Caliphate Journal of Science & Technology (CaJoST)

ISSN: 2705-313X (PRINT); 2705-3121 (ONLINE) Research Article

Open Access Journal available at: https://cajostssu.com and https://www.ajol.info/index.php/cajost/index

DOI: https://dx.doi.org/10.4314/cajost.v4i1.12

Article Info

Received: 13th June 2021

Revised: 18th January 2022

Accepted: 23rd January 2022

Study on Intestinal Helminthoses and the Efficacy of Anthelminthoses Drugs among School Children in Girei Local Government Area, Adamawa State

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Cite this: *CaJoST,* 2022, 1, 93-100

Intestinal helminthoses have adverse effects on the physical and mental development in poorly nourished community populations. This study was conducted to determine the prevalence of helminthoses and to evaluate the efficacy of two antihelminthoses drugs (albendazole and levamisole) among school aged pupils in Girei local government area of Adamawa State, Nigeria. A total of 384 primary school pupils were randomly selected from six public primary schools in Girei local government area of Adamawa state. Statistical tools used for data collection was a structured questionnaire, while simple percentages and chi-square test of association were used for data analysis with the help of statistical package for social sciences (SPSS) version 26. Clean plastic containers were distributed to the participants at enrollment with detailed instructions about the procedure for stool specimen collection. All stool samples were collected early in the morning and conserved in ice boxes before transportation to the laboratory. Each specimen was examined for the presence of intestinal parasitic organisms by the concentration techniques and kato-katz was used for egg count. The age specific prevalence were 21.1% among pupils with age 6-9 years, 17.1% among pupils with age ≥10 years and 10.4% among the youngest children ≤ 5years of age.

Keywords: *Intestinal Helmnthosis,* Efficacy, Anthelminthic, Drugs

1. Introduction

Intestinal helminthoses are infections of the intestine caused by round worms of the phylum nematoda and are among the most common infections occurring throughout the developing world (Usip and Ita, 2017). There are an estimated 280 million children infected with hookworm, 478 million with *Ascaris lumbricoides* and 347 million with *Trichuris trichiura* in the world. Between 500 million and one billion people are estimated to be infected annually. The global prevalence and number of cases of intestinal helminths infection in school children have been estimated to be Roundworm 35% (320 millions); Whipworm 25% (233 millions); Hookworm 26% (239 millions), others 14% (128millions) (Partnership for child development [PCD],2001). Other species of intestinal helminths are not widely prevalent. Intestinal helminths rarely cause death. Instead, the burden of disease is related to less mortality than to the chronic and insidious effects on health and nutritional status of the host (Ohta, 2007). In addition to their health effects, intestinal helminth infections also impair physical and mental growth of children, thwart educational achievement, and hinder economic development (Drake *et al*., 2003).

The high prevalence of these infections is closely correlated with poverty, poor environmental hygiene and impoverished health services (Crompton & Savioli, 2007). Intestinal helminth infections occur in all regions of Africa; particularly in sub-Saharan Africa, they are common and of major health concerns because of factors that predispose man to the infections such as poverty, poor sanitation, ignorance and malnutrition prevail (Ijagbone, 2014).

The soil-transmitted helminths (STHs) or geo-helminths are nematodes commonly known as intestinal worms. STHs are group of parasitic nematode causing human infection through contact with parasite invasive eggs or larvae. Immature stages (eggs) require incubation in the soil before they become infective. Most often

humans become infected by ingestion of infective form of geo-helminths either from soil, raw fruit and vegetables, or dirty hands. They include roundworms (e.g. *Ascaris lumbricoides*), whipworm (e.g. *Trichuris trichiura*), threadworm (e.g. *Strongyloides stercoralis*) and hookworms (e.g. *Ancylostoma duodenale* and *Necator americanus*). They are most prevalent in regions exhibiting warm and moist climates coupled with poor sanitation and hygiene. Epidemiologically, it is well established that though individuals of all age's habour worms, the highest rates occur among children in rural areas of the tropical and subtropical areas (Bethony *et al*., 2006). Another important risk factor explaining high STHs infection among children is behavioural in nature. Children are generally very active, playing with the soil and objects in the environment with little or no supervision. The preponderance of helminthic infection in school-aged children makes this subgroup a good target for helminth control programmes in the general population and schools provide good opportunities for implementation of control programmes (Ojurongbe, 2014).

Human lifestyle and behaviours have been implicated to exacerbate transmission of soil-transmitted helminths. Predominant among these are poverty, inadequate sanitation, lack of access to health care, and overcrowding (WHO, 2002).In Nigeria, the occurrence of human intestinal helminthoses is increasingly high (Nwosu, 2007; Obiamiwe and Nworsi, 2013). Intestinal worm infections thrive in communities without better housing, sanitation, water supplies, health care, education and low income (Wiebejanyce, M., Rebecca, F. and Thoman, P.O *(*1999). Intestinal helminthes infections have continued to prevail because of low levels of living standards, poor environmental sanitations, and ignorance of simple health promoting behaviours (Usip and Matthew, 2015).

The burden of associated worm disease is enormous, school children between the age of (3-15 years of age) harbour heavy intestinal parasites and thus are a good study groups; they are the groups that are grossly responsible for the contamination of the environment and transmitting deadly infections (Albonico *et al.*, 2002).Two principal factors in maintaining endemicity of intestinal helminthes infections are favourable condition of the soil and frequent contamination of the environment by wastes or faeces (Ekaette *et al.*, 2013). Transmission within a local community is directly related to human behaviour with regards to defecation, eating habit, cleanliness and level of literacy (Usip and Matthew 2015).

Water supply and other environmental factors for domestic and personal hygiene, housing, conditions such as demographic, socio-economic and health related habits are known to influence these infections (Atting, I.A, Ukpe, I. and Usip, L.P.E 2013). In terms of efficacy of anthelmintic drugs, effective drugs such as levamisole, morantel and pyrantel have been known to aid in reduction of the parasites. Broad spectrum anthelmintics are effective against parasitic worms and Nematodes. However, the majority of drugs are more limited in their actions (Chuveran , 2006).

In view of the negative socio-economic impact of these parasites infections among school aged children, there is a need for the development of good preventive and control measures adaptable for the tropics. This cannot be done effectively amongst school children without baseline data on the occurrence of parasitic infection in a particular area. Thus, this study will:

i Determine the prevalence of intestinal helminthic infections among school children of Girei local government area.
ii Determine the association between intestinal helminthic infection and socio-demographic factors as well as knowledge and hygiene practices
iii Assess the comparative efficacy of the various types of anti-helmintic drugs used in Girei local government area.

2. Materials and Methods

2.1 Study Design

Six schools were randomly selected in the study area – Girei local Government area of Adamawa State.

2.2 Study area

Girei is one of the local government areas we have in Adamawa state where the study was conducted. The study area lies between Latitude 9^0 11' -9^0 39'North and longitude 12^0 21' -12^0 49' East of the Greenwich Meridian (Adebayo, 2012). The area falls within the Northern Guinea Savannah Zone and has a tropical wet and dry climate. Dry season lasts for a minimum of five months (November-March) while the wet season spans April to October. Mean annual rainfall is about 700mm. Song Local Government Area bound the Study area to the North, Fufore to the East and Yola North and Demsa to the South and West respectively. The area has a total land mass of about 2,186 square kilometres. The total population is 129,995 and predominantly agrarian (National Population Commission [NPC], 2006).

2.3 Study Population

Based on Girei local education authority (GLEA, 2018) total number of children was 199589, age bracket of 3-15 school age was 25, 352, the total number of the pupils in the six school was 10,000 Pupils. Out of the six schools that where randomly selected.

2.4 Sample size and sampling procedure

In determining the sampling size to be drawn from the population of school children in Girei local Government Area, the sample size of this study was estimated by taking the prevalence as 50 % because there was no published report on the prevalence intestinal helminthises so far in the study area Adamawa, North East. Sample size was calculated using the formula (Naing *et al*., 2007). For population greater than ten thousand

For population >10,000

$$n=\frac{z^2 p(1-p)}{d^2}$$

Where
n = minimum sample size
z = value- value of standard normal distribution-from confidence level table for 95%
P = prevalence of disease (50%)
d=the maximum allowable deviation or error of the estimate
95% confidence level on the standard normal distribution table, thus z=1.96

The population proportion of the phenomenon by previous studies=50%, Margin of error = ±5%

$$n=\frac{1.96^2\, 0.5\,(0.5)}{0.05^2}$$

n=384

2.5 Sampling procedure

The cross-sectional sampling technique was carried out for this study, involving the use of purposive sampling to select the six schools among the population of schools in Girei Local government area of Adamawa State; this was done purposively to meet desired objectives. Secondly Stratified sampling technique with proportional allocation was used to allocate the sample size proportionately based on the selected school populations. The sampling method was to allocate sample number to the six schools drawn from the ten wards using simple random sampling. The formula for the stratified proportion sampling method; $n_h = (N_h/N) * n$ When $n_h$is the sample size for straum h, N_h is the population size for stratun h, N is total population size and n is total sample size. The total of 384 participants from the schools was selected among the children, 83 from Lamido Lawan primary school, 62 from Sangere Primary School, 76 from Sabon Gari Primary School, 40 from Bakalchi Primary School, 54 from Bakari Hamidu Primary School, and 69 from Wuro Madi Primary School. The selection of participant in each school was done using simple random sampling.

Table 1: Sample size for the school children in Girei local government area

Schools	Sample size
Lamido Lawan Primary School	83
Bakari Hamidu Primary School	54
Bakalchi Primary School	40
Sangere Primary School	62
Sabongari Primary School	76
Wuro Madi Primary school	69
Total	**384**

Sampling and the recruitment of participants for the study was done randomly in the schools to ensure that every child have the chance of being selected or included. During the sampling, participants were clearly informed of the nature of the study and requested to consent through a voluntary, informed consenting process. This sampling process eliminates biasness in the selection of participants.

2.6 Stool collection and Examination

Clean plastic containers were distributed to the participants at enrollment with detailed instructions about the procedure for stool specimen collection. All stool samples were collected early in the morning and conserved in ice boxes before transportation to the laboratory. Each specimen was examined for the presence of intestinal parasitic organisms by the concentration technique.

2.7 Laboratory Investigation and Testing for Drugs Efficacy

During the laboratory investigation, Kato-katz and Concentration method were used in the examination of stool. On collection of the faecal samples, they were taken to the laboratory for examination. The concentration method was used and kato-katz was used for egg count. The result of the analysis was taken to the schools after thorough examination of the samples, in a company of a medical officer together with Anthelmintic drugs for those with helmintic infections. Orientation was given to the teachers and children on the dosage and method of drug administration by the researcher. Two different drugs were administered to two groups, which were taken in the morning before meal. After a week, a follow-up test was conducted on the infected pupils to check for the efficacy of the anthelmintic drugs (albenadazole, and levamisole)

to ascertain the cure rate (CR) and egg reduction rate (CRR).

2.8 Administration of Questionnaires

A structured questionnaire was administered to each participating pupil school by school. In collecting data the respondents are to ticked options that fit their opinion on the liker scale. The questionnaire were filled and collected at a sport to avoid missing of the questionnaire. The researcher allows the respondents to fill the questionnaire under a closely monitoring for proper and accurate work. The purpose of the questionnaire was to collect information on personal bio-data, characteristics of their homes and the school environment, as well as their hygiene and knowledge of worm infections.

2.9 Parasitological Technique

The concentration method was used for the analysis of stool samples collected.

2.10 Identification of Helminth Eggs Using Concentration Method

Identification of helminth eggs in stool samples was examined using concentration technique is associated with high sensitivity. It allows the detection of eggs and organisms in low infections that may be missed by other methods especially the direct wet smear technique. Basically, concentration technique operate in two ways, either by sedimentation in which the parasite sink to the bottom of the liquid suspension, or by floatation in which the parasite forms are suspended in a liquid of high specific density to make them buoyant and float to the surface where they are collected for examination. Some parasite stages have been described as "sinkers" and others as "floaters ", some do both, and do either. Therefore, no ideal method of concentration is capable of detecting all forms of parasites that may be present in stool specimens. In general, floatation gives a “cleaner” preparation than sedimentation yet each has a preference over another in certain aspects (Cheesbrough, 2005).

By spinning laboratory samples at very high speeds, the components of a given mixture are subjected to centrifugal force, which causes more dense particles to migrate away from the axis of rotation and lighter ones to move toward it These particles can sediment at the bottom of the tube into what is known as a pellet, and this isolated specimen, or the remaining solution, the supernatant, can be further processed or analyzed. The speed of centrifugation in rotations per minute, or RPM, is contrasted with relative centrifugal force, or RCF, as a measurement of the magnitude of centrifugation, which is independent of rotor size (CDC, 2015).

2.11 Data Analysis

The Statistical Package for the Social Sciences (SPSS, Chicago, Illinois, USA) for windows version 26 was used to analyze the data. Socio-demographic characteristics of the participants were presented as frequencies and percentages for the categorical variables chi-square was also employed to boost association between the variables. A P-value of <0.05 was considered statistically significant.

3. Results and Discussion

3.1 Results

3.1.1 *Prevalence of Helminths in Relation to School*

A total of 384 school children were examined in the six primary schools in Girei, comparing of the 183(47.6%) of the children were positive for the helminthic infection. Among the 83 pupils examined in Lamido lawal primary school, 39(10.2%) of the pupils were positive and among the 62 pupils examined for helminthic infection in Sangere primary school 30(7.8%) were positive, Sabo.ngari primary school had 37(9.6%) of the positive out of the 76 pupils examined. Bakalchi primary school had 20(5.2%) infected out of the 40 pupils examined. Bakari hamidu primary school had 26(6.8%) infected out of the 56 pupils examined. Wuro madi primary school had 31(8.1%) infected out of the 69 pupils examined. Overall prevalence of the helminths among the study pupils revealed 47.7% (183 out of the 384) of this, the highest prevalence was recorded among pupils in Lamido Lawal primary schools with 10.2% and the least was in Bakalchi primary schools with 5.2% as shown in Table 1.

3.1.2 Prevalence of Helminthiases Based on Gender

Prevalence of the helminthiases based on gender revealed that males had the highest (25.5%) as compared to the females with the least with 22.1% as shown in Table 2. However, the difference in prevalence was insignificant higher ($P > 0.05$).

3.1.3 Prevalence of Helminthiases Based on Age

Prevalence of the helminthiases based on age revealed that 6-9 year age category had the highest (20.1%) as compared to the <5year age category with the least with 10.4% as shown in Table 3. The difference in prevalence was not significant among age groups.

3.1.4 Distribution of intestinal helminthiases among the pupils in the study area

183 of 384 (47.7 %) stool samples examined were positive for soil transmitted helminth eggs. The eggs of soil transmitted helminths observed in the faecal samples were those of *Ascaris*

lumbricoides, Trichuris trichiura and hookworms at prevalence of 18.5%, 9.6% and 14.6%, respectively making 42.7% of the single specie infection. Prevalence of double infection was 4.9% (Table 5). These comprised 2.9% of *A. lumbricoides* and hookworms, 1.3% of *A. lumbricoides* and *T. trichiura* and 0.7%of hookworms and *T.trichiura.* No multiple infections greater than double were recorded.

Table 2: Prevalence of intestinal helminthiases among school age children of Girei LGA

School	No. examined	No. infected	Prevalence (%)
Lamido Lawal Primary School	83	39	10.2
Sangere Primary school	62	30	7.8
Sabongari Primary School	76	37	9.63
Bakalchi Primary School	40	20	5.2
Bakari Hamidu Primary School	54	26	6.8
Wuro Madi Primary school	69	31	8.1
Total	384	183	47.7

X^2 cal, X^2 tab, df=s (P value 0.9963)

Table 3: Prevalence of intestinal helminthiases based on gender among school children in Girei LGA.

Gender	No. Examined	No. infected	Prevalence (%)
Male	177	98	25.5
Female	207	85	22.1
Total	**384**	**183**	**47.6**

X^2 cal, X^2 tab, df= 1 (P value 0.03997)

Table 4: Prevalence of intestinal helminthiases based on age among school children in Girei LGA

Age (in Years)	No. Examined	No. infected	Prevalence (%)
<5	90	40	10.4
6-9	151	77	20.1
≥10	143	66	17.2
Total	**384**	**183**	**47.7**

X^2 cal, X^2 tab, df=3 (P value 0.5555)

Table 5: Distribution of intestinal helminthiases among the pupils in the study area

Helminths	N=384	No of positive (%)
Single	*Ascaris lumbricoides*	72 (18.5)
	Trichuris trichiura	36 (9.6)
	Hookworms	56 (14.6)
	Sub-total	164 (42.7)
Double	AL +HW	11(2.9)
	AL+TT	5(1.3)
	TT+HW	3(0.8)
	Sub-total	19 (4.9)
Overall total		**183 (47.7)**

AL = Ascaris lumbricoides
HW = Hookworm
TT = Trichuris trichiura

AL + HW = *Ascaris lumbricoides + Hookworm*
AL+TT= Ascaris lumbricoides + Trichuris trichiura
TT+ HW = Trichuris trichiura+ Hookworm

3.1.5 Distribution of intestinal helminthiases among the pupils in the study area

183 of 384 (47.7 %) stool samples examined were positive for soil transmitted helminth eggs. The eggs of soil transmitted helminths observed in the faecal samples were those of *Ascaris lumbricoides, Trichuris trichiura* and hookworms at prevalence of 18.5%, 9.6% and 14.6%, respectively making 42.7% of the single specie infection. Prevalence of double infection was 4.9% (Table 5). These comprised 2.9% of *A. lumbricoides* and

hookworms, 1.3% of *A. lumbricoides* and *T. trichiura* and 0.7%of hookworms and *T.trichiura.* No multiple infections greater than double were recorded.

3.2 Discussion

A total of 384 school-aged children were examined in the six primary schools in Girei, comparing of the 183(47.6%) of the children were positive for the helminthic infection. Among the 83 pupils examined in Lamido lawal primary school, 39(10.2%) of the pupils were positive and among the 62 pupils examined for helminthic infection in Sangere primary school 30(7.8%) were positive, Sabo.ngari primary school had 37(9.6%) of the positive out of the 76 pupils examined. Bakalchi primary school had 20(5.2%) infected out of the 40 pupils examined. Bakari hamidu primary school had 26(6.8%) infected out of the 56 pupils examined. Wuro madi primary school had 31(8.1%) infected out of the 69 pupils examined. Overall prevalence of the helminths among the study pupils revealed 47.7% (183 out of the 384) of this, the highest prevalence was recorded among pupils in Lamido Lawal primary schools with 10.2% and the least was in Bakalchi primary schools with 5.2% as shown in Table 2.

Prevalence of the helminthiases based on gender revealed that males had the highest (25.5%) as compared to the females with the least with 22.1% .as shown in Table 3. However, the difference in prevalence was insignificant ($P > 0.05$).

Prevalence of the helminthiases based on age revealed that 6-9 year age category had the highest (20.1%) as compared to the <5year age category with the least with 10.4% as shown in Table 4**.** The difference in prevalence was not significant among age groups.

183 of 384 (47.7 %) stool samples examined were positive for soil transmitted helminth eggs. The eggs of soil transmitted helminths observed in the faecal samples were those of *Ascaris lumbricoides, Trichuris trichiura* and hookworms at prevalence of 18.5%, 9.6% and 14.6%, respectively making 42.7% of the single specie infection. Prevalence of double infection was 4.9% (Table 4). These comprised 2.9% of *A. lumbricoides* and hookworms, 1.3% of *A. lumbricoides* and *T. trichiura* and 0.7%of hookworms and *T.trichiura.* No multiple infections greater than double were recorded.

4. Conclusion

The helminthes parasite species found in study area includes *A. lumbricoides*, *T.trichiura,* and hookworms. *A. lumbricoides* and hookworm were the dominant parasites among the school-children. The study revealed that *A. lumbricoides* was the most prevalent parasite among the children and most abundant helminth species contaminating the soil of the study area. The result of this study also showed relatively high prevalence and low intensity of STH infection among the school children. This study also identified risk factors associated with STHs infections in the study area; factors such as types of toilets in home and presence of human/animal faeces were significantly associated with STHs infections and play a great role in affecting prevalence.

The result indicated that albendazole is more effective in the treatment of Ascaris and hookworm infections, while the levamisole drug has positive effect on the *T.trichuria* as revealed by their cure rates and egg reduction rates.

Since these infections has high prevalence in the area, there should be means of making the people understand the mode of transmission, and methods of prevention of the infection, alongside chemotherapy approach should be adopted in order to interrupt transmission and to achieve local elimination of helminthiasis and other related intestinal parasites. Constant and adequate de-worming is equally recommended. The people need good social amenities that include good water, cheap water treatment could easily be taught to the people, encouraging boiling their drinking water before use. Indiscriminate defecating should be discouraged. The farmer should be encouraged to wear boots and hand gloves during farm work and also more hospitals should be built in the study area. Albendazole drugs should be use in the treatment of Ascaris and hookworm as revealed by the study that they effective as treatment regimen for both single and double infections. While levamisole should be used for treatment of T trichiura.

Acknowledgements

My sincere gratitude goes to Prof. Qadeer M.A for allowing me as his supervisee, his prompt attention to the numerous consultations and enquires, constructive criticism and insights are commendable.

Conflict of interest

The authors declare no conflict of interest.

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