A Comparative Study of Gastrointestinal Parasites among Secondary School Students in the Rural and Urban Communities of Makurdi Local Government Area of Benue State, Nigeria

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Abstract
Intestinal parasitic infections have always been an important public health problem in the tropics and subtropics particularly in developing countries. A comparative study involving 300 secondary school children of both sexes and ages of 10-24years in two rural and two urban secondary schools in Makurdi Local Government Area of Benue State Nigeria was investigated between the months of October, 2016 through March 2017. Saline wet mount and sedimentation techniques were employed for the study. Out the 300 feacal samples examined 127(42.3%) were infected with different intestinal parasites. The parasites and their prevalence rates found were *Giardia lamblia* (6.3%), *Entamoeba histolytica* (9.4%), *Ascaris lumbricoides* (37.8%), *Taenia spp* (3.1%), *Enterobius vermicularis* (1.6%), *Trichuris trichuira* (8.7%), Hookworm (22.8%), *Fasciola Sp.* 10.2% respectively. *Ascaris lumbricoides* recorded the highest prevalence 37.8% while *Enterobius vermicularis* had the lowest infection rate 1.6%. Junior Secondary School/Universal Basic Education Apir had the highest prevalence 46.2% and Padopas Harmony Secondary School High level had the lowest prevalence 28.6% ($P<0.05$). Rural secondary school children had the highest prevalence 44.2% while urban secondary school children had the lowest 40.7% ($P<0.05$). The prevalence of intestinal parasites in relation to sex and age showed no significant difference. However, it was observed that there was a slight decline in prevalence as the age increased. Single parasitism was 30% while poly-parasitism was 6.66 % ($p>0.05$). The prevalence of parasitic infection in relation to water source showed no significant difference ($P>0.05$) while occupation of parents showed a significant difference ($P<0.01$) in the parasitic infection among students. Prevalence based on mode of faecal disposal showed a significant difference ($p<0.01$) in the infection rate. Result showed that there was a direct correlation between students' hygiene and parasite prevalence rates.

Keywords: Gastrointestinal Parasites, Secondary School Students, Rural, Urban, Makurdi, Nigeria.

1.0 INTRODUCTION

Parasitic infections have continued to present a major challenge to the health and well-being of millions of people across the world, particularly those living in the poorest regions of the tropics and subtropics [1]

Intestinal parasitic infections are endemic worldwide and remain major public health problems in many tropical and subtropical countries [2]. It is estimated that more than three billion people are infected with intestinal helminthes and protozoa [3]. Gastro-intestinal parasites are identified as a cause of morbidity and mortality throughout the world particularly in the under developed countries [4]. They can be largely categorized into two groups, protozoans (e.g. *Entamoeba histolytical, Giardia duodenalis, Trichomonas horminis, Balatidium coli* etc.) and helminthes (e.g. *Ascaris lumbricoides, Trichuris trichura, Necator americanus* etc) [5]

In sub-sahara Africa, intestinal helminthes are the most common diseases with higher negative public health and socio-economic impact [6]. The transmission of this intestinal parasites infection has behavioural, environmental and biological bases [5]. These parasites are transmitted by ingestion of faecal contaminated food or water or when faecal contaminated hands comes in contact with the mouth or by skin penetration of the larva when in direct contact with faecal contaminated soil.

According to [7] personal hygiene, dietary habits, education level of the community, socio-economic status and climate are among the common factors that influences the distribution and the prevalence

of intestinal parasitic infections. The effects of the intestinal parasitic infections depend on the species of the parasites, the affected organ and the host immunological status. In an immune-competent person, early infection of intestinal helminthes and protozoa may cause diarrhea and other gastrointestinal discomfort such as vomiting and bloating [8]

Patients infected with intestinal parasites often experience abdominal discomfort, dysentery or other general symptoms such as bloating, diarrhea and fever. In heavy infection, serious health conditions and problems such as malnutrition and mental retardation especially in children may occur [8]. Most of parasitological survey of common parasitic infections in Nigeria has been confirmed to rural villages, where poor sanitation and hygiene as well as general ignorance of the disease, provide optimal environment for transmission [9]

Therefore the study is aimed at investigating the comparative prevalence of intestinal parasites among students attending secondary schools in the rural and urban communities in Makurdi, Benue State, Nigeria.

2.0 MATERIALS AND METHODS

2.1 Study Area

The research was carried out in Makurdi the capital of Benue State, a town with latitude of 104 metres above sea level World Atlas. It lies on the sandstone flood plain of its prominent geographical feature the River Benue. Makurdi is located in the heart land of the guinea savanna zone of central Nigeria. The climate of the area is tropical and the vegetation characteristic is predominantly guinea savanna with an annual rainfall of 1000mm. The urban area is defined by a 16km^2 radius with the centre at point with geographical coordinates, latitude 07^0 44'30 and 08^0 31 '24' located within the premises of the general post office and represented on the ground by survey pillar number GMC (Gazette, No 5) (land survey office Makurdi, unpublished data). The town is divided into zones, North bank, Wurukum, High level, Wadata, low level and Ankpa ward. It is inhabited mainly by civil servants, paramilitary, soldiers, trades, fishermen, farmers and craftsmen. Makurdi has a temperature range between a minimum of 27, 38^{0}C to 28, 00^{0}C and a maximum of 30.10^{0}C to 34.09^{0}C (Metrological Department, Nigerian Air force Base Makurdi, Unpublished Data). There are two seasons, the rainy season which last from April to October and the dry season which last from November to March.

2.2 Study Population

A total number of three hundred (300) students aged between10-24 years were selected from 4 secondary schools in Makurdi, Benue state. Using systematic random sampling method, two schools were selected from the rural and two from the urban communities. The principals, tutors and students of the schools were consulted and briefed on the objectives of this study.

2.3 Sample collection and ethical consideration

Informed consent was obtained from the authority of each of the schools and subjects enrolled for the study before samples were collected. The students were educated on the consequences of gastro-intestinal parasitic infections among school-aged children.

All enrolled students were given a clean, dry, wide mouthed sample bottle labeled with serial number, school and demographic information. Questionnaires were also administered to the students to obtain their demographic information. The students were instructed on how to collect their faecal samples and immediately return them.

2.4 Sample analysis

10g of stool sample were collected from the secondary school children into a well labelled wide mouthed sterile specimen bottle. Fresh stool samples were collected in the morning between 7.00am to10.00am without contamination with urine and were immediately transported to the University of Agriculture Makurdi Laboratory for microscopic examination. All samples were examined on the same day of collection, using wet mount and sedimentation techniques as described by [1, 10]. Saline wet mount was made by mixing a small quantity (about 2 mg) of faeces in a drop of saline placed on a clean glass slide. The smear is then examined under microscope. Saline wet mount is used for the detection of trophozoites and cysts of protozoa, and eggs and larvae of helminthes. It is particularly useful for detection of live motile trophozoites of *Entamoeba histolytica*, *Giardia lamblia* etc.

Sedimentation techniques

Fresh faecal specimen was emulsified by mixing about 1g of stool with7 mL of 10% formol saline and was kept for 10 minutes for fixation, then strained through three folds of gauze. The filtrate was added to 3 mL of ethyl-acetatand then centrifuged at 1500rpm for 5 minutes and allowed to settle. The supernatant was removed and two drops of the sediments on a slide covered with a cover slip. The preparations were examined microscopically using X 10 and X 40 objective and observations were recorded [10].

2.5 Data analysis

Chi-square test was used to compare the relative frequencies between group (sex and age). Data analysis was conducted using SPSS version (20 IBM) set at alpha range which shows that when $p>0.05$ it means there is no significant difference in the rate of infection among the frequencies and when the value of $p<0.01$ it means there is a significant difference in the rate of infection recorded.

3.0 RESULTS

Various parasites were recovered among secondary school students in both rural and urban communities in Makurdi. Out of the 300 faecal samples examined, a total of 127 (42.3%) were found to be infected with one or more parasites. *Ascaris lumbricoides* recorded the highest prevalence rate 37.8%, this was followed by Hookworm 22.8 %, *Fasciola sp.* 10.2%, *Entameoba histolytica* 9.4%, *Trichuris trichiura* 8.7%, *Giardia lamblia* 6.3%, *Taenia sp.* 3.11%, while *Enterobius vermicularis* had the lowest prevalence rate 1.6% as shown in table 1.

Table 1: Prevalence of gastrointestinal parasites recovered

Parasites	Number infected (%)
Giardia lamblia	8(6.3)
Entamoeba histolytica	12(9.4)
Ascaris lumbricoides	48(37.8)
Taenia sp.	4(3.1)
Enterobius vermicularis	2(1.6)
Trichuris trichuria	11(8.7)
Hookworm	29(22.8)
Fasciola sp.	13(10.2)
Total	**127(42.3) (p> 0.05)**

Age related prevalence of the infection among students shows that those between ages 10-14 years had the highest prevalence 45.0% followed by those between the ages 15-19, while ages 20-24 had no infection. There was no significant difference between the different age groups (P>0.05) (table 2). Distribution by sex showed more prevalence of Gastro-intestinal parasites in female (44.2%) than in male (40.7%). However no significant difference in the rate of infection between the two sexes (*P*>0.05) as shown in table 2.

Table 2: Prevalence of gastrointestinal parasites in relation to age and sex

Age (years)	No examined	No infected (%)
10-14	160	72(45)
15-19	138	38(27.53)
20-24	2	0(0.00)
Total	300	110(36.67)
Sex		
Male	162	66(40.7)
Female	138	61(44.2)
Total	300	110(36.67)

The result in table 3 showed the Prevalence of gastrointestinal parasites in relation to the selected Secondary schools. Students of Universal Basic Education (Junior secondary school) Apir had the highest infection rate of 46.4%, and this was closely followed by St. Mark's secondary school (37.5%), ECWA secondary school 31.5% while Padopas Harmony secondary school had the lowest infection rate of 28.5%. However, statistical analysis showed no significant difference (p>0.05).

Table 3: Prevalence of gastrointestinal parasites in relation to the selected schools

	Name of School	Number examined	Number positive (%)
Urban	ECWA	73	23(31.50)
	PADOPAS	63	18(28.57)
Rural	UBE	84	39(46.42)
	ST. MARK	80	30(37.50)
	Total	300	110(36.67)

Table 4 showed the prevalence of single and multiple parasitic infections as observed. The analysis shows 30 % prevalence for single parasitism and 6.6 % prevalence for co-infection. Analysis showed no significant difference between locations (rural/urban).

Table 4: Prevalence of Gastro-intestinal parasites in relation to single and co-infection

Parasitism	Urban	Rural	Overall infection (%)
Single parasitism	34	56	90 (30.00)
Poly-parasitism	6	14	20(06.66)
Total	40	70	110(36.67)

From the result obtained, out of the 300 samples examined, in figure 1, students residing in the rural areas of Makurdi recorded the highest infection rate of 48.7%. While students residing in the urban areas had lower infection rate of 34.5% (p>0.05)

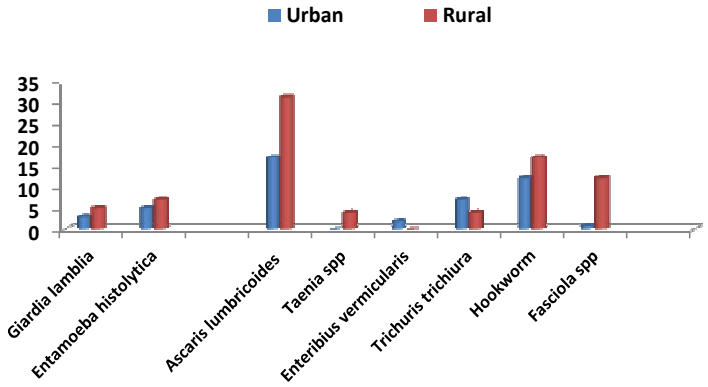

Fig. 1: Prevalence of gastrointestinal parasites in urban and rural communities in Makurdi (p>0.05)

Responses from the questionnaires showed that students who used well as their source of water had the highest prevalence of infection with (38.4%) followed by students who used Tap (37.5%) as source of water and the lowest prevalence was recorded by students who used borehole as source of water with (33.3%) infection rate. There was no significant difference (p>0.05) in the rate of parasitic infection among the studied subjects as shown in table 5. Prevalence of infection according

to occupation of parents, students whose parents were farmers had the highest infection rate (44%) followed by students whose parents were traders (39.1%) while students whose parents were civil servants recorded the lowest prevalence of (26.5%). There was a significant difference ($p<0.05$) in the distribution of parasites among the students base on the occupation of the parents.

Prevalence of infections according to method of faecal disposal, students who defecate in the open field had the highest infection rate (47.2%), followed by those who defecate in pit latrine toilets (41.6%) while students who defecate in water closet had the lowest infection rate of (12.5%). Chi-square analysis shows a significant difference in the distribution of parasites base on the toilet types.

Table 5: Demographic variables of respondents

Factors:	**No examined**	**No infected (%)**	
Water source			
Tap	80	30(37.5)	
Well	130	50(38.46)	
Borehole	90	30(33.33)	
Total	300	110(36.67)	**(p>0.05)**
Occupation of parents			
Farmers	100	44(44.00)	
Traders	87	34(39.08)	
Civil servants	113	30(26.54)	
Total	300	110(36.67)	**(p<0.01)**
Toilet used			
Water closet	208	26(12.50)	
Pit latrine	120	50(41.66)	
Bush	72	34(47.22)	
Total	300	(36.67)	**p<0.01)**

Discussion

The result of the present study revealed that 42.3% of the secondary school students examined in Makurdi Local Government Area of Benue State were infected with different gastro-intestinal parasites. The result obtained from this study is lower when compared with previous studies conducted [11] who reported 58.5% among Children in Makurdi, Benue State, [12] who reported 84.6%, [13] 42.7% in River State, [14] reported 72% in Awka-Etiti, Anambra state, Nigeria, [15] reported 68.1% in Thailand and [16] reported 71.2% in Nepal. The low prevalence in this study may be attributed to an improved sanitation and personal hygiene. In contrast, the overall prevalence was higher in our study when compared to the studies by [17] who reported 30.7%, [18] reported 19.2% in River state, Nigeria, [19] reported 13.8% and 22.4% in Turkey, 38.7% in Oman, 10.94% in Saudi Arabia and 24.4% Gaza 24.5% and 27.6%, Tehran 18.4% and in Cambodia 25.7% [19]. This high prevalence of intestinal parasitic infection in Makurdi may be due to the lack of awareness about personal cleanliness and hygiene among rural population and care free attitude among the rural dwellers.

Parasites identified in this study were *Giardia lamblia, Entamoeba histolytica,* hookworm*, Ascaris lumbricoides, Taenia spp, Enterobius vermicularis, Trichuris trichuria, Fasciola spp.* Among these

parasites, *Ascaris lumbricoides,* hookworm spp and *Entamoeba histolytica* were the most encountered in all the samples. Poor environmental hygiene and socioeconomic conditions are among the factors that promote the survival and transmission of these parasites.

Comparatively, the study showed higher prevalence at the rural areas 44.25% than the urban areas 40.7%. The schools located in the slums of Makurdi (Wurukum and Wadata) and University of Agriculture staff school recorded the high prevalence of intestinal parasitic infections this was attributed to the residential conditions of most parents [20]. Some of the parents reside in the neighboring villages or in the pre-urban quarters such as North-Bank where most areas are unsanitary with widely scattered waste dumps. A combination of factors such as age, area of residence, lack of sanitation facilities especially latrines, shortage of adequate water supply, poor sewage systems, poor personal hygiene practices of students and parental occupations of the students could be responsible for the high prevalence of intestinal parasitic infections among secondary school students [20] The highest prevalence recorded by Universal Basic Education/Junior secondary school Apir could be that the school constitutes more children who play within and outside the school with soil, bare foot and could pick objects on the ground or eat without washing hands. It could also be lack of good sanitary environment and good water.

This study revealed that the children residing in the rural schools had the highest prevalence while the children in urban schools had least prevalence. There was no significance difference between parasitic prevalence and the location of the schools. This study was in agreement with [20] who reported that schools located in the slums of Makurdi recorded the highest prevalence of intestinal parasitic infections. These areas are populated by mainly farmers, fishermen and traders. Schools in this areas lack good toilet systems and are surrounded by garbage dumps and the soil around are contaminated with both human and animal faecal matter.

Ascaris lumbricoides and hookworm were the major intestinal parasites identified from the school children with higher prevalence. Contrary to this finding, some studies in Nigeria and elsewhere had earlier on reported higher prevalence rate of *Entamoeba histolytica*. [21] reported 63.27% around Amalaparam, India. However, similar findings had been reported by [22] who carried out a study on the prevalence of intestinal parasites among school age of pupils in Mafa L.G.A Borno State, Nigeria.

This study revealed that *Ascaris lumbricoides* and Hookworm recorded the highest prevalence. This was in agreement with the study done on prevalence of intestinal parasitic infection in Wukro Town Eastern Trigary, Ethiopia by [23] who reported higher prevalence in *Ascaris lumbricoides* Hookworm and *Trichuris trichuria* respectively. Lack of sanitation facilities in these schools might also contribute to the high prevalence or lack of adequate water supply in the school and houses. Contrary to this, Odu *et al*. (2013) reported higher prevalence of 15.7% among school children in Rivers State, Nigeria.

The study reveals that there was a decline in prevalence as the age increased. This might be due to the fact that children in this age group are often in contact with contaminated water and soil, either in their play ground or during farming activities. Also this can be due to the fact that children within this age group have an under develop immune system and as such are more vulnerable to this parasitic

infections. The decrease in the prevalence in older students may be explained by influence of age on behavior, good personal hygiene practices and developed immunity

This study showed a higher prevalence in females than in males. There was no significant difference between the enteric parasitosis and sex. This suggests that intestinal parasite is independent of sex in Makurdi, Benue State, Nigeria. It agreed with [24] who reported that gender wise parasitic infection rate was found to be almost equal among males and females but disagree with [22] who reported that intestinal parasites were significantly higher in males than females.

Students that used well had more cases of infection than those that use tap and bore-hole as source of drinking water. This might be due to the fact that most of the time; students get their water from the well where these water source are not usually covered; hence they are predisposed to contamination by waste including human and animal faeces containing cyst, ova or larvae, spread by vectors such as flies.

This study revealed that students of lower socio-economic class had a high prevalence of infection. This high rate or infection may be attributed to lack of good drinking water, good toilet systems, constant contact with contaminated soil and water, as most of their parents are farmers and they spend more time on their farms where good personal hygiene practices are not observed.

It has been reported that the availability or lack of sanitary facilities particularly latrine would greatly determine the prevalence of intestinal parasite in any given place. In this study, students that defecate in water closet and pit latrine had fewer cases of parasitic infections than those who defecated in the open. Students who defecated in the open field may sometimes not have access to clean water around the field and even if there is water, it may also have been contaminated with feaces. This is in line with several studies in Nigeria. [20] who reported that children who defecated in the open field recorded high infection rate of hookworm but in contrast with the study carried out by Luka *et al*. (2000).

Conclusion

The study reveals that parasitic infections are prevalent in the study areas but most prevalent in the rural areas than urban areas. Wider population coverage may reveal the hidden facts and figures pertaining to gastrointestinal parasitic infections in rural and urban children.Mass education on hygiene practices, mode of transmission of these parasites as well as prevention should be introduced and intensified in schools, public places and health care centers.

Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper

AUTHORS' CONTRIBUTIONS

Author **AMUTA, E.U.** designed the study, **IBOYI, M.O.,** wrote the protocol, and wrote the first draft of the manuscript. **AJANGEM, S.** and **IBOYI, M.O.,** managed the analyses of the study (collection of samples and parasitological analysis) and performed the statistics. All authors read and approved the final manuscript.

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