https://dx.doi.org/10.4314/dujopas.v10i4c.21
ISSN (Print): 2476-8316
ISSN (Online): 2635-3490
Dutse Journal of Pure and Applied Sciences (DUJOPAS), *Vol. 10 No. 4c December 2024*

Prevalence of Gastrointestinal Parasites Among School Children in Ngurore, Yola South LGA., Adamawa State, Nigeria

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Abstract

Gastrointestinal parasites are those types of intestinal parasites, which infect the lumen and lining tissue of the lumen of the small and large intestines. Around 1.5 billion people suffer from soil-transmitted helminths, above 267 million preschool children, and over 568 million school-age children reside in gastrointestinal helminths prevailing areas. These infections are regarded as serious public health problem, as they cause iron deficiency anemia, growth retardation in children and other physical and mental health problems.

This study was carried out to determine the prevalence and intensity of Gastrointestinal parasites among school children in Ngurore community, Yola - South LGA. Data for this study was collected from 5 primary schools in Yola South Local Government Area. The result show that Wuro Yanka Primary School had the highest prevalence infection with 58(44.6%), followed by Ngurore Central Primary School 15(9.3%), Alfurqan Academy 9(22.5%), Abaifa International Academy 4(10.0%) and Sharp Brain 3(6.0%) had the least prevalence of infection. Hookworms have the highest prevalence 47 (12.3%) followed by Ascaris lumbricoides 23 (6.0%), Trichuris trichiura 7 (1.8%), Entamoeba coli 6 (1.6%), Giardia lamblia, Stongyloides stercoralis 2 (0.5%) and Enterobius vermicularis 2 (0.5%). Socioeconomic disparities, such as access to good education, clean water and sanitation facilities, may contribute to variations in infection rates among different age groups. Children from lower socioeconomic classes may face greater challenges in accessing clean water, and sanitation, thereby increasing their susceptibility to parasitic infection.

Keywords: Gastrointestinal parasites, Infection, Prevalence, Yola, Ngurore

INTRODUCTION

Gastrointestinal parasitic infections are the main causes of health deterioration in developing countries, and are among the most common infections all over the world (Ngui *et al*. 2008). It is estimated that around 3.5 billion people are affected by different diseases, and that 450 million are feeling uncomfortable as a result of gastrointestinal parasitic infections, the

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majority of them being children (Ngui, 2013). In Nigeria, high morbidity rates in children have been correlated with gastrointestinal parasitic infection (Unachukwu, 2014).

Gastrointestinal helminths and protozoan infections are important sources of sickness and death all over the world, Protozoan and Soil Transmitted Helminths (STHs) are the primary causative agents of gastrointestinal parasites (Haque, R.2007). Humans exhibit various kinds of parasites that contain both protozoan and helminth; protozoan includes *G. lambia*, *Cryptosporidium,* and *E. histolytica* species while four species of gastrointestinal helminthic parasites, also known as soil-transmitted helminths include: *Ascaris lumbricoides* (roundworm), *Trichiuris trichiuria (*whipworm), *Ancylostoma duodenale* and *Necator americanus* (Hookworms). These infections are most prevalent in tropical and subtropical regions of the developing world where adequate water and sanitation facilities are lacking (Savioli *et al*., 2004).

Children are particularly susceptible to parasitic infection and re-infection because they are potentially more exposed to pathogens, having an underdeveloped immunity system, immature personal hygiene efforts, and dependent on the care of others (Krause *et al.,* 2005). The spread and occurrence of different gastrointestinal parasites vary from region to region. This might be due to multiple interconnected factors such as: Environmental (rainfall patterns, temperature, ecosystem diversity etc), Socioeconomic (education level, economic status, access to clean water etc), Human behavioural (cultural practices, dietary habits, population density etc) and Biological (genetic variation, host immunity etc) (WHO, 2017). These infections spread mostly in areas with poor sanitation and are most common in tropical developing countries of African, Asian, and South American continents (CDC, 2011). For many years, medical practitioners have acknowledged the substantial impact of gastrointestinal parasitic infections on the health of Nigerian children. School children carry the heaviest burden of the associated morbidity due to their dirty habits of playing or handling infested soils, eating with soiled hands, unhygienic toilet practices, drinking and eating contaminated water and food, These infections have been associated with an increased risk for nutritional anaemia, protein-energy malnutrition and growth deficits in children (Sackey *et al* 2003).

Absar *et al.* (2010) reported that the public health and socio-economic consequences of intestine helminths are of considerable global concern, especially in children's health and development where it can cause malnutrition, which compromises their learning capabilities in their formative years.

Different authors have reported a high predominance of gastrointestinal parasites among children in sub-Saharan African countries; 22–95% in Nigeria and other parts of Africa (Mohammed *et al*., 2015; Erismann *et al.*, 2016; Gyang *et al.*, 2019). As a result, continuous monitoring of intestinal parasites and their associated risk factors is necessary among school children in the country, particularly in places where basic amenities are lacking. Information/data on the spread of gastrointestinal parasitic infections in the study area is scarce. Consequently, this study was carried out to ascertain the prevalence of gastrointestinal parasites among school children in Ngurore, Yola South, LGA, Adamawa State, Nigeria

MATERIALS AND METHODS

Description of Study Area

This study was conducted among primary school children of Ngurore community, Yola South LGA of Adamawa State. Ngurore is within latitudes 9°17′19″, and longitudes 12° 14′24″E with an area of about 923,768 km². Temperature ranges from 33°C in April and 27°C in August

(Google map). The region experiences a tropical climate characterized by distinct dry and wet seasons. The rainy season commences from May and ends in October (sometimes during middle or late October), the rainfall has a mean total of 1113.3mm, August and September being the wettest months with about 25% of the total annual rainfall (National Population Commission, 2016). This serves as an edge for the parasitic diseases to leverage particularly for the months mentioned above (August and September). The vegetation in Ngurore environment is a secondary type due to human activities through construction, farming, wood gathering for fuel and grazing have altered the natural vegetation (Adamawa State Dairy, 2008). Most indigenes of Ngurore are civil servants, farmers, fishermen, and petty traders.

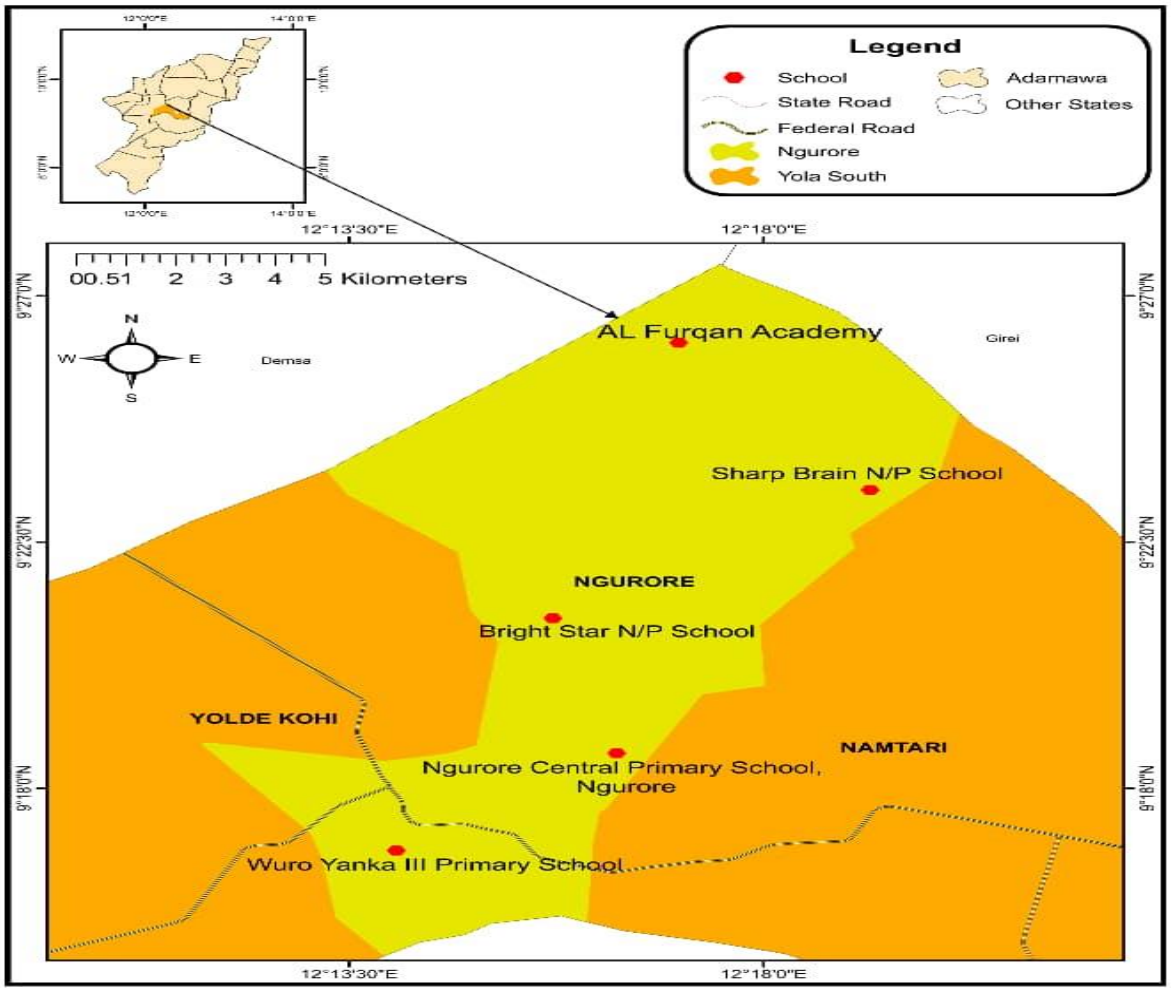

FIG 1: Map of Adamawa showing Ngurore
Source: Research Gate

Research Design

This is a cross sectional research design aimed to determine gastrointestinal parasites among Primary school children within the Ngurore community, Yola - South Local Government, Adamawa State. Individuals were selected randomly within the community including both male and female children. After obtaining an inform consent, a questionnaire was dispensed out to the volunteers.

Population Size

The population size focused on school children within Ngurore, Yola South, LGA, Adamawa State, which includes individuals aged between 1-15 years in schools, 200 students were

picked as per their availability irrespective of age, gender, health background, or tribe during the study period. The study was carried out in the month of September to November 2023.

Sampling Procedure

Since no previous studies had been done on gastrointestinal parasites among school children in the study area, we adopted a conservative sample size estimation approach using 50% prevalence. The sample size was calculated according to the formula proposed by Naing *et al*. (2007).

We calculated the sample size using the formula provided by Araoye in 2004.

$N = Z^2Pq/L^2$

Where: N = Sample area; Z = Confidence internal is 1.96 for 95%; P = Prevalence of 50% (0.50)
q = (1 – p) = 1 – 0.83 = 0.17; L = Permissible error is 0.05 (5%)

$$n0 = \frac{(1.96)^2 X\ 0.50\ X\ 0.50}{(0.05)^2}$$

$$n0 = \frac{3.8416\ X\ 0.25}{0.0025} \qquad n0 = 384$$

Since our actual population is finite, we can use the Cochran formula for finite population, thus

$$n = \frac{n_0}{1+\frac{n_0}{N}}$$

$$n = \frac{384}{1+\frac{384}{1860}}$$

n= 380

Stool Collection and examination

Clean sample bottles were shared to the volunteers with a clear and continuous guide about the procedure for stool specimen collection following the collection system extensively used in Human Microbiome Project (2012). All the stool samples were retrieved early in the morning and conserved and it was transported to the laboratory in Modibbo Adama University (MAU) after the exercise. Following WHO (1992) laid down steps on examining gastrointestinal and intestinal parasitic organisms with simple direct smear and formalin ethyl acetate concentration technique.

For parasitological analysis, fresh stool samples collected from the volunteers were instructed adequately and were given clean stool sample bottles which the cap has a stick for packing the stool and each bottles had a tag on it. The stool samples were preserve in 10% formalin immediately after retrieving the bottles before transporting to the laboratory, where 1g of each sample were processed and examine microscopically using direct wet mount and formal ether concentration techniques following the laid down guidance of WHO guidelines (WHO, 1992) as direct wet mount is the most preferred methods for the identification of motile protozoans while formal ether concentration method is used to recover helminth eggs and larvae.

Laboratory Procedures (Parasitological Examination) Formalin-ether Concentration Method

Stool samples were processed using formal-ether sedimentation technique as described by Garcia (2010). A small portion of stool samples (about 1g) was mixed thoroughly into 10ml of saline solution. The emulsion was filtered through fine mesh gauze into a conical centrifuge tube and the suspension was centrifuged at 2,500 for about 5 minutes. The supernatant was

decanted and the sediment was suspended in 10ml of normal saline solution and was re-centrifuged. The same process continued until the supernatant was clear. The supernatant was then poured out and 10ml of 7% formal saline was added, 3ml of ether was added and shaken vigorously before centrifuging again at 2500g for about 5 minutes. Using a stool bottle cap stick, the top plug of the debris formed was freed and the supernatant was decanted. A drop of the sediment was placed on a glass slide and a drop of iodine was added and covered with a cover slip, it was then viewed under a microscope at x10 magnification (Garcia, 2010).

Data Analysis

The statistical analyses were conducted using IBM SPSS Statistics version 20 (IBM. Somers, NY). Prevalence and intensity estimates were cross-tabulated with demographic data, and associations were determined using the Pearson Chi-square test (X2). Analysis of variance (ANOVA) was used for comparing intensity estimates among surveyed schools. Significances is set at $P \leq 0.05$. We calculated the percentage of gastrointestinal parasites by dividing the number of positive samples by the total samples and multiplying by 100. Statistical association between variables was set at 5% level of significance.

RESULTS AND DISCUSSION

RESULTS

Prevalence of gastrointestinal parasite infection among school children

Data for this study was collected from 5 primary schools in Yola South Local Government Area. The Primary Schools are: Abaifa International Academy, Ngurore Central Primary School, Sharp Brain, Alfurqan Academy and Wuro Yanka Primary School. A total of 40 pupils were selected from Abaifa International Academy, 120 from Ngurore Central Primary School, 50 from Sharp Brain, 40 from Alfurqan Academy and 130 from Wuro Yanka Primary School, thus making an overall total of 380 pupils that were randomly selected and examined. The overall prevalence of infection was 89(23.4%). The result also showed that Wuro Yanka Primary School had the highest prevalence of infections with 58(44.6%), followed by Alfurqan Academy 9(22.5%), Ngurore Central Primary School 15(9.3%), Abaifa International Academy 4(10.0%) and the least prevalence of infection was pupils from Sharp Brain 3(6.0%). (Table 1)

Association Between Prevalence of Gastrointestinal Parasites Infection in Relation to Age

Table 2 shows the association between the prevalence of gastrointestinal parasite infection and the age of the school children. In Ages 5-7, Hookworm had the highest number of infection 5(6.9%), followed by *A. lumbricoides* 2(2.8%), the least were *E. coli*, *E. vermicularis*, *G. lambia*, *S. stercoralis,* and *T. trichuria* having 0(0.00%). In ages 7-9, Hookworm had the highest prevalence 6(10.0%), followed by *A. lumbricoides* 3(5.0%), *T. trichuria* having1(1.7%), least were *E. coli, E. vermicularis, G. lambia, S. stercoralis* having 0(0.00%). In ages 9-11, Hookworm had the highest prevalence 9(10.8%), followed by *A. lumbricoides* 3(3.6%), *T. trichuria* having 1(1.2%), least were *E. coli, E. vermicularis, G. lambia, S. stercoralis* having 0(0.00%). In age 11-13, Hookworm had the highest prevalence 9(13.6%), followed by *A. lumbricoides* 4(6.1%), *T. trichuria,* and *E. coli* having 1(1.5%) each, the least were *E. vermicularis, G. lambia, S. stercoralis* having 0(0.00%). In age 13-15, Hookworm had the highest prevalence of 18(18.2%), followed by *A. lumbricoides* 11(11.11%), *E. coli* having 5(5.1%), *T. trichuria* having 4(4.0%), *E. vermicularis, G. lambia, S. stercoralis* having 2(2.0%%) each. According to this result, we can say the age range between 13 -15 had the highest number of participants examined and the highest number of infections.

Table 1: Prevalence of gastrointestinal parasite infection among schoolchildren

School	No. Examined	No. Infected	Prevalence (%)
AIA	40	4	10.0
NCPS	120	15	9.3
SB	50	3	6.0
AA	40	9	22.5
WYPS	130	58	44.6
Total	380	89	23.4

$\chi 2 = 59.08$ (Calculated); $\chi 2 = 9.49$ (Tabulated); df = 4; p = 0.0001
AIA= Abaifa International Academy NC= Ngurore Central Primary School
SB= Sharp Brain AA= Alfurqan Academy WYPS= Wuro Yanka Primary School

Table 2: Association between Prevalence of Gastrointestinal Parasites Infection and School Children's Age

Age	Number Examined	*A.lumbricoides*	*E. coli*	*E. vermicularis*	*lamblia*	*ookworms*	*stercoralis.*	*trichuria*
5-7	72	2(2.8)	0(0.0)	0(0.0)	0(0.0)	5(6.9)	0(0.0)	0(0.0)
7-9	60	3(5.0)	0(0.0)	0(0.0)	0(0.0)	6(10.0)	0(0.0)	(1.7)
9-11	83	3(3.6)	0(0.0)	0(0.0)	0(0.0)	9(10.8)	0(0.0)	1(1.2)
11-13	66	4(6.1)	1(1.5)	0(0.0)	0(0.0)	9(13.6)	0(0.0)	1(1.5)
13-15	99	11(11.11)	5(5.1)	2(2.0)	2(2.0)	18(18.2)	2(2.0)	4(4.0)
Total	**380**	**23(6.0)**	**6(1.6)**	**2(0.5)**	2(0.5)	**47(12.4)**	**2(0.5)**	**7(1.8)**

Hookworms spp $\chi 2 = 7.36$; df = 2; p = 0.05
Stongyloides stercoralis $\chi 2 = 2.19$; df = 2; p = 0.008
A. lumbricoides spp $\chi 2 = 8.52$; df = 2; p = 0.042
T. trichuria $\chi 2 = 1.59$; df = 2; p = 0.012
E. coli $\chi 2 = 4.25$; df = 2; p = 0.01

Risk factors in Intestinal Parasites Infections

Table 3 presents the association between intestinal parasite infection and children's risk factors. The result indicates high infections among children who do not wear shoes when outside 59(66.26%) and was low in children who wear 30(33.71%). This result indicates children who do not wear shoes outside are more susceptible to injuries, puncture wounds, and infection caused by sharp objects, contaminated surfaces, and exposure to environmental hazards.

Among the participants majority wear boots when at the farm 20 (22.47%) while those who do not have the highest number of infected pupils 69(77.53%). For children who engage in open defecation 50(56.18%) had the highest than those who do not 39(43.82%). The result implies that wearing boots can reduce the risk of infections for children by protecting their feet from cuts, scrapes, and exposure to bacteria in soil or animal waste. However, children who practice open defecation are at higher risk of exposure to faecal matter, leading to diseases like diarrhoea, cholera, and parasitic infections.

Majority 60(77.53%) of the respondents had a domestic animal at home, while only 29(22.47%) do not have one. Among them 60(77.53%) which is the highest come in contact with animals while only about 29(22.47%) do not come in contact with the animals. The result implies that most of the children come in contact with animals which may expose them to various infections, including bacteria, viruses, and parasitic diseases such as ringworm, Salmonella, and *E. coli*. Therefore, it is very crucial to teach children proper hygiene after handling animals to reduce the risk of transmission and ensure they receive timely vaccinations and deworming treatment for pets or farm animals.

Most of the children after coming in contact with animals do not wash their hands 69(77.53) while those that wash their hands have a few numbers of infections 20(22.47), Failure of children to wash their hands after each contact with animals is very crucial in increasing the rate of parasite infections such as *E.coli*, Lassa fever, swine influenza and leptospirosis. Washing hands with soap and water with proper hand hygiene can help prevent the spread of bacteria.

The result in the table also indicates that about 55(61.80%) drink zobo, kunun aya, and kunun zaki at roadside had the highest number of infections than people who do not drink 34(38.20). this result implies that most of the children take local beverages at the roadside which pose a risk of infection for children due to potential contamination from unclean water, improper storage, or poor hygiene practices during preparation.

The majority of the children always eat with bare hands 65(73.03%), while those who do not 24(26.97%). There is a significant difference between intestinal parasite infection and children's risk factors. The implication of this preceding shows that eating with bare hands can increase the risk of infection for children if hands are not properly washed, as bacteria and pathogens from the surfaces or previous contacts can be transfer to food. There is no significant different at $p < 0.05$

Table 3: Risk factors in Intestinal Parasites Infections

Risk factors	No. examined (%)	No. infected (%)	P value
Do you wear shoes when outside			
Yes	250	30(33.71)	
No	130	59(66.26)	
Total	380	89(23.4)	0.010
Do you wear boots when at the farm?			
Yes	280	20(22.47)	
No	100	69(77.53)	
Total	380	89(23.4)	0.012
Do you open defaecation			
Yes	80	50(56.18)	
No	300	39(43.82)	
Total	380	89(23.4)	0.007
Do you rear animals at home?			
Yes	290	60(77.53)	
No	90	29(22.47)	
Total	380	89(23.4)	0.004
Do you come in contact with animals?			
Yes	290	60(77.53)	
No	90	29(22.47)	
Total	380	89(23.4)	0.0012
Do you wash your hands after coming in contact with animals			
Yes	250	20(22.47)	
No	130	69(77.53)	
Total	380	89(23.4)	0.001
Do you drink street sold drink (i.e zobo etc)			
Yes	280	55(61.80)	
No	100	34(38.20)	
Total	380	89(23.4)	0.009
Do you eat with bare hand?			
Yes	310	65(73.03)	
No	70	24(26.97)	
Total	380	89(23.4)	0.016

DISCUSSION

Prevalence of Gastrointestinal parasites among school children in Ngurore Community

Intestinal parasites are a widespread global health problem that seriously impacts children's health, growth, and development. Communal settings like daycare and orphanage centers dramatically increase children's infection risks.

The overall prevalence of gastrointestinal parasites among school children in Ngurore Community agrees with previous work by Oguoma *et al.* (2008) in Imo State, where they reported a prevalence of 24.8%. It also agreed with the works by Mbae *et al.* (2013) in their study on intestinal parasitic infections in children with diarrhoea in outpatient and inpatient settings in an informal settlement with an overall prevalence of 25.6%. Parasites encountered in the present study were *Ascaris lumbricoides*, *Enterobius vermicularis*, *Entamoeba coli* Hookworm, *Strongyloides stercoralis Tricuris trichuria,* and *Giardia lamblia*. This finding was similar to studies conducted elsewhere by Adebote *et al.* (2004), Houmsou *et al.* (2010), Adefioye *et al.* (2011) and Pukuma *et al.* (2022). They all attributed these parasites' presence to several factors, including poor personal hygiene, overcrowding, waste management, and human behavior.

However, the prevalence of intestinal parasites recorded in this study shows the level of uncultured practices exhibited such as poor hand hygiene, open defecation, unsafe food handling, lack of sanitation facilities, living in unsanitary conditions, poor personal hygiene and contact with contaminated environment. It could also have been linked to poor individual and environmental hygiene, host genetic makeup, and geographical factors. According to Oluwaseun *et al.* (2023) on an examination of knowledge and perception of personal and environmental hygiene in the transmission of communicable diseases among rural dwellers in Oyo State found that 188 (62.66%) and 86 (28.67%) maintain environmental hygiene to the highest standard while 22 (7.33%) and 4 (1.33%) sometime and rarely clean their houses.

Association between the prevalence of gastrointestinal parasites and school-age children in Ngurore Community

Generally, the most prevalent intestinal parasites in relation to pupil's age were: Hookworm, *Ascaris lumbricoides*, *Trichuris trichiura*, *Entamoeba coli, Giardia lamblia*, *Enterobius vermicolaris*, and *Strongyloides stercoralis*.

Hookworm was the most prevalent 12.4% all through the months; this prevalence showed a decline in infection when compared with previous works by Egwunyega *et al.* (2004) who reported infection of 22.5% at Eku in Delta State of Nigeria and Nwosu *et al.* (2004)) who in their findings, reported 25.8% in Aba, Abia State, Nigeria.

Children particularly those in the pre-teen- and teen-age group, may engage in activities such as hand washing and cleaning of environment that increase their exposure. The greater part of protozoan infection may be as a result of availability of farming land in rural areas where the schools are situated, and their contamination with faecal matter due to open defaecation. Lack of public awareness and use of contaminated drinking water and resistant to chlorine by the cyst form of the protozoan parasites (Dahal *et al.* 2018). The lower prevalence of infection exhibited by the intermediate age group of 5-7 compared to the pre-teen and teenagers may be due to preventive behaviors exhibited and imposed on the children. It seems that the parents showed more concern on the early aged children compared to the teenagers, this is in contrast with Okpala *et al.* (2014) in their study on the prevalence of intestinal parasites among children attending daycare and orphanage centers

in Kaduna Metropolis Kaduna State who report that the overall prevalence intestinal parasites in the study was 9.2%.

CONCLUSION

In conclusion, the parasite species found in the study area including intestinal parasites such as Hookworm was the most predominant, followed by Ascaris *lumbricoides*, *Trichuris trichiura*, *Entamoeba coli Giardia lamblia, Enterobius vermicularis*, and *Strongyloides stercoralis* were identified in the study. The prevalence rates underscore the need for comprehensive strategies that address factors such as poor sanitation, limited access to clean water, and inadequate health education. By implementing effective interventions and prioritizing public health measures, policymakers and healthcare professionals can significantly reduce the impact of gastrointestinal parasites on the well-being and prospects of children in underdeveloped nations.

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