INTESTINAL HELMINTHIASIS AMONG NURSERY SCHOOL CHILDREN IN SABON TASHA, CHIKUN LOCAL GOVERNMENT AREA, KADUNA STATE, NIGERIA

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DECLARATION

I declare that the work in the thesis entitled 'INTESTINAL HELMINTHIASIS AMONG NURSERY SCHOOL CHILDREN IN SABON TASHA, CHIKUN LOCAL GOVERNMENT AREA, KADUNA STATE, NIGERIA' was performed by me in the Department of Biological Sciences, under the supervision of Prof. I.H. Nock and Prof. T.O.L Aken'Ova.

The information derived from literature has been duly acknowledged in the text and a list of references provided. No part of this thesis has been previously presented for another degree or diploma at this or any other university.

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CERTIFICATION

This thesis entitled "INTESTINAL HELMINTHIASIS AMONG NURSERY SCHOOL CHILDREN IN SABON TASHA, CHIKUN LOCAL GOVERNMENT AREA, KADUNA STATE, NIGERIA" by Kuboye Sarah M.Sc/Scie/03724/08-09 meets the regulations governing the award of degree of Master of Science Education in Biology (M.Sc. Ed.), Ahmadu Bello University, Zaria, and is approved for its contribution to knowledge and literary presentation.

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DEDICATION

This thesis is dedicated to God Almighty, my beloved husband, Mr. Bwans. J Omoh and to my lovely kids, Gift, Jotham, Samuel and M.Sc. babies - Elkanah and Elkanelah

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ABSTRACT

The prevalence, intensity and associated risk factors of intestinal helminth infections in 360 nursery school children were investigated. A structured questionnaire with associated risk factors was administered. Stool samples were collected and examined by concentration and floatation techniques to determine the prevalence and intensity of intestinal helminth infections. The data obtained were analysed using Epi Info Version 3:5:1 August 13 2008 statistical package software. The overall prevalence of helminth infections was6.67%.The data of infection with the different helminths in the 360 faecal samples were: Hookworm 14 (3.89%), *Hymenolepis nana* 5(1.39%), *Ascaris lumbricoides* 3 (0.83%) and *Schistosoma mansoni* 2 (0.56%). None of the children had multiple infections. The intensity of intestinal helminth infections measured per gram of faeces (epg), with the highest number of eggs encountered in *Hymenolepis nana* (n = 480), while the lowest number was recorded in Hookworm and *Schistosoma* (n=1). Female pupils had a higher prevalence of 3.88% compared to males with 2.22%. Hook worm, *Ascaris lumbricoides*, *Hymenolepis nana* and *Schistosoma mansoni* infected only children aged 1-3years; *H. nana* and *Schistosoma* did not infect children aged 4-5years. The highest overall prevalence of infection with all the helminths (7.5%) was obtained in children aged 1-3years and those aged 4-5years had a lower prevalence (5%). Helminth infections although generally low occurred mostly in children with the following characteristics: parents with only primary education, well as the source of drinking water; garbage piles and human faeces around their homes and those who ate food with unwashed hands. The risk factors listed were associated with helminth infections. From the findings of this study, I recommend that Ministry of Environment should regularly check the levels of hygiene among the populace and fine defaulters.

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CHAPTER ONE

1.0 INTRODUCTION

Parasitic diseases have contributed immensely to undermining the health status of the populace thereby jeopardizing the economic development of nations in tropical Africa (Ukoli, 1990)

Parasitic infections particularly those caused by intestinal helminths, cause hundreds of thousands of avoidable deaths each year and are among the world's most common infectious diseases (WHO, 1990; 1991). Intestinal helminths are more prevalent throughout the tropics, especially among poor communities (WHO, 2002). Records show increasing trends in helminthiasis, particularly in developing nations (Chan, 1997).

Helminth is a general term for parasitic worms; the most common are nematodes, trematodes and cestodes. Infection with these parasites is generally termed helminthiasis. Helminthic diseases, whether soil-transmitted, vector-borne or resulting from particular social habits, cause some of the great public health problems to humans (Laughlin, 1998).

Helminths cause human infection through contact with parasite eggs or larvae. The life-cycles of *Ascaris, Trichuris* and hookworm follow a general pattern. The adult parasite stages inhabits the intestinal tract (*Ascaris* and hookworm in the small intestine and *Trichuris* in the colon), reproduce sexually, and produces eggs, which are passed out in human faeces and deposited in the external environment (Stephenson *et al*.,1993).

School age children form one of the groups at high risk for intestinal parasitic infections. The adverse effects of intestinal parasites among children are alarming. Intestinal parasitic infection has detrimental effects on their survival (De Silva *et al.,* 1997) appetite, growth and physical fitness (Stephenson *et al.,* 1993), school attendance (Nokes and Bundy, 1993) and cognitive performance (Hadidjaja *et al.,* 1998) of pre-school children.

Studies from Brazil (Tsuyuoka *et al.,* 1999) and Mexico (Quihui-Cota *et al.,* 2004) have demonstrated the influence of intestinal parasitic infections on the anthropometric indices of school-age children. In contrast to this, a study in Ethiopia on children under-five years has showed that there was no significant association between malnutrition and intestinal parasitic infections (Asfaw and Goitom, 2000).

It has been estimated that more than one billion people in the world are infected by soil-transmitted helminths, especially *Ascaris lumbricoides, Trichuris trichiura* and hookworm (Crompton, 1999). Developing countries appear to be the worst affected as about 13 million children die each year and the majority of cases are attributed to soil-transmitted diseases (Tomkins and Watson, 1989).Global estimates indicate that soil-transmitted helminthiasis is among the most common of all parasitic infections (Stephenson, 1987).

Helminthiasis has low detectability due to perhaps confusion of the symptoms associated with the infection. Most often, investigations only consider the possibility of helminth infections after other likely conditions have been ruled out. At such times, effective detection methods must be employed if fatalities are to be reduced or prevented (Anonymous, 2010).

Generally, helminth infections are acquired by children through consumption of fruits, vegetable and water contaminated with faecal matter; they may also acquire infection through ingestion of contaminated soil. Environmental pollution or improper sanitation practices, to a large extent, account for a high prevalence of helminth infections. Indiscriminate disposal of human and animal faeces play an important role in this respect. The danger is evident since parasite cysts and eggs from such sources can be passed directly to the mouth or through contaminated hands or food (Nock and Tanko, 2000).

In many parts of the developing world, children are reported to have a prevalence of helminth infections of between 50% and 80% (Tosson *et al.,* 1991; Kabatreine *et al.,* 1992).There is increasing concern that intestinal helminth infections may be responsible for a considerable amount of morbidity in children in developing countries (Bundy and De Silva, 1998). Investigations have revealed that helminthiasis reduces growth rate, cognitive ability and causes iron deficiency anaemia in children (Cowper, 1993). This translates to a negative impact on the economy of a nation whose productive population is affected by this menace. The physical growth retardation, cognitive and educational impairment caused by heavy chronic infection, among school children has led to calls for school-based periodic deworming programmes.

Intestinal helminthiasis is particularly common in school children who carry the heaviest burden of morbidity (Anonymous, 1995), Increasing evidence suggests that helminthiasis affects school attendance of children (Connolly and Kvalsvig, 1992). Intervention trials using specific anthelminthic therapy have shown significant health

improvements after treatment, including some indicators of cognitive function (Nokes and Bundy, 1993).

Research and intervention targeting helminths in nursery school age children have been limited. The lack of focus on nursery school age is based on an assumed low prevalence and infection intensity, accompanied by a belief that low intensity infections do not result in significant morbidity (Crompton and Nesheim, 2002) However, the reasons to expand the focus to include helminth infection in pre-school age children are increasing. Recently, in Sao Paulo Brazil, mebendazole treatment of pre-school age children was demonstrated to have a greater benefit on growth in children 6-30 months of age than in children of 30-71 months of age, despite the younger children having lower egg counts (Stoltzfus *et al.,* 2004). These suggest that helminthiasis characterized by low egg count can produce significant morbidity in young children. Incomplete immune system development and a high metabolic demand make the youngest of these nursery school age children a group that may be especially susceptible to growth defects induced by helminth infections (Maizels and Yazdanbakhsh, 2003).

1.1 STATEMENT OF THE PROBLEM

Helminthiasis in children, especially nursery children is poorly reported and therefore not known to permit formulation of intervention strategies by relevant authorities. This situation prevails in Sabon Tasha and Kaduna State as a whole.

1.2 JUSTIFICATION

The results obtained will provide information on the prevalence of intestinal helminthiasis in nursery school children of Sabon Tasha, in relation to the associated risk factors from which the need for formulating intervention strategy could be assessed.

1.3 AIM

To evaluate the degree of intestinal helminthiasis among nursery school children in Sabon Tasha.

1.4 OBJECTIVES

The objectives of this study were to determine the:

1 Prevalence of intestinal helminthiasis among nursery school children in Sabon Tasha.

2 Species of intestinal helminths causing helminthiasis in nursery school children in Sabon Tasha.

3 Intensity of infection of intestinal helminthiasis among nursery school children in Sabon Tasha.

4 Relationship between infection rate and the various parameters (age, gender, educational background of parent, source of water supply, hand washing, type of toilet, refuse dumps.

1.5 HYPOTHESES

- Intestinal helminthiasis is not prevalent among nursery school children in Sabon Tasha
- Nursery school children in Sabon Tasha are not infected by helminths.
- There is no significant association between risk factors such as age, sex, source of water supply, type of toilet, educational attainment of parents/guardian, and the prevalence of intestinal helminthiasis in nursery school children in Sabon Tasha.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 INTESTINAL PARASITES

According to WHO (1981), the level of helminth infection can be viewed as an index of a community's progress towards a desirable level of sanitation. Poor hygienic living conditions give rise to helminth infections in children, with the prevalence of such infections being an excellent indicator of their socio-economic status (Schulz and Kroeger, 1992).

2.2 DISTRIBUTION AND PREVALENCE OF INTESTINAL PARASITES IN THE WORLD

Prevalence of intestinal parasites has been reported from all over the world. Wani *et al. (*2010) diagnosed 352 children for helminths in Kashmir, India; 75.28% had one or more types of intestinal helminths. *Ascaris lumbricoides* was highest (71.18%), followed by *Trichuris trichiura* (26.42%), *Enterobius vermicularis* (13.92%) and *Taenia saginata* (5.39%). Conditions most frequently associated with infection included the water source, defaecation sites, personal hygiene and the extent of maternal education. Wiselka and Nicholson (1992) diagnosed 22 cases of schistosomiasis in Leicester during a 5-year period. The survey identified eleven cases of *Schistosoma haematobium* infection and three 3 of *Schistosoma mansoni* infection. The *Schistosoma* types in the remaining eight 8 cases were uncertain.

Thiong'o *et al.* (2001) randomly diagnosed individuals of 5-20 years. The overall prevalence and geometric mean egg count per gram of faeces for *Schistosoma*

mansoni were 31.6% and3.1; Hookworm 36.8% and4.1; *Trichuris trichiura* 21.8% and 1.5; and *Ascaris lumbricoides* 16.5% and 2.5. More girls (34.9%) than boys (28.6%) were infected with *S. manson*i; hookworm infection increased with age but *Ascaris* and *Trichuris* infections decreased with age without gender bias. Ferreira *et al*. (1994) conducted a research on the prevalence of infection by intestinal parasites in an urban slum in Sao Paulo, Brazil using stool specimens from 407 random house-hold based samples from dwellers of all age groups. Intestinal parasites were detected in 45.7% of the specimen; the most prevalent was *Ascaris lumbricoides* (23.8%) followed by *Trichuris trichiura* (17.2%); 17 individuals (4.2%) harboured *Giardia duodenalis* and six (1.5%) harboured *Entamoeba histolytica*. Mixed infection by *Ascaris lumbricoide*s and *Trichuris trichiura* (including mixed infections) were highest among children of 2-12 years. Awasthi *et al.* (1997) examined 1,061(1-5yrs) pre-school slum children in Lucknow, India, in a survey on the prevalence of malnutrition. They obtained 7.5% prevalence of infection; 68.1% of the infected children were infected with *Ascaris lumbricoides* and 32.9% by *Giardia lamblia*. A retrospective survey of laboratory records of 8,590 stool samples examined for intestinal parasites from local Hong Kong residents showed changes in the pattern of infestations, particularly at the age of acquiring first infection and the peak of occurrence for the different intestinal parasites in comparison with the data obtained 12 years earlier (Kabatereine, 1992). *Clonorchis sinensis* was the most prevalent, found in 453 (5.3%) subjects, followed by *Trichuris trichiura* in 192 (2.2%), Hookworm in 35 (0.4%) *Ascaris lumbricoides* 26 (0.3%), *Entamoeba* 23 (0.3%) and *Strongyloides stercoralis* 3 (0.3%).An epidemiological study of intestinal nematodes based on 1,292 children ranging from birth through 11 years, living in south-east Madagascar was conducted by Kightlinger *et al*. (1994). Prevalences of 78% for

Ascaris lumbricoides, 38% for *Trichuris trichiura*, 16% for Hookworm and 0.4% for *Schistosoma mansoni* were obtained. The three nematodes were over-dispersed. The age profiles showed a rapid acquisition of *Ascaris lumbricoides* during infancy, increasing to 100% prevalence by the age of 10.

Dada-Adegbola *et al*. (2005) in his survey in a farming community with no tarred access road, electricity or pipe-borne water, diagnosed 170 children of which 68.2% had one intestinal helminths infection or the other. Co-infection with more than one helminth was fairly common; 49.1% of the infected population while 35.4%, 11.2% and2.6% had double, triple and quadruple infections respectively.

Also enteropathic aid in north-eastern Tanzania was conducted by (Tarimo *et al.,* 1996). A total of 352 patients were recruited, 158 (45%) had chronic diarrhoea. Of the 352 patients, 123 (35%) had intestinal parasites. Out of the 123 subjects, 77 (62.6%) had chronic diarrhoea. The parasites detected were, *Cryptosporidium, Isospora belli, Strongyloides stercoralis, Schistosoma mansoni, Trichuris trichiura, Ascaris lumbricoides,* hookworm and *Entamoeba histolytica*. The study further found that, the prevalence of intestinal parasites was significantly higher in patients with chronic diarrhoea than those without.

Kabatereine *et al*. (1996) studied *Schistosoma mansoni* infection in 451 people living in three villages in western Uganda; 90.7% were infected with *S. mansoni,* with geometric egg count of 561.3 eggs per gram of faeces. Males had significantly higher mean egg counts (608.3 epg) than the females (415.6 epg). Other common parasites observed were *Ascaris lumbricoides, Trichuri strichiura* and Hookworm.

Kabatereine *et al.* (1997) worked on the human intestinal parasite in primary school children in Kampala, Uganda. The common infection found were, *Trichuris trichiura* 28%, *Ascaris lumbricoides* 17% and Hookworms 12.9%. Other less commonly found parasites were *S. mansoni, S. stercoralis, Taenia* spp and *E. vermicularis*

Infection and transmission of human *Schistosoma mansoni, Schistosoma haematobium*, or both species among 6,122 children from schools in the former White Nile province of Sudan, was carried out by Ahmed *et al*. (1995). The prevalence was 10.1%, 21.4% and 4.5% respectively. School-specific prevalence and intensities of infection were positively correlated both for *S. Mansoni* and *S. haematobium*. Prevalence and intensities of infection were generally similar in male and female subjects, and in different age groups.

Tadesse (2005) in his report diagnosed 415 (98.3%) in Babile Town (Eastern Ethiopia) among these, 271(65.3%) were males and 144 (34.7%) were females. The mean age was 11.2 years. Nine species of intestinal helminths were identified with an overall prevalence of 27.2%. The prominent parasite involved was *H. nana* which was observed in 42(10.1%) hookworm in 28(6.7%) and *S. mansoni* in 18(4.3%). The prevalence of soil-transmitted helminth was 14.2% (59 of 415).

2.3 DISTRIBUTION AND PREVALENCE OF HELMINTHS IN NIGERIA

Ojurongbe *et al.* (2011) in his work among school children in Osogbo Nigeria, found the prevalence of *Plasmodium falciparum*, intestinal helminth infections, co-infection of malaria and helminths in the study to be 25.6%, 40.2% and 4.3% respectively. Five species of intestinal helminths were recovered from stool samples; *A. lumbricoides*

32.2%, Hookworms 5.1%, *T. trichiura* 2.6%, *D. latum* 0.9% and *Trichostrongylus* species 0.9%. In an evaluation report of hookworm as a public health problem in Nigeria urban population, Oyerinde (1982) reported that 743 people out of the 2,797 examined were infected among the young adults of 16-25 years old.

Galadima and Olatunde (1985), showed that, out of 208 children examined for intestinal parasitic infections in Samaru-Zaria, 90 (43.3%) were infected. The identity and prevalences of the parasites encountered were: Hookworm(5.8%), *S. mansoni*(4.89%), *S. Haematobium* (0.5%), *H. nana, T. solium* and *T. saginata*4.3% each, *T. trichiura, A.lumbricoides*3.8% each*, E. vermicularis (*3.4%) and *G. lamblia* (7.2%).

Some factors involved in the transmission of schistosomiasis among 1,834 residents of a small settlement within an agricultural establishment near Yola were studied by Akogun and Akogun (1995), where children age group of 5-12 years accounted for 40% of water contacts and contamination of Lake Geriyo with faeces and urine. Parasite prevalence was 98% for *S. haematobium* and 79% for *S. mansoni*.

A comparative study of intestinal helminthiasis was conducted in two communities along the Benue River in Adamawa State by Akogun and Badaki (1998). Out of the 350 stool samples collected and examined for parasites, intestinal helminth infections were found to be more frequent in Jambutu community(52.1%) than Bajabure (38.5%), while urinary schistosomiasis was more prevalent in Bajabure (22.9%) than Jambutu (12.5%). The individual parasite prevalences were: *A. lumbricoides* (18.8%), *T. trichiura* (14.9%), *E. histolytica* (18.8%) and *S. haematobium* (18.8%).

A survey was carried out on 4000 pupils in five local government areas of Katsina State by Idris (2001). The age range of the pupils was between 5 and 19 years. Pupils infected with at least one species of intestinal parasite were 1,404 (35.1%). Infection rates of helminth and protozoan species detected were *Ancylostoma duodenale*, 622 (15.55%), *Ascaris lumbricoides*, 28(0.70%), *Hymenolepis nana*, 165 (4.13%), *Enterobius vermicularis*, 153 (3.83%), *Trichuris trichiura*, 34 (0.85%), *Strongyloides stercoralis*, 16(0.4%), *Schistosoma mansoni*, 382(4.03%), and *Entamoeba histolytica* 4(0.10%). The infection was found to be influenced by sex ($P<0.05$), hygiene practice ($P<0.05$) and water supply ($P<0.05$).

2.4 TRANSMISSION AND PATHOGENESIS OF SOME HELMINTHS

Intestinal infections are mainly acquired through ingestion, inhalation or penetration of the skin by the infective forms (Kabatereine *et al.,* 1997). For instance, contact between the larvae of hookworm in contaminated soil and skin leads to penetration and resultant larval migration (Hira and Patel, 1984).

Ascariasis is caused by contamination of hands and food by eggs developing in the soil; it thus occurs at high levels in populations living under conditions of poor hygiene (Kightlinger *et al.,* 1994). *Ascaris lumbricoides* lies in the small intestine of man, most frequently in children, where it feeds on semi-digested food and growth may be affected (Cook, 1986). Ascariasis is associated with obstruction at the sites of infection. A mass of worms up to 1,000 can produce small intestinal obstructions usually at the ileal level; obstruction to the biliary system and pancreatic duct are especially important complications (Cook, 1986).

Trichuris trichiura is a common human intestinal parasite reported to infect up to 80 million people worldwide (Cooper and Bundy, 1988). Infection usually results from ingestion of infected eggs (transmitted by defaecation onto soil), and from contaminated soil) and from contaminated hands, food or drink (Cook, 1986). Massive trichuriasis may present distinctive features like rectal prolapse or digital clubbing; the majority of infections are chronic and mild with vague, non-specific symptoms like chronic diarrhoea, growth retardation, abdominal discomfort and anaemia (Edungbola and Obi, 1992). The caecum, ileum or rectum is the usual site of infection. The adult worms obtain nourishment by liquefying mucosal cells or by sucking the host's blood (Bundy and De Silva 1998).

Schistosomiasis is the most important of all water diseases and is second to malaria in its socio-economic and public health implication. Schistosomiasis is a snail-borne infection of humans and animals caused by digeneans in the family Schistosomatidae. The infection is widespread with a relatively low mortality but high morbidity rate, causing severe illness in millions of people. The disease is found mainly in the tropics and sub-tropical regions, and it is often associated with water development projects such as dams and irrigation schemes which are breeding sites for the snail intermediate host of the parasite; people who often swim, wash or fish in associated waters get infected (Pugh and Gilles, 1978).

Schistosoma mansoni and *Schistosoma haematobium* are the most important species of schistosomes with widespread distribution (Ahmed *et al.*, 1995). The former causes intestinal schistosomiasis while the latter causes urinary schistosomiasis.

Hymenolepiasis is a disease caused by *Hymenolepis nana* (dwarf tapeworm) which is a cosmopolitan parasite of humans, being found chiefly in children. The infection is

the most common of all cestodiasis. Up to 16% prevalence has been recorded in children (Meloni *et al.,* 1988). This worm reaches only 2.5-4cm in length and lives in the small intestine of humans and rodents. Further development takes place if the egg is ingested by man (Soulsby, 1982).

2.5 CONTROL OF INTESTINAL HELMINTH INFECTIONS

Intestinal parasites can be very pathogenic to their hosts, thus affecting the life and well-being of the hosts in different ways. More people (especially in tropical and sub-tropical regions) are increasingly at risk of the infection by these parasites as a result of population increase, urbanization and associated activities. The need to control parasitic infections has thus become necessary WHO (1987). To ensure proper control, significant efforts should be geared towards improving environmental conditions, provision of safe and clean water, provision of adequate sanitation and social infrastructure, so as to improve the care capacity of mothers and food handlers to protect children from food borne diseases/hazards (Baltazar *et al.*, 1993).

In poor undernourished and often underserved communities, control of intestinal parasitic infections should involve environmental measures which require community involvement and government support (Bundy and De Silva, 1998). Furthermore, provision of safe water, research and development, the introduction of a sanitation system that is acceptable, employment of appropriate technologies, and the improvement of personal and community hygiene practices are also pertinent. The long term solution to malnutrition and helminth control therefore lies in the eradication of poverty, improvement of health care and living conditions through improved sanitation and water supplies. Such measures should be taken in conjunction with treatment programmes.

It has been observed that children with educated parents have fewer parasitic infections than those with non-aware parents. It is believed that enlightenment through public health education can help people to change or at least modify some of their ways and belief for the better (Ukoli, 1992; Nock *et al*., 2005).

CHAPTER THREE

3.0 MATERIALS AND METHODS

3.1 STUDY AREA

This study was carried out in Sabon Tasha Educational Zone of Chikun Local Government Area of Kaduna State. Sabon Tasha comprises the following Local Education Authority schools: Unguwan Boro, Unguwan Pama, Unguwan Barde, Sabon Tasha, New Sabon Tasha and Tsaunin Kura.

Sabon Tasha is located between latitude 10°19′-10°29′ North and longitude 7°14-7°25′ East (Olayiwola,1997) (Fig1). Like the whole of Kaduna State, Sabon Tasha has two distinct seasons: Wet Season (May-October) with maximum precipitation in July and August, Dry Season (November-April) with generally high temperatures between March and April, and low temperatures from December to January.

Chikun Local Government Area is notable for farming, petty-trading and has a civil service setting. Some areas in Sabon Tasha are supplied with pipe borne water while some areas depend on wells.

Sabon Tasha's environmental hygiene is poor as evidenced by heaps of refuse dumps, poor drainage coupled with indiscriminate disposal of human and animal waste, even by sides of streets.

3.2 ETHICAL CLEARANCE

Ethical clearance was obtained from the Commissioner of Education through Chikun Local Government Education Secretary to undertake the study.

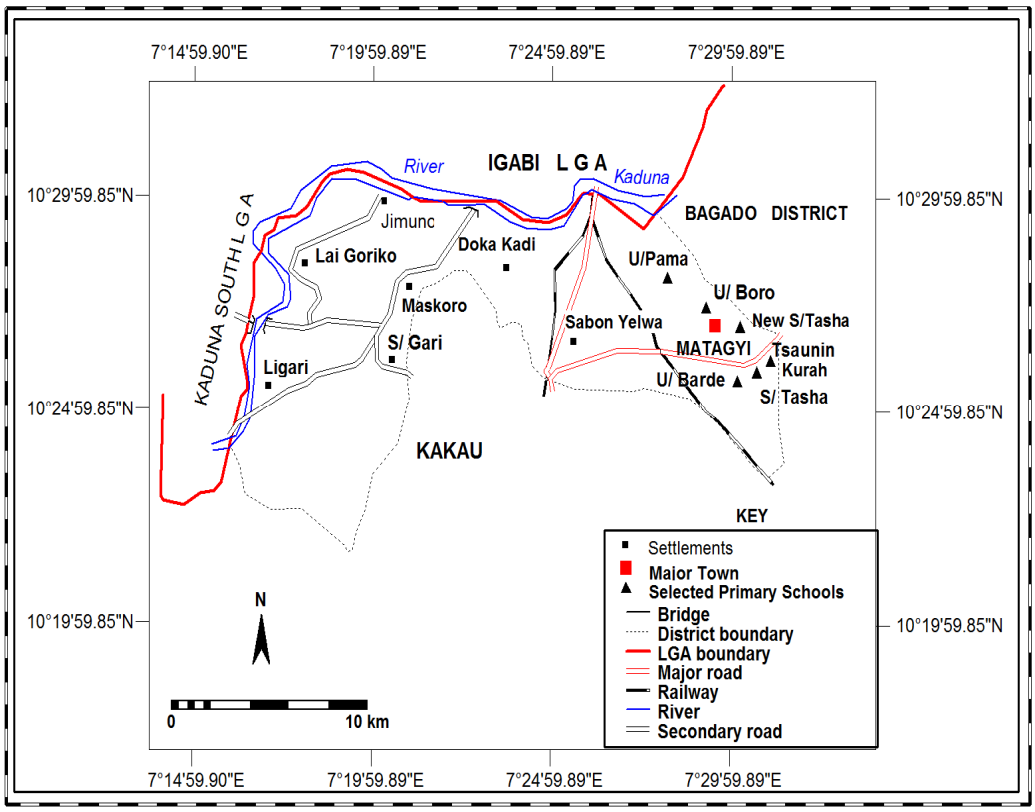


Fig. 1. Sabon Tasha Ward showing the primary schools selected for the study

Source: Adopted and modified from the Map of Chikun Local Government Area

3.3 DETERMINATION OF SAMPLE SIZE

Due to lack of data on the prevalence of intestinal helminthiasis in Sabon Tasha, Chikun Local Government Area, Kaduna 50% prevalence was used to determine the sample size using the formula of (Sarmukaddam and Gerald, 2006):

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

Where

N = Sample size,

Z = standard normal distribution at 95% confidence interval=1.96

P = prevalence, expressed as a fraction of 1. Therefore *P*= 50%= 0.5

$q = 1 - P = 0.5$

L = Allowance error which was given as 5% =0.05, substituting the values,

$N = (1.96^2 \times 0.5 \times 0.5)/0.05 = (3.84 \times 0.250)/0.0025 = 360$ samples collected.

3.4 STUDY POPULATION AND SAMPLING

The study was carried out in the nursery section of six public schools in Sabon Tasha in March/April 2011. Male and female children (1-5yrs) were randomly selected by balloting. To do this, A and B were written on pieces of paper and distributed to pupils. Stool samples were collected from only those who chose A. A total of 60 stool samples were collected from each of the following schools: L.E.A Sabon Tasha, L.E.A. Tsaunin Kura, L.E.A Unguwar Pama, L.E.A Unguwar Boro, L.E.A Unguwar Barde, L.E.A. New Sabon Tasha.

3.5 PRE-SAMPLING VISIT

A pre-sampling visit was paid to the schools during which introductory letters from the Department of Biological Sciences, Ahmadu Bello University, Zaria were delivered to the headmasters/mistresses of each school. The objectives of the study were explained to the Headmasters/Mistresses, teachers and pupils in order to get their co-operation and consent in the course of sample collection. The co-operation of parents was also sought through a letter and a questionnaire. The method of collection was explained.

All pupils enlisted in the study were given serial numbers. A questionnaire was also administered to seek information on name, age, sex, name of school, parents' occupation, source of water supply, type of toilet etc. (Appendix I).

Each of the pupils selected was given an already labelled empty specimen bottle that tallied with the student's serial number for recognition. The date for collection was also noted.

3.6 SAMPLING VISIT

A total of 60 stool samples were collected from male and female pupils aged 1-5 years from each school. Each of the faecal samples received was preserved in 10% formalin. Each child was given a clean polythene bag, wooden swab, and a clean specimen bottle.

3.7 ANALYSIS OF STOOL SAMPLES

Formol-ether concentration method of Cheesbrough (1999) and simple floatation technique were employed for stool analysis.

3.7.1 Formol-ether concentration technique (Cheesbrough, 1999)

One gram of faeces was placed in a universal bottle and3ml of 10% formol-saline was added and mixed thoroughly with a glass rod.

The mixture was poured through a funnel lined with gauze into a test tube.

The filtrate in the test tube was made up to 8ml with normal saline in a wash bottle 1-3ml of diethyl ether was added, corked and shaken vigorously for 1- 2 minutes.

The mixture was centrifuged at 1,500 revolutions per minute for 2 minutes during which the gas generated by the shaking escaped.

The supernatant was decanted and the sediment with a little supernatant was carefully mixed and a drop was placed on a clean slide using a pipette; a drop of Lugol's iodine was added and mixed.

The mixture was covered with a cover slip and examined under a microscope using ×10 and ×40 objectives.

Any eggs of helminths found were identified using Cheesbrough (1999).

3.7.2 Simple floatation technique

2 gram of faeces was placed in a universal container in to which a floatation medium was added and mixed thoroughly with a glass rod.

The mixture was emptied into a funnel, fitted with gauze to filter into test tube.

The funnel was carefully removed; mixture was filled with a floatation medium until a meniscus was formed.

A cover slip was placed on test tube, allowed to stay for 10 minutes.

Cover slip was mounted on clean glass slide and examined.

3.7.3 Intensity of infection

The infection intensities (eggs per gram of faeces) were scaled as follows: 1-199 epg light, 200-399epg (moderate) ≥ 400epg (heavy) for hookworm and *H. nana*, while 1-299 epg, 300-499epg and ≥ 500 epg (light, moderate and heavy respectively) for *A. lumbricoides,* and 1-49 epg, 50-199 epg and ≥200 epg (light, moderate, and heavy respectively) for *S. mansoni.* The infection intensity was determined by processing one gram of each positive stool sample, but as in this case, the sediment was mixed with a dropping pipette. The whole sediment mixture was placed in a counting chamber and the eggs were counted under the microscope and expressed as eggs per gram of stool.

3.8 STATISTICAL ANALYSIS

- The prevalence of intestinal helminths was expressed as percentages.
- The association between prevalence and age, sex, parental occupation, source of water supply and educational status of parents, was determined using Odds Ratio and Chi-square.
- The number of eggs per gram of faeces and the mean intensity of infection were determined.

- T-test was used to test for any significant difference in the prevalence and intensity of infestation of male and female pupils.
- Correlation analysis was used to determine the coefficient (r) between prevalence of infection and age of children.

CHAPTER FOUR

4.0 RESULTS

4.1 IDENTIFICATION OF HELMINTH EGGS

The eggs of hookworm were recognised as oval with rounded ends and a clear space between the developing embryo and a thin outer layer of egg (Plate 1a). The eggs of *Hymenolepis nana* are round in shape with a rough outer layer and a distinct demarcation between the inner and outer layers (Plate 1b). Those of *Schistosoma mansoni* are elongated, ovoid with a large lateral spine projecting near one end (Plate Ic). While the eggs of *Ascaris lumbricoides* are oval-shape with a rough coat (Plate 1d).

4.2 OVERALL PREVALENCE OF HELMINTH INFECTIONS

Of the 360 stool samples examined, 24 (6.67%) had eggs of intestinal helminths (Table1). Hookworm was the most prevalent 14(3.89%), followed by *Hymenolepis nana* 5(1.39%), *Ascaris lumbricoides* was 3(0.83%) and *Schistosoma mansoni* 2(0.56%).

4.3 PREVALENCE OF INTESTINAL HELMINTHIASIS ACCORDING TO SCHOOLS

With respect to the distribution of helminths among the schools, the results showed that all the four helminths encountered occurred in L.E.A S/Tasha, three in L.E.A Ung/Pama and two helminths each in L.E.A. T/Kura and Ung/Barde; one each was recorded in New Sabon Tasha and Ung/Boro. Hookworm was the most prevalent helminth recorded in all the schools sampled (Fig 2).

Table 1: Overall Prevalence of Helminths in the Six (6) Schools Sampled (n=360)

Helminth	No. Infested	Prevalence (%)
Hookworm	14	3.89
Hymenolepis nana	5	1.39
Ascaris lumbricoides	3	0.83
Schistosoma mansoni	2	0.56
Total	24	6.67



Plate I. Eggs of helminths recovered during the study: **a,** *Ancylostoma duodenale*; **b,** *Hymenolepis nana*; **c,** *Schistosoma mansoni* (**Source:** http/www.path.cam.ac.uk/schisto/schistosoma/schisto_lifecycle_egg.html **d,** *Ascaris lumbricoides.*

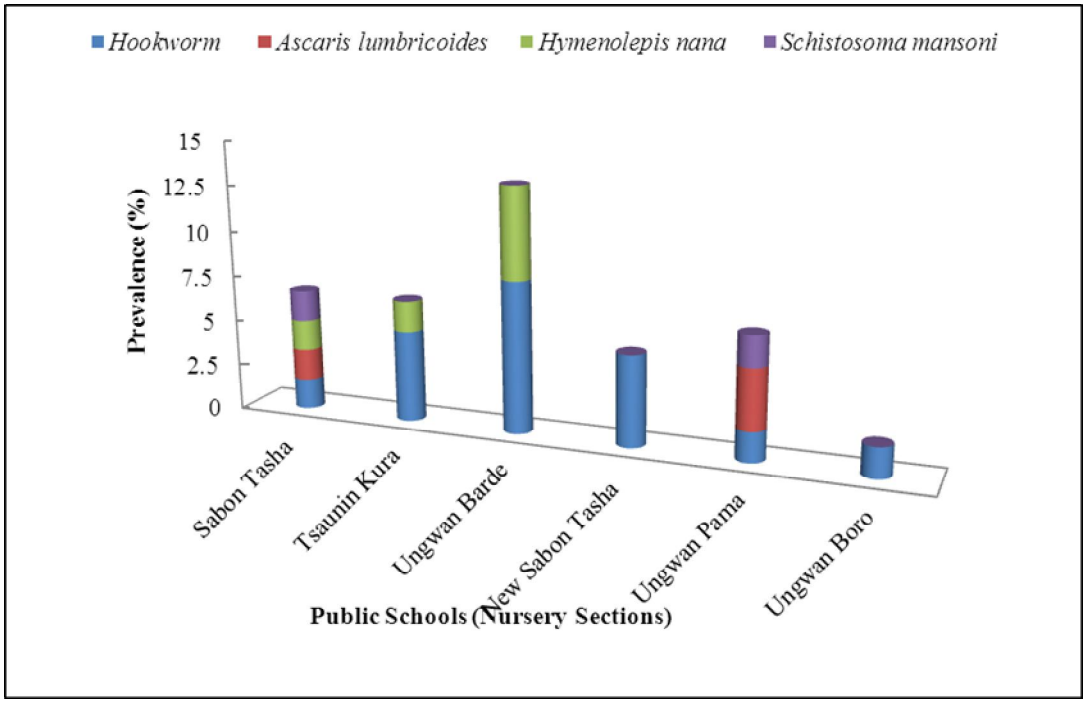


Fig 2: Prevalence of Intestinal Helminthiasis according to L.E.A. Schools in Sabon Tasha

Table 2: The Prevalence of Intestinal Helminthiasis in Relation to Gender

Gender	**No. Examined**	**No. Infected (%)**	**OR**	χ^{2}*	***P***
Male	173	8 (4.62)	1.93	1.65	0.200
Female	187	16 (8.56)			
Total	360	24 (6.67)			

4.4 INTESTINAL HELMINTHIASIS IN RELATION TO GENDER

Table 2 shows that 173 males were examined out of which (4.62%) were infected with helminth, 187 females were examined of which 16(8.65%) were infected as demonstrated by the eggs in stool samples examined. Both males and females harboured the four helminth eggs encountered, except *Ascaris lumbricoides* whose prevalence was higher in females than in males. The prevalence of infestation of female pupils was higher than those of males. However, the difference in prevalence was not significant (P>0.05) (actual P-value =0.235).

4.5 PREVALENCE OF HELMINTHIASIS IN RELATION TO AGE

The prevalence of helminthiasis shows an inverse relationship with age (r=-0.87); infection decreased with increase in age; however, the highest prevalence of 7.5% was found in the age group of less than 2 years. Similarly, there was an increase in prevalence with age in hookworm infection (r=0.87) whereas, *Hymenolepis* and *Schistosoma* prevalence decreased with age in the following relationship-0.98, -0.66), and -0.87*,* respectively (Table 3).

4.6 MEAN EGG COUNT PER GRAM OF STOOL (EPG)

Table 4 shows the mean egg count for hookworm, *A. lumbricoides, H. nana,* and *S. mansoni*. Eggs of hookworm and *Ascaris lumbricoides* were found to be higher among females. *Hymenolepis nana,* which was found only in the South side of Sabon Tasha, was more prevalent in male than in female pupils*; Schistosoma mansoni* was found in both males and females. Among the helminths recorded, *H. nana* had the highest intensity of infection as shown by the number of eggs per gram of faeces

(480), and this was recorded among the 2-3 years age group. The lowest intensity of helminth infection was in hookworm and *S. mansoni,* each with 1 egg per gram of faeces.

4.7 PREVALENCE OF INTESTINAL HELMINTHS IN RELATION TO EDUCATIONAL BACKGROUND OF PARENTS

Table 5 shows that out of 152, 138 and 70 of the children examined, whose parent had primary, secondary and tertiary school background. 9.2%, 6.52% and 1.43% of these children were infected respectively. The difference in prevalence was however, not significant $P>0.05$(actual P-value =0.149, 0.896 and 0.090 respectively).

4.8 PREVALENCE OF INTESTINAL HELMINTHS IN RELATION TO SOURCE OF WATER SUPPLY

The prevalence of intestinal helminth in relation to source of water supply is shown in Table 6. Out of 162 children who drank pipe borne water, 11(6.79%) were infected. Of the 178 who drank from well 12(6.74%) were infected. While of 20 who drank from bore hole 1(5%) was infected. Children who drank from the three sources were infected $P>0.05$ (actual P value =0.898, 0.876 and 0.877 respectively).

4.9 PREVALENCE OF INTESTINAL HELMINTHS IN RELATION TO HAND-WASHING

Table 7 shows prevalence in relation to hand-washing. Out of 59 children who always washed their hands 2(3.39%) were infected. Of the 138 who sometimes washed their hands 8(5.79%) were infected. Of those who did not wash their hands, at all infected 14 (8.58%), 39%, 79%, and 58% of these children were infected respectively. However, the difference in prevalence was not significant $P>0.05$ (actual P value = 0.413, 0.760 and 0.263 respectively).

Table 3. Age-Related Prevalence of Intestinal Helminths in Children of L.E.A Schools, Sabon Tasha

	Pooled data of helminth infections		**No. Infected according to helminth (%)**			
Age group (Years)	**No. Examined**	**No. Infected (%)**	**Hook worm**	***A. lumbricoides***	***H. nana***	***S. mansoni***
< 2	120	9 (7.50)	4 (3.33)	1(0.83)	2 (1.67)	2 (1.67)
2 – 3	120	9(7.50)	5 (4.17)	1 (0.83)	3 (2.50)	0 (0.00)
4 – 5	120	6 (5.00)	5 (4.17)	1 (0.83)	0 (0.00)	0 (0.00)
Total	**360**	**24(6.67)**	**14 (3.89)**	**3 (0.83)**	**5 (1.39)**	**2(0.56)**

Table 4. Intensity of Infection with Hookworm, *Ascaris lumbricoides, Hymenolepis nana* and *Schistosoma mansoni* by age and class of pupils in LEA Schools, Nursery sections in Sabon Tasha

Class & Age	Hookworm			*A. lumbricoides*			*H. nana*			*S. mansoni*		
	LI	MI	HI	LI	MI	HI	LI	MI	HI	LI	MI	HI
Kindergarten <2 (n=154)	4(0.8)	0.0	0.0	1(0.)	0.0	0.0	2(0.5)	0.0	0.00	2(0.1)	0.0	0.0
Nursery 1 2-3 (n=765)	5(0)	0.00	0.0	1(0.)	0.0	0.0	3(1.7)	0.0	0.00	0(0.0)	0.0	0.0
Nursery 2 4-5 (n=111)	5(0)	0.00	0.0	1(0.)	0.0	0.0	0(00.)	0.0	0.00	0(0.0)	0.0	0.0
Infection status threshold	1-199 EPG	200-399	≥400	1-300 EPG	301-499	≥5000	1-199 EPG	200-399	≥400	1-50EPG	51-200	201-600

Key = LI = Light infection, MI = Moderate, HI = Heavy infection EPG = Egg per gram of stool.

Infection status threshold is based on WHO (World Health Organization) Threshold (Montresor *et al.,* 2002)

Table 5: Prevalence of Intestinal Helminths in Relation to Educational Background of Parents

Educational Background of Parents	No. Examined	No. Infected (%)	OR	CI	χ^2*	*P*
Primary	152	14 (9.21)	2.01	0.81, 5.03	2.07	0.149
Secondary	138	9 (6.52)	0.96	0.38, 2.42	0.02	0.896
Tertiary	70	1 (1.43)	0.17	0.01, 1.20	2.86	0.090

* Yates' corrected value used

Table 6: Prevalence of Intestinal helminthiasis in Relation to Source of water Supply

Source	No. examined	No. infected (%)	OR	CI	χ^2*	*P*
Pipe borne	162	11(6.79)	1.04	0.42,2.55	0.02	0.898
Well	178	12(6.74)	1.02	0.42,2.52	0.02	0.876
Bore Hole	20	1(5)	0.73	0.02,5.00	0.87	0.877

*Yates' corrected value used

4.10 PREVALENCE OF INTESTINAL HELMINTHS IN RELATION TO TYPE OF TOILETS

Table 8 shows that 3.75% of the pupils that used water closet were infected with helminths, whereas a higher number (7.63%), of those who used pit latrine were infected with helminths

and 5% of children who used other sources were also infected with helminths. However, the difference in prevalence was not significant $P>0.05$ (actual P value = 0.383, 0.334 and 0.877 respectively)

Table 7: Prevalence of Intestinal Helminthiasis in Relation to Hand-Washing

Frequency	No. Examined	No. infected	OR	CI	χ^2*	*P*
Always	59	2(3.39)	0.44	0.07, 2.04	0.67	0.413
Sometimes	138	8(5.79)	0.79	0.30, 2.03	0.09	0.760
Not at all	163	14(8.58)	1.76	0.76, 4.40	01.25	0.263

* Yates' corrected value used

Table 8: Prevalence of Intestinal Helminthiasis in Relation to Types of toilet Used

Toilet type	No. examined	No. infected	OR	CI	χ^2*	*P*
Water closet	78	3(3.86)	0.50	0.11,1.82	0.76	0.383
Pit latrine	262	20(7.63	1.90	0.61,6.91	0.93	0.334
Others	20	1(5)	0.73	0.02,5.00	0.02	0.877

*Yates' corrected value used

4.11 PREVALENCE OF INTESTINAL HELMINTHS IN RELATION TO PRESENCE OF HUMAN FAECES IN AND AROUND THE HOME ENVIRONMENT

Table 9 shows the prevalence in relation to presence of human faeces in and around home environment. Out of 62 children who had human faeces around home environment 10(16.13%) were infected. Of the 298 children who had no human faeces around their homes 14 (4.69%) were infected. Prevalence showed significant association with infection $P<0.05$(actual P-value = 0.003).

Table 9: Prevalence of Intestinal Helminthiasis in Relation to Presence of Human Faeces in and Around Home Environment

Response	**No. examined**	**No. Infected**	**OR**	**CI**	χ^2*	***P***
YES	62	10 (16.12)	3.90	1.51,9.98	9.02	0.003*
NO	298	14 (4.69)				

*Yates' corrected value used

4.12 PREVALENCE OF INTESTINAL HELMINTHS IN RELATION TO GARBAGE PILES IN AND AROUND HOME ENVIRONMENT

Table 10 shows that (10%) of the pupils that had garbage piles in and around their homes were infected by helminths whereas a lower number (4.28%) of those without garbage piles were infected. The association between helminth infection and garbage piles around the home was significant P<0.05 (actual *P*-value = 0.053).

Table 10: Prevalence of Intestinal Helminthiasis in Relation to Garbage Piles in and Around Home Environment

Garbage piles	**No. Examined**	**No. Infected %**	**OR**	**CI**	χ^2*	***P***
With garbage	150	15(10)	2.48	0.99,6.34	3.72	0.053*
Without garbage	210	9(4.28)				

* Yates' corrected value used

CHAPTER FIVE

5.0 DISCUSSION

Soil-transmitted helminths are a great public health problem in several tropical and subtropical developing countries such as Nigeria, due to poor socio-economic status and personal hygiene. This is more common in school-going children and it is associated with high morbidity and mortality and economic loss to the country (Girum, 2005; WHO, 2000; Ukoli, 1990). The results of this study appear to agree with this remark.

A prevalence of 6.67% with intestinal helminths was obtained in this study; the eggs of hookworm, *Ascaris lumbricoides, Hymenolepis nana* and *Schistosoma mansoni* were recovered. This may illustrate the general trend among nursery school children throughout the state as roughly the same environmental conditions apply.

In this study, the observed overall prevalence (6.67%) is relatively lower than obtained in studies done elsewhere within the state (63.3%) (Inabo and John, 2010) and the country at large (48%) (Ezeagwuna *et al*., 2010).The time at which this study was carried out (Dry season) could be responsible for the low prevalence obtained since it has been shown that high temperatures, combined with high rainfall are conducive to acquiring intestinal helminths(Laughlin, L.W. 1998).

The highest prevalence of helminth infestation was recorded in Unguwan Barde L.E.A; this may be due to the inadequate toilet facilities and improper disposal of refuse recorded in the area.

The overall prevalence obtained in this study (6.67%), is relatively lower than obtained in studies done in children elsewhere within Kaduna State, and the country at large. Inabo and John (2010) found that (63.3%) of the children in orphanages had overall prevalence of

helminths while Ezeagwuna *et al.* (2010) observed an overall prevalence of (48.08%) in pre-school children in Anambra.

The high prevalence of the infection among females obtained in this study may be due to the frequency and intensity of playing with soil which exposes them to contamination in the area of study. This agrees with the reports of Ezeagwuna *et al.* (2010) who recorded a high prevalence in females (8.56%) compared to (4.62%) in males.

The four (4) species of helminths encountered in the stool samples were found to be present in L.E.A Sabon Tasha. This may be because the children were seen sitting on the dusty floor of their class rooms (Plate2) as dust is important for the transmission of helminths.

In this study, *Trichuris trichiura* was not encountered perhaps because *Trichuris* cannot successfully complete its life cycle in the absence of moist soil; this study was carried out at the end of the dry season (March-April).

Sabon Tasha is divided into North and South by a Federal road, *Hymenolepis nana* was found only in the south side of Sabon Tasha, this may be because the people from that side do not restrict their children from animals like dogs as fleas are important vectors of this species, and children in close contact with flea infested dogs are particularly prone to infection.

The finding that hookworm had the highest prevalence (3.89%) agree with the findings of Ezeagwuna *et al.* (2010), the prevalence obtained here was however, much lower than that of Ezeagwuna *et al.* (2010) who reported hookworm prevalence of (25.38%) in a similar investigation in Eastern Nigeria. In another study of primary school children in Oshogbo the overall percentage of helminths obtained was 48.7% (Kusaya *et al.*, 1989). This is consistent with earlier reports that intestinal helminthiasis caused by hookworm and round worms are common especially among urban poor populations in Nigeria (Chukwuma *et al.*, 2009).

In this study, *Hymenolepis nana* eggs were recovered from the faecal samples examined, although only a small proportion of the faeces contained eggs of this worm; however, Inabo and John (2010) did not encounter *Hymenolepis nana* infection in their study. This may be due to the fact that the children straddled for the study lived under different environmental conditions. It may also suggest that the infection is not very common in both areas of study.

In this study, the children are said to be compulsorily de-wormed annually with anthelmintics supplied by the Ministry of Education at an affordable cost. This may probably be responsible for the low prevalence of helminth eggs obtained in the stool samples.

It has been observed that major behavioural factors play a role in helminth infection transmission (Habbari *et al.,* 1999).

The prevalence of infestation was higher in children whose parents had primary education compared to those whose parents had tertiary education. This may be because the parents do not compromise on the hygiene of their children considering their educational status. However, there was no significant association between parents' levels of education and the infestation of helminths.

Children who drank from tap and well had a higher prevalence of helmiths infestation compared to their counterparts who drink from borehole. However, there was no significant association between sources of water supply and helminths infestation.

It is surprising that the result obtained showed no significant association between hand washing and types of toilets used, this could be due to annual de-worming of children and or resistance to infestation. However, this suggests the need for proper disposal of faeces; latrines should be used with the highest level of hygiene in order to check the spread of infestation and also campaign for hand washing.

The significant association between the presence of human faeces and garbage piles in the vicinity of homes is of great concern and indicates a need for regular environmental sanitation and inspection of premises.

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

The present study revealed that intestinal helminth infestation occurs among nursery children in Sabon Tasha.

At least four (4) species of helminths infest nursery school children in Sabon Tasha.

Prevalence of helminthiasis in nursery school children of the six (6) public schools (nursery sections) in Sabon Tasha is relatively low.

Improper disposal of refuse, indiscriminate disposal of human and animal faeces promote helminthiasis.

Female children in the school are more susceptible to helminthiasis than their male counterparts.

RECOMMENDATIONS

The annual supply of anthelmintic to schools should be made free to encourage complete mass de-worming.

The impact of any preventive measure taken should be maximized through a health education programme directed at nursery children and their mothers in particular, and to communities in general.

I recommend further study to ascertain the occurrence of *Hymenolepis nan*a in Sabon Tasha south alone, by studying a larger population of children

Ministry of Environment should regularly check the levels of hygiene among the populace and fine defaulters.

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APPENDIX 1: QUESTIONNAIRE

DEPARTMENT OF BIOLOGICAL SCIENCES

FACULTY OF SCIENCE,

AHMADU BELLO UNIVERSITY,

QUESTIONNAIRE

Dear Pupil,

I am a post graduate student of Department of Biological Sciences, Ahmadu Bello University, Zaria. I am working on a research project, titled: Prevalence of Intestinal helminthiasis among Pre-School Children in Chikun Local Government Area, Kaduna State. Kindly fill the questionnaire as honest as you can. Every information you give will be treated with confidentiality and used for the purpose of this research work only.

Thank you for your cooperation.

Kuboye, Sarah.

Age of pupil: 1-2yrs [ ] 2-3[ ] 3-4[ ] 4-5[ ]

Sex of pupil: Male[ ] Female[ ]

Class of Pupil: KG[ ] Nursery1[ ] Nursery2[ ]

Type of toilet: Pit latrine [ ] Water system [ ] Others [ ]

Educational background of parent: Primary [ ] Secondary [ ]Tertiary[ ]

Source of water supply: Pipe borne [ ] Well [ ] borehole[ ]

Presence of human faeces in or around home environment: Yes[ ] No[ ]

Presence of garbage piles around school environment: Yes [ ] No[ ]

Presence of animal faeces in or around home environment: Yes[ ] No[ ]

Do you wash fruit\vegetables before eating: Yes [ ] No[ ]

Do you wash hands after using toilet: Yes [ ] No[ ]