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PREVALENCE OF HOOKWORM AND HAMEOGLOBIN EVALUATION AS FACTORS THAT CONTRIBUTETO ANAEMIA AMONGST PRIMARY SCHOOL CHILDREN IN SOME PARTS OF KADUNA STATE, NIGERIA

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ABSTRACT

Introduction: Anaemia is a major public health problem in school age children in developing countries. The abnormal reduction in hemoglobin level results in anaemia which is often associated with behavioral disturbances in children and causes impaired neurological development with reduced scholastic performance in school-age children.

Aim: The aim of the study was to evaluate factors that contribute to anaemia among primary school children in some selected Local Government Areas (LGA) of Kaduna State, Nigeria.

Methods: The study was cross sectional and blood samples were collected aseptically from the children to measure Haemoglobin (Hb) level using Hemacue Haemoglobin method.

Results: The overall findings revealed that the prevalence of anaemia among the children was 70.0%. The severity of anaemia associated with hookworm infection among school age children was studied by measuring their Hemoglobin level. About 34.3% children had mild anaemia, while 54.3% and 11.4% had moderate and severe anaemia respectively. The prevalence of anaemia by gender was also studied and classified into anaemic and non-anaemic based on their Hemoglobin concentration. The males that were anaemic had 66.7% while the non-anemic was 33.3%. Also, the females that were anaemic had 44.1% and non-anaemic 55.9%. Statistical analysis also showed significant association in the prevalence of anaemia with respect to gender (P= 0.03) and age group (P=0.0013).

Conclusion: However, no significant difference was found in the distribution of anaemia in the three zones and their correlates. Anaemia is still prevalent and a matter of public health concern in school children in the study area. Sustainable public awareness programmes at school and community levels among these populations will help to improve their health and nutritional status.

Keywords: Hookworm, Anaemia, Children, level, primary, Kaduna.

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INTRODUCTION

Hookworms are classed as soil-transmitted helminth (STH). Since they need to spend time developing outside the host in the soil before the larvae reach the infective stage. During the stage the egg hatches usually within 24 hours. The first stage larva lives in a mixture of faeces and soil feeding on faecal bacteria (1). Hookworm infection is mainly acquired by walking barefoot on contaminated soil. The most serious effects of hookworm infection are blood loss leading to anaemia, in addition to protein loss (2). The two main species of hookworm that primarily affects humans are *Ancylostoma duodenale* and *Necator americanus* which causes anaemia and protein malnutrition in an estimated 740 million people in developing nations (1). The largest number of cases is found in impoverished rural areas of sub-Saharan African, Latin America, South East Asia and China, where *N. americanus*is common worldwide, while *A. duodenale* is geographically restricted to sub-Saharan Africa (3).In children, a chronic hookworm infection has been shown to impair physical and intellectual development, reduces school performance and adversely affect their school learning potentials (4, 5, 6). Anaemia in children also has been related to, reduced work performance, reduced cognitive functions, growth retardation and impaired immune systems (7). Anaemia is estimated to affect half school age children and adolescent in developing countries (8). This condition continues to be a major public health problem worldwide. Clinical manifestation as exemplified by the severity of anaemia varies with the hookworm species involved (9).The route of infection for each hookworm species also differs from species to species (e.g., *N. americanus* infection is mainly by skin penetration, and *Ancylostoma* spp. infections are more common by ingestion of infective third-stage larvae). Species identification is paramount in designing appropriate and effective prevention and control strategies. Moreover, if a zoonotic hookworm is prevalent, the control target and strategies formulated also need to encompass animal hosts. It is an important cause of morbidity in school-age children who harbour the highest intensity of worm infestation. Some of the significant morbidity attributed to soil transmitted helminths are malnutrition, growth retardation, anaemia, vitamin A deficiency and impaired intellectual performance (10). The study therefore aimed at evaluating factors that contribute to anaemia among primary school children in some parts of Kaduna State.

MATERIALS AND METHODS

The Study Design and Area

The study was a descriptive cross-sectional study. Kaduna State is located in the North-western geo-political zone of Nigeria with a population of 6,066,562. It is made up of 23 Local Government Areas which are further grouped into three senatorial districts viz: North, Central and South. It is a metropolitan as well as cosmopolitan industrialized state, with over 80 commercial and manufacturing industries. It is one of the education centers in Nigeria with many institutions of higher learning. Agriculture is practiced in the state with about 80% of the people actively engaged in farming activities. It is defined by longitude 10^{o}- 20^{o}N and Latitude 90^{o}- 03^{o}E. The

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vegetation is the guinea savannah with scattered trees and shrubs. There are two distinct seasons, the wet season which lasts from April to October and dry season that occurs from November to March. It experiences a rainfall of 1530mm in Kafanchan-Kagoro in the southeast and 1015mm in Ikara/Makarfi districts in the Northwest (11). This study was conducted in public primary schools in the three senatorial zones of Kaduna State viz: The Southern, Central and Northern zones.

Chikun Local Government Area

Chikun Local Government Area (LGA) is in Kaduna State, Nigeria. It headquarters is in Kujama town. It has an area of 4,645km^2 and a population of 368,250at the 2006 Census. Chikun Local Government is bordered by Igabi LGA, and Kaduna South to the north, Kujama to the East, and Kachia LGA and Birnin Gwari LGA to the south and West respectively. The LGA is located 10^o 27N, 8^o 7 E, Northern Nigeria. The inhabitant of this Local Government Area are mostly Gbagyi and Fulanis, other tribes include Hausa, Bajju, Jaba, Moro'a, Kataf, Nimzom, Igala, Idoma, Igbo, Yoruba. The teaming populations are mostly agriculturists who are involved in farming activities and trading. Most of the civil servants are resident in this Local Government Area.

Soba Local Government Area

Soba is a Local Government Area in Kaduna State, Nigeria. Its headquarters is in the town of Maigana. It has an area of 2,234km and a population of 293,270 at the 2006 Census. Most of the inhabitants are Hausa, Fulani. They are involved in agriculture and farming activities. They practice subsistence farming of cotton, groundnut and sugarcane.

Kagarko Local Government Area

Kagarko is a Local Government Area in Kaduna State, Nigeria. Its headquarters is in the town of Kagarko. It has an area of 1,864km^2 and a population of 240,943 at the 2006 Census. It comprises about eleven (11) districts which are Shadalafiya, Katugal, Kushe, Jere, DogonKurmi, Kenyi, Kurmin Dangana, Kubacha, Aribi and Kagarko districts. The people of Kagrko Local Government are predominantly Koro by tribe. The Koro people are very hard working and mostly farmers, about 70% of ginger produced in Kaduna State is from Kagarko Local Government. These LGAs, Chikun, Soba and Kagarko are the selected representative of the senatorial district in Kaduna State for this study.

Study Population

This research focused mainly on public primary school children between 5 – 13 years old because of their susceptibility to infection by soil-transmitted helminth in the study areas: LEA Tudun Saibu, LEA Gardago (Soba LGA), LEA Narayi, LEA Sabon Tasha (Chikun LGA), Jamila Kagarko, UBE 2 Kagarko (Kagarko LGA) representing Northern, Central and Southern senatorial zone of Kaduna State.

Ethical Approval

Approval (Appendix I) for the research was obtained from the authorities of the Local Government Education Authorities of (i) North-Zone - Soba Local Government Area, (ii) Central Zone - Chikun Local Government Area, (iii) South Zone -

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Kagarko Local Government Area respectively.

Sample Size

The Minimum sample size was determined by using the formula.

$$N = \frac{Pq}{(El\ 1.96)^2}$$

Omalu *et al* (12), reported a prevalence of 64.4%

Where:

N = Sample size
P = Prevalence of previous studies = 64.4% = 0.644
q = 100 - 64.4 =36.6
E = allowable Error
= 5% (which is = 0.05)

$$\text{Thus } N = \frac{64.4 \times 35.6}{3.8416}$$

= 596.8597

A total sample of 600 was determined using the formula above. Therefore, to obtain a reliable result a total of 900 samples were collected. 300 samples each from the three senatorial zones understudy. One hundred and fifty samples were collected each during the dry and wet season respectively.

Data Collection Using Questionnaire

A structured questionnaire was used to obtain information from each pupil on the following: Demographic factors: Age, sex, school, Father's occupation, Risk factors: Toilet system being used, whether hand was washed after using the toilet, whether fruits and raw vegetables were eaten sometimes, how often fruits and vegetables are washed before eating, source of drinking water.

Collection of Samples

The pupils were educated on the risk factors involved in the transmission of hookworm infection. Thereafter, a labeled wide-mouthed sample bottle with screw caps were distributed to them and instructed on how to obtain their freshly passed stool to avoid contamination. While for anaemia the measurement of haemoglobin (Hb) was done by hand prick using HemocueHb 301 system (Angelhom-Sweden) machine. A total of 900 stool samples and 900 blood samples were collected.

Analysis of Samples

The detection of soil-transmitted helminth (hookworm) was confirmed by the recovery of helminth eggs and larvae in the laboratory. After collection, the feacal samples were taken to Gwamna Awan General Hospital Kakuri Kaduna for analysis.

Microscopy

Two methods were used for the detection and identification of these parasites: Direct wet mount for preliminary investigation and detection of heavy infection, Concentration method for the confirmation of eggs and larvae in high infection. Direct-wet-mount preparation was employed on the 900 stool samples by emulsifying a portion into normal saline on a glass-slide cover with a cover slip and examined microscopically using x 10 and x 40 objectives for ova of hookworm (3).

Formaldehyde – Ether Concentration Method

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One gram of the faecal sample was emulsified in 7ml of formol saline, sieved, and the suspension collected in the centrifuge tube, followed by the addition of 3ml of ether. The suspension was well mixed and centrifuged at 3000 rpm for 1 minute. The supernatant was discarded and the sediment examined microscopically using x 10 and x 40 objectives for ova of hookworm (3).

Measurement of Haemoglobin (HB)

The haemoglobin concentration of each child was measured by taking a finger – prick blood sample using a hemacue Haemoglobinometer (Hemacue, Angelhom, Sweden). A prick was made on the tip of a middle finger after the site was cleaned with disinfectant (methylated spirit). The first drop of blood was cleaned off and the second drop (0.05ul) was collected to fill the micro-cuvette which was then placed in the cuvette holder of the device (HemocueHb 301+) for measuring haemoglobin concentration. The displayed haemoglobin value was then recorded. The technique is recommended by WHO in field survey (13).

Data Analysis

The data obtained in this study were analyzed using SPSS 20. These were presented in tables, interpreted in percentages. Significant level (0.05) for the studies was determined at 95%confidence interval.

RESULTS

Prevalence of Hookworm in Selected Schools

The Prevalence of hookworm infestation among the school children in the selected senatorial zones is shown in Figure 1. The prevalence of hookworm infestation among the various public schools was studied. The schools at Magade 1 (Soba LGA) and UBE 2(Kagarko LGA) had the highest prevalence rate of (6.7%) and (7.3%) respectively. The least is found in LEA Narayi (Chikun LGA) of Kaduna State

The prevalence of hookworm among the male and female children showed significant difference (P=0.03). Out of 900 samples examined, 52 (5.8%) children were infected with hookworms (Table 1).

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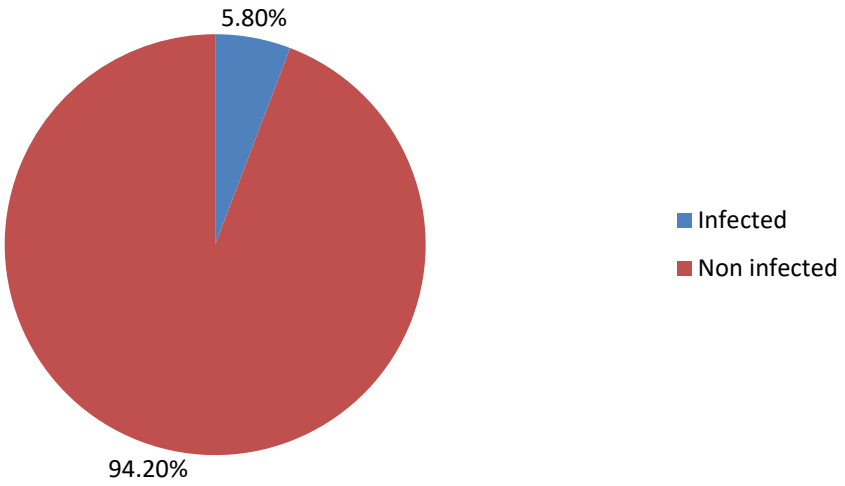

Figure 1: Prevalence of hookworm infestation among the school children in parts of Kaduna State

Table 1: Prevalence of Hookworm among school children by Microscopy in some parts of Kaduna State

Sex	Number examined	Number infected (%)
Male	457	32 (7.0%)
Female	443	20 (4.5%)
Total	**900**	**52 (5.8%)**

χ^2=2.56, df =1, p=0.03

Gender Distribution of Hookworm Infection in Schools

In table 2 the distribution of the hookworm infection in relation to gender is shown below, with males having the highest incidence in the LGAs with exception of LEA Gardago and LEA S/Tasha. The distribution of Hookworm infestation among public schools showed a very strong significant association in the prevalence of hookworm among the female and male children in the study area (χ^2=59.96, df=5, P < 0.001)

Table 2: Gender distribution of Hookworm infection with respect to schools

Name of School	Male		Female	
	Number	Number	Number	Number

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	examined	infected (%)	examined	infected (%)
LEA T/Saibu	76	6(7.9)	73	4(5.5)
LEA Gardago	76	4(5.3)	73	5(6.8)
LEA Narayi	76	4(5.3)	73	2 (2.7)
LEA S/Tasha	76	3(3.9)	73	4(5.5)
JamilaKagarko	76	9(11.8)	73	2(2.7)
Ube 2 Kagarko	77	6(7.8)	78	3(3.8)
Total	**457**	**32 (7.0)**	**443**	**20 (4.5)**

X^2=59.96, P =< 0.001

Occurrence of Hookworm Infection Based on Age Group:

The occurrence of hookworm infestation among school children by age is shown in Table 3. The highest percentage of 9.2% was observed among males in age group 12 – 13 years. While the females in group 8 – 9 years had the highest percentage of 6.3%. When males and females are brought together, the 12 – 13 years age groups were the most infected than pupils in the 10 – 11 years age group emphasizing the clinical correlation of aneamia burden within the age group. Statistical analysis showed that their difference was significant with P – value = 0.0013

Table 3: Occurrence of Hookworm infestation among children by Age

Age Group (Years)	Male		Female	
	Number examined	Number infected (%)	Number examined	Number infected (%)
6 – 7	112	5(4.5)	106	3(2.8)
8 – 9	110	6(5.5)	112	7(6.3)
10 – 11	115	10(8.7)	110	4(3.6)
12 – 13	120	11(9.2)	115	6(5.2)
Total	**457**	**32(7.2)**	**443**	**20 (4.5)**

X^2=15.68, df – 3, p = 0.0013

Distribution of Hookworm Infection Based on Pupils Parent Occupation:

Out of the total of male pupils examined, pupils whose parent were artisans had the highest prevalence of hookworm infestation of 9.0% while pupils whose parent were civil servants had the lowest hookworm infestation of 3.6%. Similarly, out of the female pupils examined, whose

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parents were farmers had the highest hookworm infestation of 5.7%, while pupils whose parents were civil servants had lowest hookworm infestation of 1.8%. (Table 4)

Table 4: Distribution of soil transmitted helminth (Hookworm) among children by Parent occupation

Occupation	**Male**		**Female**	
	Number examined	Number infected (%)	Number examined	Number infected (%)
Farmer	150	12(8.0)	140	8(5.7)
Trader	120	9(7.5)	120	6(5.0)
Civil servant	110	4(3.6)	110	2(1.8)
Artisan	77	7(9.0)	73	4(5.5)
Total	**457**	**32(7.0)**	**443**	**20 (4.5)**

$X^2 = 12.00$, df = 9, p=0.21

Health Habit of Washing Vegetable amongst Children:

The effect of washing vegetables and fruits on the prevalence of hookworm infection was also studied. These revealed that Male and Females children who never washed vegetables and fruits before eating had the overall prevalence of 8.8% and 6.7%. Prevalence of 5.5% was found among males who always washed their vegetables and fruits, 3.3% among females who sometimes wash their vegetables and fruits. Though there was no significant association between hookworm infection and the sanitary habits of washing fruits and vegetables (Table 5).

Table 5: Habit of children on washing Vegetables

Washing vegetable and fruits	**Male**		**Female**	
	Number examined	Number infected (%)	Number examined	Number infected (%)
Always	145	8(5.5)	143	5(3.5)
Sometimes	152	10(6.6)	150	5(3.5)
Never	160	14(8.8)	150	10(6.7)
Total	**457**	**32 (7.0)**	**443**	**20 (4.5)**

X^2= 3.00, df = 2, p=0.20

Type of Toiletry System, Hygiene and Sanitary Habit of Children:

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The type of toilet system used by the pupils was also studied. Those that used flush (water Cistern) had prevalence of 6%, while those that use pit latrine had 5% and those that defecate in the bush had 6.3% and were the most infected. There was no significant difference between type of toilet used and hookworm infection P > 0.05.

Table 6: Hygiene and sanitation of children to type of toilet used

Toilet Facility	Number examined	Number infected (%)
Water Cistern	200	12(6.0)
Pit	300	15(5.0)
Bush	400	25(6.3)
Total	**900**	**52(5.8)**

X^2= 6.00, df = 4, p =0.20

Source of Drinking Water and Hookworm Infection:

The prevalence of soil-transmitted helminth (hookworm) infection was also studied through the children source of drinking water. Children who drank Tap water had prevalence rate of 1%, while those who drink well water and stream water had 5.6% and 4.7% respectively (Table 7). This was not statistically significant. P >0.05

Table 7: Sanitary standard and habit of children on source of drinking water

Source of Drinking Water	Number examined	Number infected (%)
Tap	100	10(1.0)
Well	500	28(5.6)
Stream	300	14(4.7)
Total	**900**	**52 (5.8)**

X^2= 2.00, df = 1, p=0.16

Seasonal Distribution of Hookworm:

Table 8 shows the prevalence of hookworm infection based on the season of the year. The prevalence of hookworm among school children in the study area was higher during the wet season, representing 7.1%, with a lower prevalence rate of 4.4%during the dry season. The association was however not significant at P> 0.05.

Table 8: Seasonal Distribution of Hookworm Infection

Seasons	Number examined	Number infected (%)
Wet season	450	32(7.1)
Dry season	450	20(4.4)
Total	**900**	**52(5.8)**

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X^2= 2.00, df = 1, P =0.16

Evaluation of Aneamia amongst School Children:

The severity of anaemia among school age children was also studied by measuring their haemoglobin level. Approximately 34.3% children had mild anaemia, while 54.3% and 11.4% had moderate and severe anaemia respectively. The overall prevalence of anaemia in the school children studied was 70.0% as shown in Table 9

Table 9: Level of Anaemia among school children

Age Group (years)	Number with Mild anaemia (%)	Number with Moderate anaemia(%)	Number with Severeanaemia(%)
6 – 7	4(20.7)	10(50.0)	6(30.0)
8 – 9	9(69.2)	4(30.8)	0(0.0)
10 – 11	3(20.5)	10(66.7)	2(13.3)
12 – 13	8(36.4	14(63.6)	0(0.0)
Total	**24(34.3)**	**38(54.3)**	**8(11.4)**

X^2= 12.00, df = 9, p =0.04

Anaemia Based On Gender

The prevalence of anaemia by gender was also studied. The children were classified into anaemic and non-anaemic based on their haemoglobin concentrations. The aneamic males were 66.7% while the non-anaemic were 33.3%. 44.0% females were aneamic while 55.9% were non-aneamic as shown in Table 10.

Table 10: Prevalence of Anaemia by Gender

Sex	Number examined	Non- anaemic(%)	Anaemic(%)
Male	457	152(33.26)	305 (66.7)
Female	443	249(55.89)	195(44.0)
Total	**900**	**400(44.4)**	**500(55.6)**

X^2= 2.00, df = 1, p =0.16

Distribution of Anaemia amongst the School Children in the Three (3) Senatorial Districts:

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Prevalence of anaemia in the three zones was also classified into anaemia and non-anaemic. The highest prevalence of anaemia was found in the northern zone 61.0%, while the least 47.33% was found in the central zone. For the non-anaemic, the highest prevalence of 52.7% was found in the central zone, while the least prevalence of 39.0% was found in the northern zone (Table 11).

Table 11: Distribution of Anaemia in the three Zones

Zone	Anaemic (Hb<10g/dl) (%)	Non-anaemic (Hb>10g/dl) (%)
Northern	183(61.00)	117(39.0)
Central	142(47.33)	158(52.66)
Southern	175(58.33)	125(41.67)
Total	**500(55.6)**	**400(44.4)**

X^2= 6.00, df = 4, p=0.20, Key: Hb - Haemoglobin

Clinical Correlation of Hookworm Infection and Anaemia

Table 12 shows the correlation between hookworm and anaemia. There exist a positive low and non-significant correlation (r=0.06) between number of positive samples and anaemia. Indicating that for every positive case of hookworm infection there will be corresponding decrease in heamoglobin concentration of the pupil.

Table 12: Correlation of hookworm and anaemia

	No. of Positive	Anaemia
No. of Positive	1	0.06^{ns}
Anaemia	0.06^{ns}	1

Key: NS = Not Significant No. = Number

DISCUSSION

Different factors contributed to the prevalence of soil transmitted helminths (hookworm) among a given population, the most important being environmental, parasites and host factors (14).This study established a low-level of hookworm infestation on the study population of (5.8%), when compared to (28.6%) obtained in Vietnam, (54.0%) in India and (11.0%) in Ethiopia (15, 16).In Nigeria, Houmsou *et al* (2009) (17) recorded a high prevalence rate of (34.2%) in Benue State, while Arosoye *et al*, (18) recorded a prevalence rate of (7.6%) in Ondo State.

The prevalence in this study of (5.8%) is lower than the aforementioned but still higher than (3.5%) prevalence rate recorded by Mordi *et al*, (19) in Edo State, Nigeria.

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The seasonal variation and fluctuation could account for the prevalence rate. Other factors such as geographical, economic, and behavioral across these different settings may be responsible for the differences in infestation pattern. Another reason, for the low (5.8%) prevalence could be due to the mass deworming programmes of children embarked upon recently in Kaduna State. The two schools are located in a rural settings meaning that they are both involved in agricultural and farming activities. Most especially, LEA Magade 1, is located few metres away from the river banks where fishing and growing crops like sugar cane, tomatoes, potatoes are being carried out as means of livelihood. The prevalence recorded in this study could be due to the careless and unhygienic habits practiced by these children not wearing protective shoes as a cover as they prefer walking barefooted when farming or fetching water from the surrounding river and may get infected with these worms (10).In the current study, the age group that was mostly affected was 12 – 13 years (7.2%). The least was 6 – 7 years (3.6%). The difference in infection rate between the age groups was not statistically significant (P = > 0.05). This result was in contrast with the reports of Asaolu *et al.*, (20, 21, 22), that infection decreased with the age of the pupil. This study revealed increase in infection rate as the age of the pupil increased. These age group (12-13) brackets are active and are the ones mostly involved in farming activities which are always in constant contact with faecal contaminated soil (23). The lack of public health awareness, refusal to observe sanitary procedures and application of knowledge acquired in Primary Science could also be the reason for the high prevalence in this group. The distribution of hookworm infection was associated with parental occupation. Artisan's children had the highest prevalence rate of (7.3%) followed by farmers' children (6.8%) and traders' (6.2%). While the least were the children of civil servants with prevalence of (2.7%). The prevalence rate could be attributed to the poor sanitary status and personal hygiene in children as documented by Abah *et al* (24) in Rivers State, Nigeria. Also, the tendency for the children to acquire infection is a well-known fact that the children who live in rural communities do get infected with worms through farming activities and trading (25). This may also be due to poor sanitation and illiteracy. This research is an agreement with previous report by Habbari *et al* (26) that major behavioural factors played a rule in disease transmission. The higher prevalence recorded among children who never washed their hands, fruits and vegetable thoroughly could serve as a risk factor in acquiring the infection. Also the fact that those vegetables are normally cultivated in open farms where people defecates and that untreated refuse are also dumped as manure was documented by Barnabas BB(27).The prevalence rate of those children that use the bush to pass excreta (6.3%) against those users of pit latrine (5%) and water system (6.0%) are almost similar to one another probably due to poor personal hygiene by the children, and also the usage of feacal contaminated soil and water contribute to the prevalence infection. In this study, the pit latrines were dirty in almost all the schools studied, most houses in the communities had no latrines, resulting in open defecation by the children

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in the surrounding and bush close to the school environment, this similar to a report by Williamson *et al*, (28). Those without latrine usually defecate at the backyard or river side where fishing is done. Lack of hand washing basin and soap was observed in almost all the schools visited. The high prevalence of hookworm (5.6%) observed in those children who use well water as their source of drinking water was a result of their failure to observe the rule by WHO that all wells must be dug at least 100 metres away from latrines to avoid cross contamination of the well water (10). The faece secreted at the backyard could also be washed down to the well if they are not properly covered and this will result to infection if consumed. Odebunmi *et al*, (29) confirmed that children drinking water from the stream were found to have a greater prevalence of infection than those who had access to tap water. Poor hygiene practices associated with access to faecal contaminated water is a highly probably risk factor for increased parasitic infection (30). Water also serves as a vehicle of transmission of parasites into bodies of susceptible hosts. The study equally revealed a seasonal variation in the prevalence of hookworm infection with high prevalence of hookworm recorded in the wet season (7.1%) than in dry season (4.4%). This study agrees with Chigozie *et al* (31) that wet or damp soil favours the embryonation of helminthes and so thrives well in rainy season. Similarly, the high prevalence observed during the wet season in the study area could be due to the availability of moisture, high humidity and low temperature needed for hatching of parasite eggs. While the low prevalence of hookworm infection observed in the dry season might be due to desiccation of ova as a result of high temperature and low humidity. The overall prevalence of anaemia observed among the students was 70%. This prevalence is high and significant. Though the prevalence was lower than that recorded in a study in Abia State, where the children had (82.6%) anaemia suggesting that anaemia is still a public health problem among school children (32). The high prevalence could be due to the presence of soil transmitted helminthes, According to WHO, if the hemoglobin concentration is above 10g/dl but below the cut off level it is mild anaemia, moderate anaemia when the concentration is between 7 and10 g/dl, and severe anaemia when it is below 7g/dl. The result in this study showed that the prevalence of anaemia among males was high (66.73%) when compared with their female counterpart (44.01%), but not significant ($P > 0.05$). It is evident from this result that, a significant number of apparently healthy children suffer from anaemia from other factors other than hookworm infestation. High consumption of carbohydrate and junk food, and lack of balance diet may be responsible for healthy children become anaemic (33). The prevalence of anemia is high in developing countries due to poverty, inadequate diet, certain diseases, lack of access to health service. Considering the prevalence of anaemia in the three senatorial zones of study, there is similarity in the prevalence of anaemia among children in both northern (61.0%) and southern (58.3%) zones. Pearson correlation = 0.76. The association is not significant ($P = 0.20$) and is also validated with likelihood ratio chi square value of 6.59 which implies similarity in prevalence of anaemia in the 3 zones.

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Correlated response within the zones were positive and high (r = 0.76). This also indicates that prevalence of anaemia in any of the zones will have direct effect in the other zone. The lower prevalence of anaemia observed in the central zone (47.3%) which is lower than the above could be as a result of the children living in an urban setting where more environmental sanitation, social amenities like potable water, easy access to health facilities, consumption of balanced diet, public enlightenment campaign are found. Table 12 shows the relationship between positive sample and anaemia. There exist a positive but low and non-significant correlation (r = 0.06) between positive sample and anaemia. This implies that there could be other factors involved in the cause of anaemia, apart from the helminth.

CONCLUSION

The result of the study showed a low-level prevalence of hookworm among school children in the three selected local government areas. Higher prevalence was recorded among males than females. The infection rate among these children increased with increase in age. Children of farmers and artisans were mostly affected than those of civil servants. The behavior and attitude of these school children as regarded to the washing of fruits and vegetables was also found to be a risk factor in the transmission of soil transmitted helminth in various communities. The present study had established that soil transmitted helminthes (hookworm) are still in existence among the school children and therefore need proper attention in the control and management of helminthiasis. This study also revealed high prevalence of anaemia among the study population with the male having a higher prevalence. The correlation between soil transmitted helminthes (hookworm) and anaemia was weak, implying that it is not the major cause of anaemia among this study population.

RECOMMENDATION

There is need to incorporate the control of soil transmitted helminth into expanded programme on Immunization (EPI). The prevalence of infection could be attributed to the poor sanitary status and poor personal hygiene of the children. Therefore, improvement in these factors through basic health education and deworming at intervals is highly recommended. There is the need to acquire knowledge of the species infecting human populations in order to succeed effectively in the long-term treatment of the diseases. Hookworm disease would largely disappear if the populations of areas where hookworm persist had access to appropriate and affordable sanitation.

Conflict Of Interest

The authors have none to declare.

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