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Prevalence of Soil-Transmitted Helminth Infections among Various Primary School Pupils in JentaAdamu, Jos North Local Government area of Plateau State, Nigeria

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Abstract
Intestinal parasites are known to cause significant nutrient deficiency, morbidity and mortality if not detected and treated at an early stage especially in children. A survey of Soil-Transmitted Helminths (STHs) among primary pupils in JentaAdamu, Jos was carried out between December, 2019 and January, 2020. 205 stool samples were randomly collected from four different primary school pupils of both sexes with ages ranging from 4 to 15 years old. The collected samples were examined for Intestinal Helminths using direct mount and concentration techniques to process the stools. The prevalence of soil-transmitted helminthiasis among the study population was 80(39.02%). Ascaris lumbricoides (16.09%) was the most common parasites, followed by Ancylostoma duodenale (9.27%). Strongyloidesstercoralis and Schistosoma mansoni caused 4.39% each. Trichuris trichiura caused 1.46% while Taenia saginata caused 0.97% of STHs and 2.45% constitute intestinal protozoan. Pupils between the age group of 8-12 had the highest 18.53% rate of infection while those within the age group of 13-15 had the lowest 5.36% infection rate. The prevalence in relation to sexes showed high infection in males(22.44%) than females(16.59%). No significant difference (sig P value >0.05) was observed between worm infectivity, sex, age and socioeconomic status in the study sample. This study showed a low prevalence of Intestinal helminths infection among primary school pupils, indicating that some measures are being implemented to control the spread. However, efforts should be intensified to promote health education, environmental and personal hygiene and regular deworming of school children should be encouraged.

Keywords: Soil-Transmitted Helminths, Socioeconomic status, Helminthiasis

1. INTRODUCTION

Soil- Transmitted Helminths (STHs) are intestinal parasitic worms that are transmitted via eggs in fecal matter. These eggs hatch in the soil and infect humans through larval skin penetration or by ingesting food or water contaminated with eggs. While infection can occur at any age, school age children are most often infected by STH.

According to World Health Organization (2017), the common STHs are roundworm (*Ascaris lumbricoides*), whipworm (*Trichuris trichiura*) and hookworm

(*Ancylostoma duodenale* or *Necator americanus*). Soil-transmitted helminth infections are among the most common infections worldwide and affect the poorest and most deprived communities (World Health Organization, 2019). More than 1.5 billion people or 24% of the world's population are infected with soil transmitted helminths and are widely distributed in tropical and subtropical areas, with the greatest number occurring in sub-Saharan Africa, America, China and East- Asia (WHO, 2019).

Over 267 million pre-school age children live in areas where these parasites are intensively transmitted, and are in need of treatment and preventive interventions (WHO, 2019). Soil transmitted helminths are highly prevalent in developing countries, particularly in the tropics, and is a serious medical and public health problem (WHO, 2013). Bethony*et al*(2006)stated that over two billion people are infected with one or more types of soil transmitted helminths. The basic of aggregation of soil-transmitted helminths in a population still remains unknown. This may be dueto heterogeneity of the parasite, differences in susceptibility of human population, soil behavioral or nutritional factors.

The intensity of soil-transmitted parasites is usually higher in communities where poverty, poor environmental and personal hygiene are endemic (WHO Report, 2002). In most of these endemic communities' fecal disposal is indiscriminate, and this results in the contamination of soil, water, food, and vegetables.Also, the habit of walking bare footed, eating unwashed fruits, and poor washing of vegetables usually increase high transmission rates in such communities.

The parasitisation of soil-transmitted helminths is a general indication of the level of development, as high prevalence rate is almost invariable associated with poor living conditions. The vulnerable group to intestinal helminths is children and may affect their mental and physical developments through several mechanisms including mal-absorption, blood and protein loss, anorexia and chronic dyspeptic syndromes, all of which compromises of mal-nutrition in these children (WHO, 2002).

People with infection of light intensity, are not really affected and some may be asymptomatic. However,heavier infections can cause a range of symptoms including intestinal manifestations (diarrhea and abdominal pain), malnutrition, general malaise, weakness, impaired growth and physical development. Infection of very high intensity can cause intestinal abstraction that is usually treated surgically (WHO, 2017).

Studies by (Sam-Wobo*et al.,* 2006) had shown that the prevalence rate of intestinal parasites varies considerably in different parts of Nigeria, with *Ascaris lumbricoides* as the most prevalent helminths followed by hookworms (*Trichiuris trichura*) and *Strongyloides stercoralis*..

Parasitic helminths have adopted diverse adaptations to enhance their survival as free-living parasitic organism. The degree of structural modifications or adaptations of parasitic helminths is related to their level of parasitism. Unlike their free-living counterpart, certain basic structure and sensory activities are greatly reduced or absent in parasitic worms (Olubunmi, 2013). Helminths exhibit all types of animal associations, ranging from free-living to parasitic existence. However, a large majority of helminths are parasitic organism, particularly in man and his domestic animals.

Saka *et al.,* 2006 reported a prevalence of 47.4%among school pupils from Ilorin, Salawu*et al*; also reported a higher prevalence of 59.2% among pupils from Ife, southwest Nigeria, Odinaka*et al.,* on the other hand reported a prevalence of 30.3%

from Imo state, south east Nigeria. Low socioeconomic status was common factor found among these children (Saka *et al.,* 2006; Salawu*et al.,* 2015; Odinaka*et al.,* 2015).

1.1 The Study

The aim of this study was to determine the prevalence of soil-transmitted helminths among primary school children in JentaAdamu, Jos North Local Government area of Plateau State. The specific objectives were to determine the prevalence of soil-transmitted helminths infections among these pupils in relation to age, to compare the distribution of soil-transmitted helminths infection among these pupils according to gender and to determine the prevalence of soil-transmitted helminths infection among these pupils in relation to socio-economic status of their parents.

2. MATERIALS ANDMETHODS

2.1. Study Site

The study was carried out in four (4) different primary schools in JentaAdamu, which is located in Jos North Local Government Area of Plateau state. The Jos plateau is located near the Centre of Nigeria. Jos is located between latitude $09^0 75^{'}$N and longitude $08^0 53^{'}$E.

The city of Jos lies in the guinea savannah belt, with an altitude of 4,062 feet (1,217) above sea level. It enjoys a more temperate climate than most of the rest of Nigeria with average monthly temperatures ranging from $20 – 25^0$c.

There are two distinct seasons, the wet and dry. The wet season lasts from April to October, while the dry season lasts from November to March. The city of Jos is known as the coldest towns in Nigeria, temperatures as low as 9^0C or even less have been recorded.

2.2. Ethical Clearance

Approval for this study was obtained from the research ethics committee of Plateau State Specialist Hospital (PLSSH) Jos. Visitations were made to heads of the various primary schools for approval and permission to carry out the research. An introductory letter was obtained from the Head of Department, Zoology, Faculty of Natural sciences, University of Jos, and this was submitted to the hospital and school in order obtain approval for this study. Interactive sessions were held at the various schools with the pupils through the help of their class teachers and their head teachers about how to collect the stool samples correctly.

2.3. Study Population and Sample

The study population comprised of the total number of pupils in four different primary schools, in JentaAdamu Jos North, Plateau State. However, due to ambiguity in the large number of pupils, a sample size of 205 pupils was adopted for the study. Judgmental sampling technique was used to select the respondents.The pupilsused for the study were between the ages of 4-15 years. The study lasted for about two months from December, 2019 to January, 2020. Permission and consent were sought from head teachers and parents of pupils prior to data collection.

2.4. Sample Collection and Evaluation

Collection of faecal samples was carried out as described by (Mordi, Evelyn, Fredrick & Okafor 2011). Clean well labelled ‘wide mouthed and corked’ sterile bottles were given to the pupils for the collection of their stool samples at home and structured questionnaires were distributed among the participating pupils for the collection of demographic information such as name (optional), age, sex, type of toilet facility used, and number of individuals in the house, parent’s occupation, foot were habits,

pet/domestic animals reared, regularity of deworming etc. and accordingly labeled (ID). Based on their ages, the pupils were guided while filling the questionnaires to ensure validity and reliability of data. The containers with samples were retrieved the next day and taken to National Veterinary Research Institute (NVRI) Vom, under the parasitology laboratory unit for examination. In situations where samples could not be examined immediately, 10% formal saline was added to each sample as preservative.

2.5 Parasitological Techniques

Two methods of parasitological stool analysis used for this study includes normal saline wet mount and Formal ether concentration techniques,as positedby Cheesbrough, (2009); ShittaandAkogun, (2017).

2.5.1 Normal Saline Wet Mount

A drop of normal saline was placed on a clean grease free slide; an applicator stick was used to pick a pea size of the stool sample and emulsified on the drop of the normal saline on the slide, after which coarse particles were removed. Pasteur pipette was used to pick a drop of watery stool and placed on the normal saline. It was covered with a cover slide and was observed under the microscope starting with x10 and x40 objective lens.

2.5.2 Formal/Ether Concentration Method

1g of stool sample was mixed with 10ml of normal saline using an applicator stick to form a suspension. The suspension was filtered into a test-tube and centrifuged at 1000 revolution per minute for 1 minute (1, 000), and the supernatant was discarded. About 3-4ml of 10% formal solution was added to the deposit to form a homogenous suspension and the mixture was allowed to stand for 5 minutes on the length. A 3-4ml of diethyl ether was added and shaken vigorously and allowed to stand for 2 minutes, it was then centrifuged at 1000 revolution per minute for 1 minute. The faecal debris from the side of the tube was detached with the aid of a glass rod (spatula) and the supernatant discarded leaving the deposit at the bottom of the centrifuge tube. The deposit was tapped with finger to mix and using a pasteur pipette, a drop of the deposit was applied on a microscope slide mixed with Lugol's iodine, covered with a cover slide and examined using x10 objective lens while x40 objective lens was used for identification of eggs.

2.6 Statistical Analysis

Data obtained was analyzed using percentages and chi-square (x^2) as tools to determine the significance of the observed differences in the study sample. The software used for data analysis was Statistical package for Social Science (SPSS) version 21. A p-value of $P > 0.05$ was considered statistically not significant in all statistical comparison.

3. RESULTS

Out of the two hundred and five (205) children stool samples examined, 80(39.02%) were infected with intestinal helminths. The species of intestinal helminths detected were *Ascaris lumbricoides* 3(16.09%), *Ancylostoma duodenale* 19(9.27%), *Strongyloides stercoralis* 9(4.39%), *Schistosoma mansoni* 9(4.39%), *Trichuris trichura* 3(1.46%), *Taenia saginata* 2(0.97%) and some protozoans 2.45%.

Table 2 shows the prevalence of intestinal helminths in relation to gender.Sex specific prevalence of intestinal helminths among school pupils revealed that out of 104 males examined, 46(22.44%) were infected while out of 101 females examined, 34(16.59%) were infected.

Table 1: Prevalence of Intestinal Helminths Among Primary School Pupils in JentaAdamu

Schools	Number Examined	Number Infected	Percentage Infected (%)
Cocin salvation nursery and primary school	50	22	10.73
Alheri primary school	50	18	8.78
Heroes foundation primary school	50	19	9.27
Ideal nursery and primary school	55	21	10.24
Total	**205**	**80**	**39.02**

Table 2: Prevalence of Intestinal Helminths Among Primary School Pupils in JentaAdamu in relation to gender

Sex of pupils	Number Examined	Number Infected	Percentage (%) Infection
Male	104	46	22.44
Female	101	34	16.59
Total	**205**	**80**	**39.02**

Table 3: Prevalence of Intestinal Helminths Infection Among Primary School Pupils in JentaAdamu in relation to Age

Age Group	No. examined	*Ascaris lumbricoides*	*Ancylostoma duodenale*	*S. stercoralis*	*S. mansoni*	*T. trichura*	*T. saginata*
4 -7	74	14(6.83%)	7(3.41%)	2(0.98%)	2(0.98%)	1(0.49%)	0(0%)
8 - 12	108	15(7.32%)	11(5.37%)	2(0.98%)	6(2.93%)	2(0.98%)	2(0.98%)
13 -15	23	4(1.95%)	1(0.49%)	5(2.44%)	1(0.49%)	0(0%)	0(0%)
Total	**205**	33(16.09%)	19(9.27%)	9(4.39%)	9(4.39%)	3(1.46%)	2(0.97%)

The prevalence of intestinal helminths in relation to age groups is represented in Table 3. This study showed that children between the ages of 8-12 years had the highest 38(18.53%) prevalence while those children between the ages of 13-15 years had the lowest 11(5.36%) prevalence. The most occurring parasites was *Ascaris lumbricoides* 33(16.09%) and the least was *Taenia saginata* 2(0.09%).

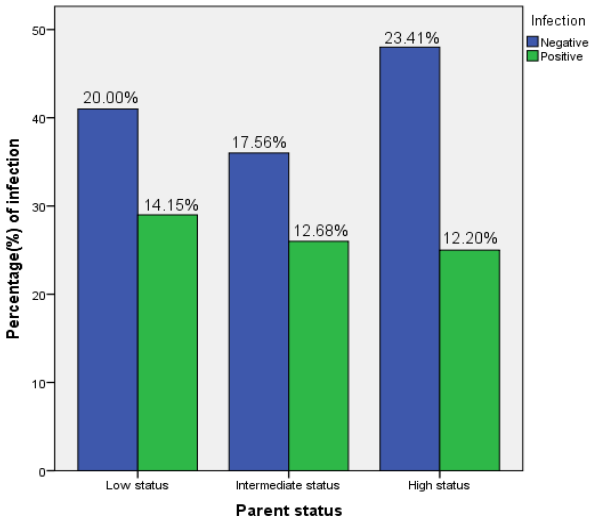

Figure 1: Prevalence of Infection According to Socioeconomic Status of Parents.

Figure 1 shows that infection was highest among the low status with infection rate of (14.15%), low level of the infection was recorded for the intermediate status with a value of (12.68%) and high status individuals recorded (12.20%)for all parasites. The computed chi-square shows P>0.05). The socioeconomic status of pupils parents was determined by their occupation.

4. DISCUSSION

The result of this study showed that there was significantly low prevalence of intestinal helminths infections among the pupils in all the nursery and primary schools studied. The overall prevalence (39.02) recorded is contrary to the finding of Constancy *et al.,* (2014) who recorded the prevalence of 88% among primary school children in Calabar. It also varied with the values of 66.7% and 45.5% reported by Mordi, Evelyn, Fredric and Okafor(2011), in Delta State, Nigeria and Lorina (2013) in Nsukka region of Enugu State respectively.

The report in this study markedly differed from the results obtained in the other countries with the values of 12.9% and 29.26% as reported by Mutuku, Mary, Annah, Maryana andPrescilla, (2008) in Kenya and Zahid, Afzal and Mushtag(2004) in Pakistan respectively. The result reveals the presence of intestinal helminths: Egg of *Ascaris lumbricoides* (roundworm), *Trichuris trichura* (whipworm), *Ancylostoma dudenale* (hookworm), *Strongyloides stercoralis*(threadworm), *Schistosoma mansoni, Taenia saginata* and protozoan: Cyst of *Entamoeba coli, Entamoeba histolytica, Giardia lamblia*. The most abundant helminth was *Ascaris lumbricoides* with a prevalence of 16.09%, followed by hookworm 9.27% which is in accordance with a research carried out by Waghatsoma and Asien (2005) on children in Benin where *Ascaris lumbricoides* was higher in the prevalence followed by hookworm. The Soil-Transmitted Helminths (STH) found could be because of their easy transmission method, which is through contamination of hands, improperly cooked foods, from raw vegetable produce farms, poor standard, personal hygiene, shortage of clean water and indiscriminate defecation (Abdullah &Abdullazez, 2000). In the study area, lack of environmental and personal hygiene, inadequate supply of clean portable water, absence of toilet facilities tremendously contributed to the rate reported. It has been reported that lack of sanitary facilities particularly latrine, would greatly determine the prevalence of roundworm in any given place (Anosike*et al.,* 2004).

It was observed that the prevalence of intestinal helminth infections was higher in males 46(22.44%) than in females, 34(16.56%). This follows the same trend with Mordi, Evelyn,redric& Okafor, (2011), that reported higher prevalence (60%) in males than females (35%). This might be due to the engagement of the male pupils in some farm activities at home, some go to nearby fields to play football and other games and all this puts them at higher risk compared to the females who tend to be more domestic after school hours. Emmanuel, Kalu, Emeka, &Olaka, (2015); Esiet&Usip, (2017) also reported higher prevalence in males than in female's pupils. This finding is contrary to Mengistus, Malaku& Tesfu, (2014) that reported higher prevalence of infection in females than their male counterparts.

Children between the age groups of 4-7 years and 8-12 years recorded higher prevalence rates. This may be due to the fact that these children tend to engage in play activities in contaminated environments that could facilitate transmission of intestinal helminths. These children also tend be less cautious of their personal hygiene because they are not old enough to understand the

need for general cleanliness, unlike their counterparts in the age group of 13-15 years in which the infection rate was very low (5.36%). A lower infection rate in the age group of 13-15 years may be due to the psychosocial development of the mid-adolescent, as they are more self-conscious of their personal hygiene and outward appearance to attract the opposite sex. Thus, mid-adolescent is likely to walk around barefooted. Similar finding and reasons have been adduced by other researchers. (Adefioye, Efushile, Ojurongbe*et al.,* 2011) and this is contrary to Mengistus and Tesfu (2014) who recorded higher prevalence between age group of 11-14 years.

The parental socio-economic status is another important variable determining risk factors predisposing pupils to *A. lumbricoides* infection and other helminth infections. From logistic regression analysis, the odds of being infected by pupils whose parents were farmers was 3.0 times more likely than pupils whose parents were civil servants. A simple explanation for this could be the fact that farmers were exposed to contaminated soil especially those that use night soil as fertilizers for crops. This result is in conformity with the report of Kirwan et al., (2009) who reported that children of farmers usually harbor higher load of *A. lumbricoides* than those parents were businessmen or professionals. In this study, children of parents of low socioeconomic status had the highest infection rate. This however expected as high of rate of intestinal helminths is often associated with poverty, malnutrition, inadequate sanitation, minimal health care services, poor housing and low standard of education. (Shitta&Akogun, 2017). The highest level of the infection among the children of low socioeconomic status parents in this study is in consonant with Mordi, Evelyn, Fredric & Okafor (2011) who also reported same for primary school pupils in Delta State Nigeria.

5. CONCLUSION

Indiscriminate defecation, inadequate water supply and deficiency in the awareness of personal hygiene and sanitation has been a major problem in Nigeria and other developing countries in the world today. This has led to the transmission of soil transmitted helminths which has been a public health problem among school pupils and adults because the environment is conducive for their survival, they remain prevalent and facilitate the transmission of helminthiasis.

The prevalence of intestinal helminths in the study area according to the age of pupils was not significant as the computed chi-square value obtained showed a P>0.05. Male had higher (22.44%) prevalence than (16.59%) females. Although the computed chi-square value was not significant (P>0.05). The null hypotheses which states that no significant difference of soil-transmitted helminths in relation to gender and sex, is here by accepted.

Helminths infection was more prevalent in pupils whose parent were of the low socioeconomic status as 14.15% were infected in this group, followed by the intermediate status whose had infection rate of 12.68%. There was however, low infection recorded among pupils whose parent were of the high-class status. Here, the null hypotheses which states that socioeconomic of pupils is not related to prevalence of soil-transmitted helminths infection in pupils, is accepted as sign P value >0.05.

There was low prevalence of intestinal helminths among primary school pupils in JentaAdamu Jos-North Local Government Area, Plateau State. The parasitic load in all the primary schools was not significant.

RECOMMENDATIONS

Good health is very important for the wellbeing of pupils in every school and helps them perform soundly both morally

and academically. The following are recommended to eradicate the transmission of the infection.

i. Individual should maintain good personal hygiene to help in the complete eradication of this infection
ii. Infected pupils and adult should be treated to avoid the spread of these diseases.
iii. The management of each primary school should educate their pupils more to eradicate complete intestinal helminthiasis. This should be extended to others schools in Jos north as well.
iv. There should be constant routine of deworming after every three months.
v. Government should provide clean water, good waste disposal system and provision of well-designed public toilets.

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