(RESEARCH ARTICLE)

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Intestinal helminth and the predisposing factors in Fufore LGA of Adamawa state

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Abstract

Background & Objective: Helminths have plagued humans since the era of our earliest recorded history. A large part of the world's population are infected with one or more of helminthes infection (WHO, 2016). Helminthes are endemic and have been a major problem in rural settlements in Nigeria this is as a result of poor socio- economic status and lack of basic amenities such as pipe borne water and other sanitary facilities (Okon and Okun, 2001). They also have detrimental effects on animal survival (Silva *et al*., 2009) and these parasites have the potential of being transmitted to human (Batchelor *et al*., 2008). To provide information on the prevalence, intensity and predisposing factors of intestinal helminth among School-aged children in relation to their age and gender in Fufore.

Methods: A cross sectional study was carried out to determine the prevalence of intestinal helminth and the predisposing factors in Fofure LGA of Adamawa State between October and November 2022 where five Schools were sampled for the study. 300 Students between the ages 0-15 years were randomly selected and grouped into three age groups (0-5, 6-10, 11-15). 300 stool samples were obtained from the students and examined. Each were issued a structured questionnaire so as to obtain their demographic characteristics and to examine the possible risk factors associated with this infection.

Result: out of the 300 Students examined, 17(5.7%) were positive for intestinal helminth and the Males (6.7%) had significantly higher prevalence ($P < 0.05$) than the Females (4.4%). In respect to age, the age group 0-5 (11.5%) were significantly more infected ($P < 0.05$) followed by the age group 6-10 (7.9%) than the extreme age group 11-15 (1.5%) examined. Three parasites namely *Schistosoma mansoni*, *Ascaris lumbricoides* and *Trichiuris trichiura* were recovered. The most common of these parasites were *Schistosoma mansoni* and *Ascaris lumbricoides* which occurred in high intensity in most of the positive samples.

Interpretation and Conclusion: The result of this study revealed that, poverty, ignorance, socio-cultural practice, poor hygienic practices, inadequate sanitary/ toiletry facility to be the driving forces of this infection in the study area. Intervention needed to curtail the effect and further transmission of this infection include; massive treating and health education, provision of portable drinking water and provision of good sanitary/ toilet facility.

Keywords: Adamawa State; Fufore LGA; School-aged; Intestinal helminth; Intensity; Predisposing factors

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1. Introduction

Endoparasites are parasites that live within the body of their host, and the majority of them are helminthes. Helminths are multicellular worms grouped into three category: Nematodes (roundworms), Cestodes (tapeworms) and Trematodes (flatworms) which inhabit the human gut (Moore, 2010). A large part of the world's population is infected with one or more of these helminth infections (CDC, 2022). Some helminths of medical importance to man are *Enterobius vermicularis* (pinworm), *Ascaris lumbricoides* (round worm), *Trichiuris trichiura* (whip worm), *Necator americanus* and *Ancylostoma duodenale* (hookworm), *Strongyloides stercoralis* (threadworm), *Schistosoma haematobium, Schistosoma mansoni, Taenia solium*, *Taenia saginata*, *Hymenolepis nana*, *Dipylidium caninum*, *Diphyllobothrium latum*, *Fasciolopsis buski* and *Heterophyes heterophyes*. They are mainly found in regions of the world exhibiting warm and moist climates coupled with poor sanitation and hygienic practice Michael *et al.*, (2010). Helminths have far reaching impact on human health, economy and culture as they produce diarrhoea and mal-absorption, weight loss and reduce cognitive development in children Workneh *et al.*, (2014). Although individuals from all societies and regions play host to worms at some time in their lives with the highest rate occurring among children in rural areas of the tropics and subtropics (Bethony *et al.,* 2006). According to the World Health Organization (WHO. 1998) and Obukwu, *et al.*, (2008) globally there are 800-1,000 million cases of *Ascariasis*, 700-900 million Hookworm infections, 500 million cases of *Trichuriasis* and majority are in children and women of childbearing age. These infection are easily contracted through drinking infested water or eating of undercooked/ un-boiled faecally contaminated food (Okolie, 2009).

Intestinal infection caused by parasites in general are more frequent among School age children and they tend to occur in high intensity in these age group Sehgal *et al.,* (2010). In Nigeria, children within the age of 5-14years are the most infected (Bishop, 2018). A subclinical recourse of an infection may considerably alter the growth and development. In clinical cases, even severe dehydration and death can occur (Barutzki & Schaper, 2003).

Helminths are endemic and have been a major problem in rural settlements in Nigeria this is as a result of poor socio-economic status and lack of basic amenities such as pipe borne water and other sanitary facilities (Okon and Okun, 2001). They also have detrimental effects on animal survival Silva *et al.*, (2009) and these parasites have the potential of being transmitted to human Batchelor *et al.*, (2008).

2. Material and methods

2.1. Study area

Fufore is a town and headquarter of Fufore Local Government Area of Adamawa State, Nigeria. Fufore LGA is located at 9o13'N and 12o39'E. The LGA has an average daily temperature of 34 oC, average humidity of 18% and average wind speed of 10 km/h and contains seven lakes with two most popular within the territory; the Lake Bagale and Shaffa jauole lakes. As of 2006, it has a population of 209,460 peoples (NPC, 2006) with the majority of its people being members of the Hausa and Fulani ethnic groups. It has a total land mass of about 3,666 km^2 (Tukur and Musa 2009). The area is regarded as low lying with about 80% of the entire area being at less than 300m above sea level, while the remaining 20% are hills and mountains. The area is drained by a series of rivers and streams such as River Benue which takes its source from the republic of Cameroon, River Faro and Ine which all encourage arable cropping, livestock rearing and fishing (Fadama II, 2008). The area experiences distinct dry and wet seasons with temperature and humidity varying with season. The wet season is between April and October with average annual rainfall of 750 to 1000mm. The dry season period is between November and March and characterized by dry, dusty and hazy north – east trade winds that blow over the area from Sahara desert. Temperatures are relatively high almost all the year round. The temperature of the area ranges from 30 oC to 42 oC with cold dry winds that reduce the temperatures to about 15 oC during Harmatan period with the hottest months being April and May, with mean average temperature of 34 oC (Adebayo, 1999). The major occupation of the indigenous people of Fufore LGA is farming (crops such as; Rice, beans, Soyabean, Millet and Sorghum) and cattle rearing.

The study was carried out among School children between the age ranges of 0 to 15 from the five major Schools. The Local Government authority, principals/ headmasters and the students were informed about the purpose and benefit of the study. Informed consent were issued. During the sample collection, a structured questionnaire with a well labelled screw caped universal container containing age, sex, School and ethnic group were offered.
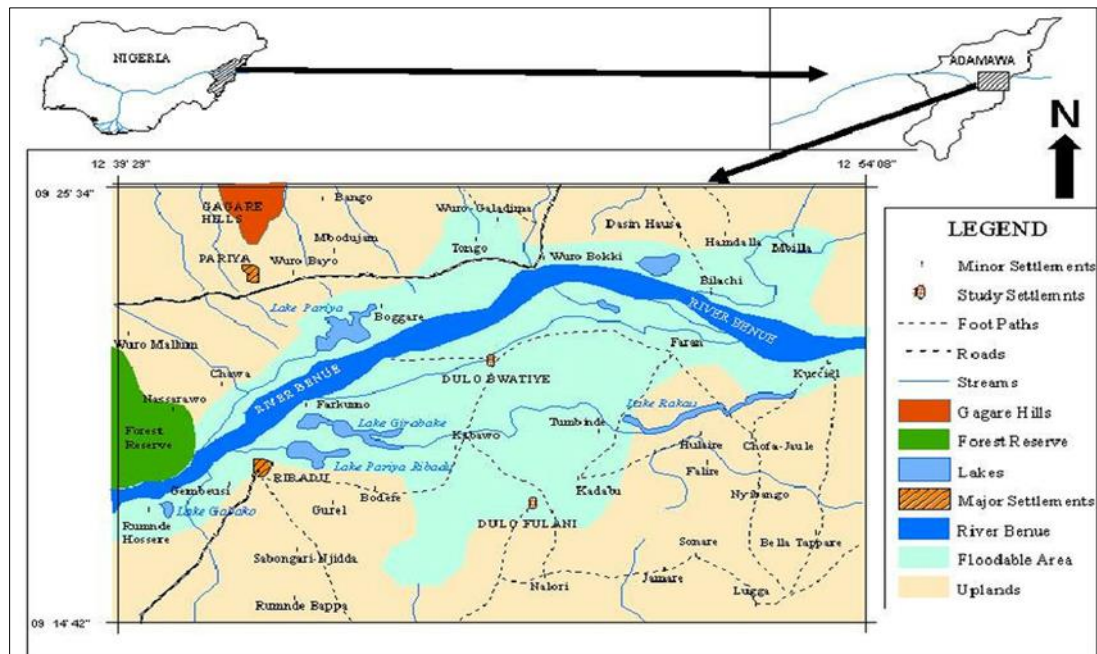
Figure 1 Map of the study area (Tukur and Musa 2009)

2.2. Ethical clearance

Ethical clearance was obtained from the local Government director Ministry of Education and the School authorities gave approval for this study.

2.3. Stool sample collection

The students were educated on how to collect their stool samples hygienically, 300 sample bottles were issued to the selected students to get their samples after which the stool samples were collected and transferred to the New Boshong Hospital laboratory Yola in a thermo box containing cold packs for parasitological examination. Examination was conducted on the fecal samples for the presence of helminthes eggs using formal ether concentration techniques while the intensity was determined by examining the number of per one gram of the stool sample.

2.4. Data analysis

The data obtained during the study was analyzed using Statistical Package for Social Sciences (SPSS) version 24. The prevalence of parasite is presented in the form of descriptive statistics while the relationship between various variables and the occurrence of parasites was determined using chi square test at 95% confidence level (P <0.05).

3. Results

Three hundred students were examined for intestinal helminth and the result revealed that 5.7% of the total Students population were infected with one or more of the intestinal helminth.

Table 1: Shows that, out of the 300 stool samples examine for intestinal helminth, 17(5.7%) were positive. Of the 300 stool samples examined, 164 were Males in which 11(6.7%) respondents were found to be positive, while 136 were Females in which 6(5.7%) respondents were found to be positive. The highest prevalence in relation to gender was recorded in the male respondents and this difference is statistically significant (P < 0.05). Out of the 300 stool samples examined in regard to age, 61 were within the age group 0-5 in which 7(11.5%) were found to be positive, 101 were within the age group 6-10 in which 8(7.9%) were found to be positive, while 138 were within the age group 11-15 in which 2(1.5%) were found to be positive. The highest prevalence in relation to age was recorded within the age group 0-5 of the respondents (Table 2).

Table 3: Shows that, three parasites namely *Schistosoma mansoni*, *Ascaris lumbricoides* and *Trichiuris trichiura* were recovered. The most common of these parasites were *Ascaris lumbricoides* (11.5%) and *Schistosoma mansoni* (7.9%)

which tends to occur in high intensity with a minimum of 3/1 (3eggs per 1g of stool sample) in most of the positive samples.

Table 4: Summarizes the result for the demographic characteristics of the study subjects and their response to the study questions.

3.1. Parents/ guardians occupation

The respondents whose parents/ guardians are farmers were 173(57.7%) out of the 300 respondents. Those whose Parents/ guardians are businessmen/ women were 36(12.0%) out of the 300 respondents. Those that said their parents/ guardians are healthcare personnel were 14(4.7%), while those that their parents/ guardians have other occupation were 77(25.7%) out of the 300 respondents.

3.2. Household monthly income

The respondents whose household monthly income is N10,000 – N15,000 were 19(6.3%), those with N16,000 – N20,000 as their household monthly income were 83(27.7%), those whose household monthly income is N21,000 – N30,000 were 117(39.0%), while those with N31,000 – N40,000 as their household monthly income were 81(27.0%) out of the 300 respondents.

3.3. Numbers in a household

The respondents that are 3-5 in their household were 79(26.3%), those that are 6-8 in their household were 188(62.7%), while those that are 9-11 in their household were 33(11.0%) out of the 300 respondents.

3.4. Types of toilet facility used

Out of the 300 respondents, those that use pit latrine in their homes were 189(63.0%), those that use water system toilet were 87(29.0%), while those that don't have toilet in their homes were 24(8.0%) out of the 300 respondents.

3.5. Wearing of shoe

Those that don't wear shoe were 6(2.0%), those that wear their shoes but not regularly were 71(23.7%), while those that always wear their shoes were 223(74.3%) out of the 300 respondents.

3.6. Washing of hands before and after eating

Out of the 300 respondents, 83(27.7%) respondents don't always wash their hands. while those that always wash their hands before and after eating were 217(72.35%) out of the 300 respondents.

3.7. Closeness with your animals

Respondents that have close proximity with their animals at home were 201(67.0%), those that were not highly close are 90(30.0%) respondents, while those that doesn't have close proximity with their animals were 9(3.0%) out of the 300 respondents.

Table 1 Prevalence of Endohelminth in relation to Gender of the respondents in the study area

Gender	Number examined	Number positive	Prevalence (%)
Male	164	11	6.7%
Female	136	6	4.4%
Total	**300**	**17**	**5.7%**

P-value: X2 = 0.733, df = 1, P = 0.392

Table 2 Prevalence of Endohelminths in relation to age of the respondents in the study area

Age group (Years)	Number examined	Number positive	Prevalence (%)
0-5	61	7	11.5%
6-10	101	8	7.9%
11-15	138	2	1.5%
Total	**300**	**17**	**5.7%**

P-value: X^2 = 9.402, df = 2, P = 0.009

Table 3 Diversity, Prevalence and Intensity of infection among the respondents of the study area

Parasites species	No. Examined	No. Positive	Prevalence (%) Intensity (Egg/g)
Schistosoma mansoni	300	7	7.9% 3/1
Ascaris lumbricoides	300	8	11.5% 5/1
Trichiuris trichiura	300	2	1.5% 2/1
Total	300	17	5.7%

Intensity = number of eggs per 1g of stool sample (Eggs/ g)

Table 4 Demographic and other characteristics of the study subjects and their response to the study questions

Questions	Options	Response (Frequency)	Percent (%)
Parent/ guardian occupation	Farmer	173	57.7
	Businessman/ woman	36	12.0
	Healthcare personnel	14	4.7
	Others	77	25.7
	Total	300	100
Household Monthly income	10,000-15,000	19	6.3
	16,000-20,000	83	27.7
	21,000-30,000	117	39.0
	31,000-40,000	81	27.0
	Total	300	100.0
Numbers in household	3-5	79	26.3
	6-8	188	62.7
	9-11	33	11.0
	Total	300	100.0
Type of toilet facility used	Pit latrine	189	63.0
	Water system	87	29.0
	No toilet	24	8.0

	Total	300	100.0
Source of drinking water	Pond	13	4.3
	Stream	97	32.3
	Well	123	41.0
	Borehole	67	22.3
	Total	300	100.0
Wearing shoe	Not at all	6	2.0
	Not always	71	23.7
	Always	223	74.3
	Total	300	100.0
Washing of hands before and after eating	Not always	83	27.7
	Always	217	72.3
	Total	300	100.0
Closeness with your animals	Highly close	201	67.0
	Not highly close	90	30.0
	No close proximity	9	3.0
	Total	300	100.0

4. Discussion

The result of this research showed a prevalence of (5.7%) in the case of study. There's a significant difference in the result obtained by other researchers within the State and it can be seen from the result of Akogun and Badaki, (1998) who work on prevalence of Endohelminths infection in Jambutu (52.1%) and Bajabure (38.5%) Communities of Adamawa State respectively. Umar, *et al*. (2018) have also reported higher prevalence (79%) in the work done on "prevalence of intestinal parasites among School Children in Mubi North LGA of Adamawa State. The higher prevalence recorded in some of these study areas could be due to the difference in environmental and climatic features, which might have favored the transmission of these infections. There is a difference ($P < 0.05$) in the prevalence rate in relation to gender. The male respondents in the study area were more infected (6.7%) with Endohelminth infection than the females (4.4%) respondents. This report did not correspond with the report of Na'acha, *et al*. (2017) who reported higher prevalence in female population than in the males. This disparity could be due to the Knowledge, Attitude and Practice of the inhabitants in the study area. However, many research have shown males to be more infected than the females as reported by Kunihya, *et al*. (2017) and Shitta & Akogun, (2017). There is a significant difference ($P < 0.05$) in the prevalence rate in relation to the age of the respondents. The age group 0-5 (11.5%) are more infected with Endohelminths than the age group 6-10(7.9%), and the least prevalence was seen in the age group 11-15 (1.5%).

The age group 0-5 and 6-10 showed the highest prevalence rate and that could be due to the fact that, children within these age groups are exposed more to sand where they do play and mostly eat fruits without care to wash. Furthermore, that could also be as a result of the poor disposal of waste, open defecating in various places of the School environments where this children play. Most of the School in the case of study have poor toilet facility and this encourages faeco-oral transmission of parasites. This report correspond with that of Sehgal, *et al*. (2010) but not in consonance with the report of Na'acha, *et al*. (2017) and Kunihya, *et al*. (2017) who reported higher prevalence in extreme age than in the younger age group. Although, Odu *et al*. (2013) reported in their work that, prevalence of intestinal parasites is not age dependent.

The highest prevalence observed among the age group 6-10 in the case of study could be due to the fact that, this age group do go out with animals except if sick and by so doing an infective stage of intestinal helminthes parasite may be picked on unwashed fruits eaten during the search for food to the animals in the bush as also reported by Akogun, Onwuliri and Shitta, *et al*. (2004) in their work. Out of the 300 stool samples examine, 17(5.7%) were positive for Endohelminths and of this positive samples, *Ascaris lumbricoides*, *Schistosoma mansoni* and *Trichiuris trichiura* were the

parasites recovered with higher distribution seen among the male samples than in the female. The most prevalent of these parasites were, *Ascaris lumbricoides* and *Schistosoma mansoni*. These parasites occur in high intensity in almost all the positive samples. This is not surprising as it is a parasite that are common with settled populations in the tropics as well as the Nomadic Fulani who are always on the move in search of greener pasture for their animals as also reported by Gundiri, *et al.* (2000), Shitta, *et al.* (2004) and Badaki, *et al.* (2005). The absence of Taenia Sp. could be related to dietary habit, beef and pork are rarely featured in the diet of the Hausa/ nomadic Fulani hence they have lesser chance of being infected.

Demography and other characteristics showed that, respondents whose parents/ guardian are farmers were 173(57.7%), those whose parents/ guardians are businessmen/ women were 36(12.0%), for those whose parents/ guardians are healthcare personnel were 14(4.7%), while those whose parents/ guardians have other occupation were 77(25.7%) out of the 300 respondents. Statistics have shown a significant difference between respondents whose parents/ guardian are farmers and healthcare personnel at $P < 0.05$ and this indicates that, the parent's occupation is attributed to the prevalence and distribution of infection as observed in the study area. Respondents whose household monthly income is N10,000 – N15,000 were 199(6.3%), those whose household monthly income is N16,000 – N20,000 were 83(27.7%), for those whose household monthly income is N21,000 – N30,000 were 117(39.0%), while those whose household monthly income is N31,000 – N40,000 were 81(27.0%) of the 300 total respondents and this clearly indicates that, poverty is a great driven force for the transmission of these infections as there will be mal-nutrition and poor hygienic practices in such children, poor hygienic practices which will lead to poor management/ disposal of waste and hence, these infections. The respondents that don't wear shoe were 6(2.0%), those that wear their shoes but not always were 71(23.7%), while those that always wear their shoes were 223(74.3%) out of the 300 respondents. Respondents that don't always wash their hands before and after eating were 83(27.7%) and those that wash their hands were 217(72.35%) out of the 300 respondents. Hygiene is highly associated with the transmission of infection in the case of study and it corresponds with the report of Ameh, *et al.* (2017). Statics have shown significant difference ($P < 0.05$) between respondents that have close proximity with their animals at home 201(67.0%) and those without close proximity 9(3.0%). This indicates that, animals are great vehicles through which infections are transmitted from one place to the other as also reported by Gundiri, *et al.* (2000), Shitta, *et al.* (2004) and Badaki, *et al.* (2005) in their work.

Recommendation

As this study revealed the endemicity of intestinal helminth among School children and the risk factors associated with these infections in Fufore LGA of Adamawa State, Nigeria. To curtail the effect and further transmission of this infection, the following should be given priority:

- Massive health education in the area so as to enlighten the people on the imminent dangers posed by these parasites especially in the case of multiple infection by an individual.
- Immediate treatment of the infected children to avoid further spray of these infection.
- Massive intervention in the case of study through provision of good sanitary/ toilet facilities so as to discourage the indiscriminate urination and defecation to avoid polluting the environment.
- Provision of potable water.

5. Conclusion

The research work have revealed the prevalence of intestinal helminth, the intensity of infection, associated risk factors and the difference in infection rate in relation to age and gender of the respondents in Fufore LGA where the male showed higher prevalence than the female respondents while the younger age group have in the other hand shown higher prevalence than the extreme age group. All this can be attributed to the knowledge, attitude and practice of the inhabitant of the case of study. Poverty and poor hygienic practices such as open defecation and poor management/ disposal of waste are the associated risk factors of this infection in the case of study. This work have contributed greatly as it has revealed the endemicity of this infection and have brought to knowledge the means of transmission, possible prevention and control measures to the inhabitant of the case of study. The foreseen increase and further transmission of this infection can be halted if the government and other relevant bodies can intervene where necessary.

Compliance with ethical standards

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Disclosure of conflict of interest

There is no conflict of interest experienced by the authors.

Statement of ethical approval

Before the research was carried out, all relevant bodies have given approval and the authors have adhered and followed the accepted ethical terms throughout the research period and after.

Statement of informed consent

All respondents were consented before they were involved in the research.

References

[1]   Adamawa State Ministry of Information (2008). Adamawa State Diary. Adamawa State Press Limited Yola, Adamawa State: 1-3.

[2]   Adebayo A.A. (1999) Vegetation and forest in: Adebayo A.A. and Tukur A.L. (eds), Adamawa State in Maps, psaraclete publishers Yola Nigeria.

[3]   Akogun, O. B. and Badaki, J. (1998). Intestinal helminth infection in two communities along the Benue River valley Adamawa State. The Nigerian Journal of Parasitology, 19: 67-72.

[4]   Ameh, V, Qadeer, M.A, Asher, R, Nganjiwa, J.I. (2015). A study on urinary Schistosomiasis amongst the inhabitants of Fufore Local Government Area of Adamawa State, Nigeria. IOSR Journal of Pharmacy and Biological Sciences (IOSR-JPBS) e-ISSN: 2278-3008, p-ISSN:2319-7676. Volume 10, Issue 4 Ver. I (Jul - Aug. 2015), PP 91-95

[5]   Arora, DR and Arora, B. (2008). Medical parasitology CBS, Publisher, New Delhi.pp 15-177.

[6]   Batchelor DJ, Tzannes S, Graham PA, Wast-Ling JM, Pinchbeck GL & German AJ. (2008). Detection of Endoparasites with Zoonotic potential in Dogs with gastrointestinal diseases in the UK. Transboundry and Emerging Diseases 55, 99-104.

[7]   Badaki, JA, Shitta, K. and Akogun, OB. (2005). Geohelminthiasis amongst School Children in two local Government areas of Taraba State, Nigeria. Journal of Tropical Biosciences, 5 (1): 38-41.

[8]   Barutzki D, Schaper R. (2003). Endoparasites in dogs and cats in Germany 1999–2002. Parasitol Res 90(Suppl 3):148–150

[9]   Bethony j, Brokker S, Albonico M, Geiger SM, Loukas A, Diemert D and Hotez PJ. (2006). Soil transmitted helminth infections: Ascaris, Trichuriasis and hookworm. Lancet 367, 1521-1532.

[10]   Bishop HG and Yohanna AZ. (2018) Contamination of vegetable with geohelminth: prevalence, intensity and roles of hygiene practice in Samaru-Zaria, Nigeria. International journal of academic and applied research, 2(4):8-13.

[11]   CDC (2022). Soil transmitted Helminth. Human Diseases and Conditions.

[12]   Fadama II, (2008): The journey so far in Fufore Local Government Area Adamawa State. pp 1-3.

[13]   Gundiri MA, and Akogun OB. (2000). Gastrointestinal and urinary parasitic infection among school children in Rumde, Yola Adamawa State. The Nigerian Journal of Parasitology, 21: 155-158.

[14]   Kunihya, IZ, Wandaje, HJ and Qadeer, MA. (2017). Gastro-Intestinal parasites among individuals attending primary Health Care Centre in Girei and Yola metropolis, Adamawa State, Nigeria. IOSR Journal of Pharmacy and Biological Sciences (IOSR-JPBS) e-ISSN:2278-3008, p-ISSN:2319-7676. Volume 12, Issue 5 Ver. V (Sep. – Oct. 2017), PP 16-21 www.iosrjournals.org

[15] Michael OH, John H, and Pierol O. (2010). Epidemiology and control of human gastrointestinal parasites in children. National Library of Medicine and National Institute of Health, 8: 219-234.

[16] Moore J. (2010). Intermediate host behavior. Encyclopedia of Animal Behavior pg. 658-662. ISBN 9780080453378

[17] Na'acha, E; Vandi, P; Chessed, G. (2017). Species and prevalence determination of Human Intestinal Parasites among Patients attending two Medical Centers in Yola, Adamawa State, Nigeria. J. Appl. Sci. Environ. Manage. JASEM ISSN 1119-8362; May. 2017 Vol. 21 (3) 431-437

[18] National Population Commission (2006): Legal notice on publication of the details of the breakdown of the national and state provisional totals 2006 Census pgB179.

[19] Obiukwu MO, Umeanaeto PU, Eneanya CI and Nwaorgu GO. (2008). Prevalence of gastro-intestinal helminth in School children in Mbaukwu, Adamawa State, Nigeria. Nigerian Journal of Parasitology 29(1): 15-19.

[20] Odu N, Elehi V and Okonko I. (2013).prevalence of intestinal helminthes infection among primary school in urban and semi-urban area in Port-Harcourt, River State, Nigeria. World Rural Observation, 5(1): 52-61.

[21] Okolie NJC. (2009). Intestinal parasites distribution among inmates of Owerri prison. International Journal of parasitic Diseases. 4(1):1-4.

[22] Okon, O. and Oku, E. (2001). Prevalence of intestinal parasites among school children in two contrast in communities in Cross River State, Nigeria. Nigerian Journal of Parasitology. 22: 117.

[23] Sehgal R, Reddya GV, Jaco J, Verweijb V, and Rao S. (2010). Prevalence of intestinal parasitic infection among school children and pregnant women in a low socio-economic area, Chandigarh, North India. Reviews in Infection. RIF 1(2): 100-103.

[24] Shitta, KB, and Akogun, OB. (2017). Intestinal helminth infections among the nomadic Fulanis in two localities of Adamawa State. Nigerian Journal of Parasitology ISSN 1117 4145 Volume 38[1] March 2017.

[25] Silva FL, Oliveira RG, Silva TMA, Xavier MN, Nascimento EF and Santos RL. (2009). Veneral transmission of canin visceral Leishmaniasis. Veterinary Parasitology 160, 55-59. CrossRef Google Scholar PubMed.

[26] Tukur AL, Musa AA and Mubi AM. (2006). Assessment of changes in land cover along the lower reaches of River Gongola, North East Nigeria: Global Journal of Environmental Sciences Vol.5 No. 2, pg 77-81

[27] Umar I, Mohammed A and Umar S. (2018). Prevalence of intestinal parasites among School Children in Mubi North Local Government Adamawa State, Nigeria. International Journal of Innovative Research and Advanced Studies (IJIRAS) Volume 5 Issue 8, August 2018. ISSN: 2394-4404

[28] WHO, (1999). Epidemiology and control of Schistosomiasis, Report of WHO Expert committee. Technical report series 728, 1999, 11-38. (8)

[29] World Health Organization (2016). Working to overcome the global impact of neglected tropical diseases: first WHO report on neglected tropical diseases Geneva: WHO; 2010.

[30] Workneh T, Esmael A and Ayichiluhm M. (2014). Prevalence of intestinal parasitic infection and associated risk factors among Debre Elias primary school children, East Gojjam Zone, Amhara region, North West Ethiopia.I. Bacterial and Parasitology., 5:181.