30 males and 30 females for urban areas. The subjects were grouped between 5-13 years age. Table 4.1 summarizes prevalence of intestinal parasites among primary school pupils by age group. The age ranging from 5-7 with frequency 32, 17 males and 15 females were found to have 14 worm infestations. Age 8-10 with frequency 55, 27 males and 28 females were found to have 26 worm infestations. Age 11-13 with frequency 33, 16 males and 17 females were found to have 15 worm infestations. For 120 samples analyzed, 55 were found to have worm infestation as positive.

Table 4.1: Prevalence of Intestinal Parasites among Primary School Pupils in Nassarawa Local Government by Age group

Age (years)	Frequency	Male	Female	Worm infestation
5-7	32	17	15	14
8-10	55	27	28	26
11-13	33	16	17	15
TOTAL	120	60	60	55

Among the 20 samples analyzed in Dakata ward, worm infestations were 14, male infested was 5 and female were 9. For Gama ward, worm infestations were 8, male infested were 3 and for female were 5. For Gawuna ward, worm infestations were 11, male infested were 5 and for female were also 6. For Hotoro, worm infestations were 9, male infested were 3 and for female were 6. For Magwan, worm infestations were 7, male infested were 4 and for female were 3. For Yankaba, worm infestations were 6, male infested were 3 and for female were also 3. Therefore, for the total number of samples analyzed in six (6) wards (120), worm infested were 55; 22 males and 32 females (see table 4.2 below)**.**

Table 4.2: Prevalence of intestinal parasites related to gender for 6-ward schools in Nassarawa Local Government, Kano State

S/N	Ward (schools)	Total No. of samples	No. of male infested	No. of female infested	Total No. of Pupil infested	Percentage of pupil infested (%)
1	Dakata	20	5	9	14	70%
2	Gama	20	3	5	8	40%
3	Gawuna	20	5	6	11	55%
4	Hotoro	20	3	6	9	45%
5	Magwan	20	4	3	7	35%
6	Yankaba	20	3	3	6	30%
Total	6	120	22	32	55	45.8%

Therefore, for 120 samples analyzed, pupils infested in Dakata were 14, Gama 8, Gawuna 11, Hotoro 9, Magwan 7, and Yankaba 6. Thus, the percentage infested were 70%, 40%, 55%,

45%, 35%, and 30%, respectively. Hence, the total number of pupils infested was recorded to be 55 and the percentage 45.8%.

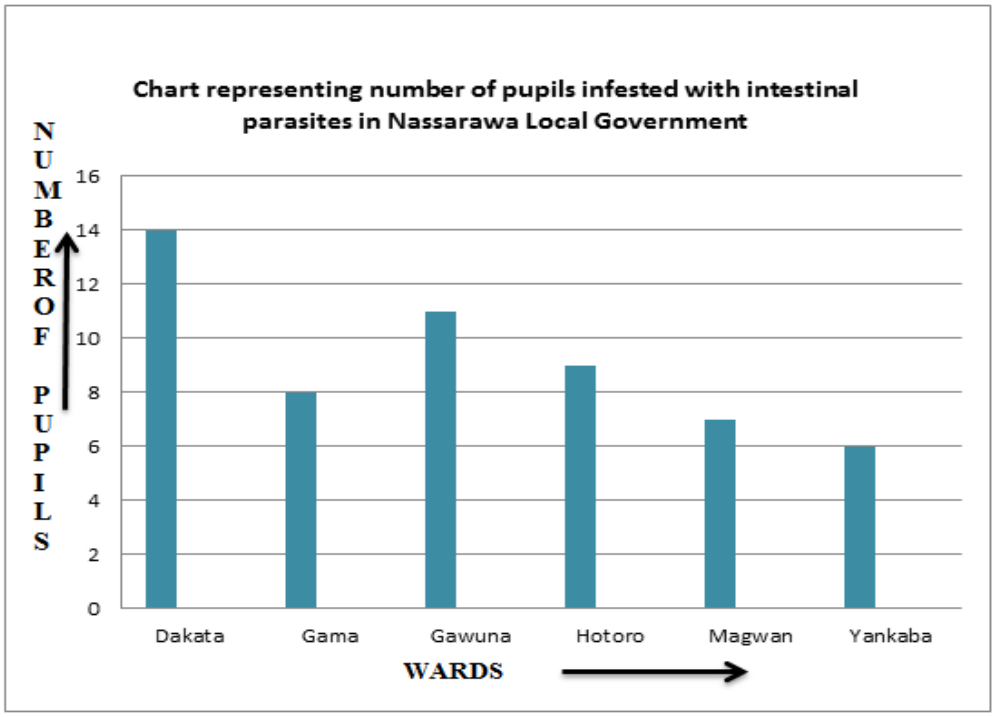


Fig 4.1: Prevalence of intestinal parasites among children in 6-ward schools (rural and urban communities) at Nassarawa Local Government Area, Kano State

Table 4.3: Parasites detected in the selected wards within Nassarawa Local Government

Parasites	**DKT**	**DKT**	**GMA**	**GMA**	**GWN**	**GWN**	**HTR**	**HTR**	**MGN**	**MGN**	**YNK**	**YNK**
	M	F	M	F	M	F	M	F	M	F	M	F
A. lumbricoides	2(10%)	1(5%)	1(5%)	-	-	-	-	1(5%)	-	-	-	-
E. histolytica	-	1(5%)	-	-	1(5%)	1(5%)	1(5%)	-	1(5%)	-	-	-
E.vermicularis	-	-	-	2(10%)	-	-	-	-	-	-	-	-
F.hepatica	-	-	-	-	2(10%)	1(5%)	1(5%)	-	-	-	-	-
G.lamblia	-	4(20%)	1(5%)	-	2(10%)	2(10%)	1(5%)	3(15%)	-	3(15%)	2(10%)	1(5%)
S. mansoni	-	-	-	3(15%)	-	1(5%)	-	-	-	-	-	-
T. trichiura	-	2(10%)	-	-	-	-	1(5%)	-	1(5%)	-	-	1(5%)
T.saginata	-	-	-	5(25%)	-	-	2(10%)	2(10%)	-	2(10%)	-	-
TOTAL	(10%)	(40%)	(10%)	(60%)	(25%)	(25%)	(30%)	(30%)	(10%)	(35%)	(10%)	(10%)

KEY: DKT-Dakata Ward, GMA-Gama Ward, GWN-Gawuna Ward, HTR-Hotoro Ward, MGN-Magwan Ward, YNK-Yankaba Ward F-Female, M-Male, (-)-Negative

The parasites were seen in the study, and the males and females found to have being infested with the parasites in each sampling sites were recorded in percentage (see table 4.3 above).

Table 4.4: Percentage (%) of intestinal parasites found in Nassarawa Local Government, Kano State

S/N	Parasites	Number of samples infested (%)	Organism (%)
1.	*A.lumbricoides*	5(3.3%)	5.9%
2.	*E.histolytica*	5(4.7%)	7.4%
3.	*E. vermicularis*	2(0.83%)	1.5%
4.	*F. hepatica*	4(2.5%)	4.4%
5.	*G. lamblia*	19(15.8%)	27.9%
6.	*S. mansoni*	4(2.5%)	4.4%
7.	*T. trichiura*	5(3.3%)	5.9%
8.	*T. saginata*	11(5%)	8.8%
TOTAL	8	55(37.93%)	(66.2%)

Table 4.4 summarizes parasites observed in the study samples. For the total number of samples (120) collected from 6 wards of Nassarawa L.G used in the study, 8 different species of parasites were identified in which *G. lamblia* was found to possess the highest percentage followed by *T. saginata* and the lowest percentage was observed in*E. vermicularis* (see table 4.4 below).Thus, *G. lamblia* eggs, 19 (15.8%) were found to be predominant.

Table 4.5: Prevalence of intestinal parasitic infection in relation to Gender and School type in rural and urban areas of Nassarawa L.G., Kano State

S/N	Variable	Intestinal Helminths infected (%)		Chi-square	p-value
		YES	NO		
1.	**Gender/sex**				
	Male (60)	22(36.7)	38(63.3)	1.63	P>0.05
	Female (60)	32(53.3)	28(46.7)		
2.	**Type of community School**				
	Rural	39(65.0)	21(35.0)	22.8	P<0.05
	Urban	23(38.3)	37(61.7)		

There were significant relationships between intestinal parasitic infection and community settings (Table 4.5). Male and female pupils were equally likely to get a parasitic infection. The female pupils were more infected with the parasites than the male school pupils (53.3% and 36.7%) and the pupils from the rural settings were more infected than those from the urban settings (65.0% and 38.3%). Although, the schools are all located in the same Local Government Area, there is a significant difference in prevalence of intestinal parasitic infection among the pupil participants from these schools; P<0.05 (Table 4.5).

Table 4.6: Risk factors associated with intestinal parasitic infections

S/N	Variable factors	Rural n=60	Percentage (%)	Urban n=60	Percentage (%)
1.	**Drink water source**				
	Tap	14	23.3	38	63.3
	Well	46	76.7	22	36.7
2.	**Nature of toilet facility**				
	Water closet	36	60.0	46	76.7
	Pit latrine	24	40.0	14	23.3
3.	**Nature of floor**				
	Tiles	13	21.7	19	31.7
	Cement	25	41.7	39	65.0
	Sand	38	63.3	2	3.3
4.	**Hand wash with soap after toilet use**				
	Yes	17	28.3	28	46.7
	No	43	71.7	32	53.3

Table 4.6 below shows relation between the various risk factors and intestinal parasitic infections among the school pupils. Among all the potential viable risk factors discussed, pupils from rural community school had the highest level of risk factors thatcould easily result to parasitic infection. A total of 76.7% use well as their source of drinking water as against 36.7% in urban, 40.0% pupil in rural community schools usepit latrine whereas only 23.3% in urban uses pit latrine, 63.3% pupil live in a house with sand as their nature of floor as against 3.3% in urban areas. The habit of washing hands with soap after toilet posed a problem in both rural and urban community schools, 28.3% in rural schools still wash their hands while only 46.7% in urban schools do wash their hands after use of toilets.

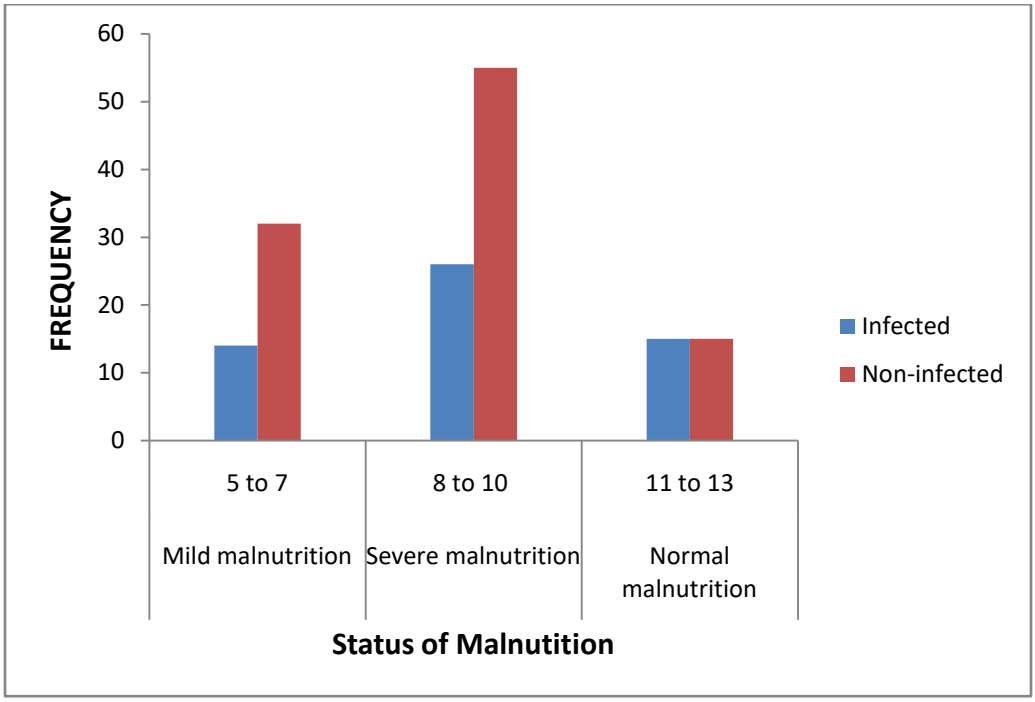


Figure 4.2: Nutritional Status based on body mass index (BMI) of infected and non-infected Pupil population in six ward-schools, Nassarawa L.G.A, Kano State

The relationship between intestinal parasitic infection and the nutritional status of Pupil population based on body mass index (BMI) is presented in Figure 4.2 above. There is an inverse correlation (r= 0.999) between mal-nutrition and parasitic infection among the Pupil participants.Thus, rural pupils were significantly ($P<0.05$) more malnourished than urban pupils.

4.0 DISCUSSION

The findings of the current study showed that, the most common parasites isolated were *G. lamblia* 19(27.9%) and *T. saginata* 11(5%) which constitute more than 50% of the infections (see Table 4.4). These helminthic organisms were endemic in the schools studied. *G. lamblia* has the highest prevalence rate with 27.9%. This may be due to the fact that,the dormant microbial cysts which may be abundant in contaminated water can be easily ingested by pupils.

The prevalence of parasitic infection shows 14(70%), 8(40%), 11(55%), 9(45%), 7(30%) and 6(30%) for Dakata, Gama, Gawuna, Hotoro, Magwan and Yankaba, respectively. The densely populated areas such as Dakata, Gama and Gawuna had the highest percentage of infestation. The densely populated areas sampled (Dakata, Gawuna and Gama) had more infection that may be due to low hygienic practices and awareness, open defecation as a result of non functional toilets in these primary schools, as well as the unavailability of clean water in all the schools sampled.

The prevalence rate also varies with sex and age. This study revealed that females were found to be more infected with 32(53.3%) males 22(36.7%). These findings are in agreement with Mwenji (2010) who reported that, females 127(19.7%) were infected with intestinal parasites compared to males 87(20.6%) in a survey of ‘the influence of intestinal parasites on academic

performance among primary school children in Nairobi province, Kenya.' and that of Eleni (2012) who also documented that, higher infestation 62.8% for females and 58.2%for malesin a survey of 'prevalence of intestinal parasitic infections and their associations with anthropometric measurements of school children in selected primary schools, Wukro town, Eastern Tigray, Ethiopia.' They suggested that it may be their pattern of consumption; females consume more junk foods compared to males and most food hawkers have unhygienic status.

The age prevalence revealed that pupils aged 8 to 10years has the highest percentage infestation 26(47.3%), followed by 11 to 13years 15(45.5%), then 5 to 7years 14(43.8%). Pupils aged 8 to 10yearswere more infested as it is indicated that at this age, they were more exposed since they play in the open field and may eat without washing hands. Age group 5 to 7 had lower prevalence, they are being taken care by their parents. These findings are similar to that of Mwenji (2010). According to this findings, the highest number of infections occurred within the age group 9 to 11years age category at 106(9.7%), 12 to 14years at 87(7.8%) and 6 to 8years at 12(1.1%). It is also similar to the findings of Opara *et al.,* (2012), where she reported to have said, the highest infection rate is at the age group 6-10 years 54.8%, followed by age group 1-5 years 48.2%, while the lowest percentage infection in the age group >20 years 27%. The reason for the fact that children in this age group were not knowing the conditions of hygiene, such as eating different foods from a variety of sources may be outside the home which gives a greater chance of infection, diarrhea and lack of parental interest in trying their self-reliance in addition to the incomplete maturity of the immune system of children (Mohammed *et al*.,2015).

The association between parasitic infection and malnutrition has been reported (Raheem *et al.,* 2014). Parasites are known to depend on their host for nutrients and in the process deprive the host of essential nutrient needed for growth and development. The inverse relationship observed between body mass index (BMI) and intestinal helminthes is therefore not surprising. BMI which is a measure of malnutrition reflected severe malnutrition in pupils infected with parasitic infections. *G. lamblia*and *A. saginata* may be directly interfering with intestinal absorption as in most intestinal helmintosis (Friedman *et al.,* 2005; Hotez and Kamanth, 2009; Shaw and Friedman, 2011).

The current study recorded a high degree of malnutrition among the pupil students investigated for intestinal parasitic infections. Pupils aged 8-10 in rural or densely populated areas were found to be underweight due to severe malnutrition (Figure 4.2). This rate is similar to what was documented by Goon *et al.,* (2011) in which they reported 43% to be underweight in Benue State Suswam *et al.,* (2013) also reported 57.9%. The higher rates of underweight were however reported by Adekunle *et al,* (2015) in rural and semi-urban communities of Osun State who reported 70.0% and 54.7% in the year 2015. These findings agree with the publication of other researchers (Stephenson *et al.,* 2000; Hadidjaja *et al.,* 2014).

5.0 CONCLUSION

The major intestinal parasites identified in all samples from school children in Nassarawa Local Government were *E. histolytica, G. lamblia, T. trichiura, S. mansoni, E. vermicularis, H. nana, F. hepatica and T. saginata.* The findings for the current study showed that, intestinal parasitic infections were prevalent among the primary school children in Nassarawa Local Government, with *G. lamblia* 19(27.9%) and *T. saginata* 11(5%) constituting over 50% of the infections.

Helminthic infections were the major public health challenge in the schools examined. Ages 8 to 10years and 11 to 13years had the higher prevalence rate of infections with 26(47.3%) and 15(45.5%), respectively. Finally, the study showed that females also weremore infested than males with 32(53.3%) and 22(36.7%), respectively.

Therefore, the prevalence of intestinal parasitic infection in this research was high and was significantly associated with the nutritional status as indicated by the BMI index for age. Additionally, the level of awareness on the possible causes of helmintosis by the communities in Nassarawa L.G area is low as reflected by over 70% of the pupil participants. It was such that children with intestinal parasitic infections were more malnourished when compared with those with no infection.

Hence, there is need for regular de-worming of pre-school age children, especially those living in the rural and congested areas. Therefore, reducing the prevalence of parasitic infections in primary school children may be of great advantage on child growth, development and educational outcome.

5.1 RECOMMENDATIONS

The poor perception of intestinal helmintosis 19(15.8%)by this portion of the population could be a threat to helmintosis control in the Local Government, the state in particular and the nation in general. Thus, the need for stakeholders and relevant Government Health Agencies to help these less privileged and vulnerable group of primary school children by educating them on the mode of transmission of intestinal parasites, providing them with relatively rich, cost-effective feeding regime and administration of the free treatment to those infected via mass treatment programs.

ACKNOWLEDGEMENT

This research was supported financially by Tertiary Education Trust fund (TETfund) Nigeria and Kano State Polytechnic, Kano State, Nigeria. We also express our sincere appreciation to the head-teachers, parents, pupils, for their approval and cooperation throughout the duration of the study.

COMPETING INTERESTS

We declared no conflicts of interest in this research.

REFERENCES

Adekunle, L. (2015). Intestinal Parasites and Nutritional Status of Nigerian Children. African Journal of Biomedical Research; 4(5):115–119.

Amuta, E., Olusi, T., Houmsou, R. (2013). Relationship of intestinal parasitic infections and malnutrition among school children in Makurdi, Benue State, Nigeria. The Internet Journal of Epidemiology. (1):20–24.

CDC (2012). Anthropometric reference Data for children and adults, United State 2007-2010. DHHS Publication, pp. 1-2.

Cheesbrough, M. (1998). District laboratory practice in tropical countries, Part 1, Cambridge, Cambridge University Press. Pp. 190-235.

Christine, M. (2015). PhD, Parasitologis. Everything You need To Know About Parasites. Types of Parasites: Protozoans &Helminths. Center for Disease Control and Prevention; World Health Organization.

Eleni, K., (2012).Prevalence of Intestinal parasitic infections and their associations with anthropometric measurements of school children in selected primary schools, wukro town, eastern tigray, Ethiopia. M.Sc. Thesis.

Friedman, JF, Kanzaria, HK, McGarvey, ST (2005) Human schistosomiasis and anemia: the relationship and potential mechanisms. Trends Parasitol 21: 386-392.

Garcia, LS, Bruckner, DA (1997). Diagnostic medical parasitology. 3rd ed. Washington, DC: ASM Press.

Gelaw, A., Endris, M., Lemma, W., Belyhun, Y., Moges, B., Angaw, B. (2013): Prevalence of intestinal parasites and associated risk factors among students of Fasil general elementary school Azezo, Northwestern Ethiopia. Ethiop J, Health Biomed Sci.

Goon, D., Toriola, A., Shaw, B., Amusa, L., Monyeki, M., Akinyemi, O. Anthropometrically Determined Nutritional Status of Urban Primary School children in Makurdi, Nigeria. Benue State Ministry of Public Health,2011; 11(1):769.

Hadidjaja, P., Bonang, E., Suyardi, M., Abidin, S., Margono, S. (2014). The Effect of Intervention Methods on Nutritional Status and Cognitive Function of Primary SchoolChildren Infected with Ascarislumbricoides. American Journal of Tropical Medicine and Hygiene. (9):791–795.

Hotez, PJ, Kamanth, A. (2009) Neglected tropical diseases in Sub-Saharan Africa: review of their prevalence, distribution and disease burden. PLoSNegl Trop Dis 3: e412.

Jaiswal, S., Dhaka, Raj, Pant, Bishnu, Raj, Tiwari1, Jay, Prakash, Sahl, Ravin, Bhandaril, and Shraddha, Upadhyaya (2014). Prevalence of Intestinal Parasite among School Children of Bharatpokhari V.D.C., Kaski, Nepal. British MicrobiologyResearch Journal 4(9): 1007-1012.

Mohammed, M., Vantsawa, PA, Abdullahi, UY, Muktar, MD (2015) Nutritional Status and Prevalence of Intestinal Schistosomiasis among Al-majiri Population in Kawo District of Kaduna Metropolis, Kaduna State-Nigeria. J BacteriolParasitol 6: 237. doi:10.4172/2155-9597.1000237.

Moussa, S., Pascal, M., Adama, DK, Magnussen, ST, Aly, L. et al. (2011) Impact of Schistosomahaematobium infection on urinary tract pathology, nutritional status and anaemia in school aged children in two different endemic areas of Niger River basin, Mali. Journal actatropica 120: S142-S150.

Mwenji, B. M. (2010).A thesis submitted in partial fulfillment for the award of the degree of Master of Public Health in the School of Health Sciences of Kenyatta University. *The Influence of Intestinal Parasites on Academic Performance Among Primary School Children In Nairobi Province, Kenya.*

Nokes, C., Bundy, D. (2015). Compliance and Absenteeism in Schoolchildren: Implications for Helminth control. Transaction of the Royal Society of Tropical Medicine and Hygiene. 8(7):148–152.

Opara, K., Udoidung, Okon D, Edosomwan E., Udoh, A. The Impact of Intestinal Parasitic Infections on the Nutritional Status of Rural and Urban School-Aged Children in Nigeria. International Journal of MCH and AIDS.2012; 1(1):73-82.

Oyeniran, O., A., Ojurongbe, O., Oladipo, E.K., Afolabi, A.Y., Ajayi, O.O. Oloke, A.A. (2014)Intestinal Parasitic Infection among Primary School Pupils in Osogbo Nigeria**.** Journal of Dental and Medical Sciences (IOSR-JDMS).

Quihui, L., Valencia, M.E, Crompton, DWT, Phillips, S., Hagan, P, G. Morales (2006). Role of the employment status and education of mothers in the prevalence of intestinal parasitic infections in Mexican rural schoolchildren. BMC Public Health; (6):225.

Raheem, S., Ayemi, JO, Fashedemi, AO (2014) Easing the 'Disease' of poverty in Nigeria. Journal of Developing country studies 4: 155-166.

Shaw, JG, Friedman, JF (2011). Iron Deficiency Anemia: Focus on Infectious Diseases in Lesser Developed Countries. Anemia 2011: 10p.

Stephenson, L., Latham, M., Ottesen, E. (2000). Malnutrition and parasitic helminth infections. Journal of Parasitology. 12(1):573–595.

Stephenson, L., Latham, M., Ottesen, E. Malnutrition and parasitic helminth infections. Journal of Parasitology. 2000;(12)1:573-595.

Stolzfus, R., Albonico, M., Tielsch, J., Chwaya, H., Savioli, L. (997). Linear Growth Retardation in Zanzibari School Children. American Society for Nutritional Sciences. 12(7):10–19.

Suswam, E., Ogbogu, V., Umoh, J., Ogunus, R., Folaranmi, D. Intestinal Parasites among School Children in Soba and Igabi Local Government Area of Kaduna State, Nigeria. Nigerian Journal of Parasitology. 2013;1(3):39-42.

UNICEF/WHO (2009). Orphan situation in Nigeria. UNICEF press release. Pp. 78–84. Available in http://www.unicef/orphan_situation_in_nigeria htm.

UNICEF/WHO (2009a). State of the World Children 2008-Child Survival. Pp. 89–93. Available in http://www.unicef/who.

World Health Organization (1991). Basic Laboratory Methods in Medical Parasitology. Geneva, Switzerland: World Health Organization; pp. 45–69.

World health Organization (2000a). The World Health Report, 2000. Geneva**.**

World Health Organization (2000b). Informal consultation on intestinal helminthes infection. Geneva, Switzerland: WHO. Pp. 16–18.

World Health Organization (2000b). Informal consultation on intestinal helminthes infection. Geneva, Switzerland: WHO. Pp. 16–18.

World Health Organization (2012). The Use and Interpretation of Anthropometry. Report of a WHO Expert Committee. Geneva, Switzerland: World Health Organization. Pp. 2–5.