

**International Journal of TROPICAL DISEASE  
& Health**  
4(7): 793-801, 2014



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## **Helminthiasis in School Aged Children in a Select Population in the Niger Delta**

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### **Authors' contributions**

*The work was designed and final data interpreted by authors SON, NCE, corrected the first manuscript while author BOF, recorded the experimental outcomes. All the authors participated in specimen collection.*

**Original Research Article**

**Received 12<sup>th</sup> February 2014**  
**Accepted 7<sup>th</sup> April 2014**  
**Published 21<sup>st</sup> May 2014**

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### **ABSTRACT**

**Aim:** Helminthiasis and its effects on the hematological parameters of school aged children in a select population in the Niger Delta.

**Study Design:** A cross sectional study (Descriptive study).

**Place and Duration:** The study was carried out in Emohua Local Government Area of Rivers State, between January–April 2011.

**Methodology:** Concentration Method (Sedimentation) was used to examine the stool samples, Packed cell volume (PCV) was obtained by the use of hematocrit centrifugation and reader method; differential white blood count (WBC) was done according to Cheesbrough (2000).

**Results:** Result of the study showed variability in the four gastrol-intestinal helminths among the 360 pupils investigated. Out of the 264(73.3%) positive samples, 142(53.7%) and 122(46.21%) were females and males respectively. Age specific gastroi intestinal worm load was relatively high in all age groups. This pattern of infection was attributed to favorable ecological factors that promote helminths transmission in the study area. However, the overall age related worm load showed that the 5-7 age group had relatively the highest parasite load in the study. The weight and height of infected pupils in relation to the uninfected varied statistically ( $p<0.05$ ) across the age ranges but was not

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statistically different ( $p>0.05$ ) within the age groups. *A. lumbricoides* (53.3%) was the most prevalent helminth amongst the infected.

**Conclusion:** Overall mixed infection was (23.4%) while the 8-9 age range recorded the highest prevalence (28.2%). Sex related prevalence varied greatly in terms of percentage infection within and across the sexes. However, gastrointestinal parasitism was not significantly different ( $p>0.05$ ) within the age groups but was significantly different ( $p<0.05$ ) between the sexes. PCV values were below the normal range in both the infected uninfected in the study group indicating poor nutritional status of the population.

**Keywords:** Age specific gastro-intestinal worm load; helminthes transmission; mixed infection; gastrointestinal parasitism; nutritional status.

## 1. INTRODUCTION

Intestinal helminths are amongst the array of parasitic infections that have impacted negatively on the health and socio-economic status of individuals in the sub tropical and tropical regions of the globe [1-5]. Globally, an estimated 3.5 billion people are affected with 450 million showing various degrees of morbidity and an annual mortality of 135,000 individuals [6-8]. It is believed that this figure will increase exponentially as world population surges except the millennium development goals are not realized especially in the developing world. Poverty in its variable shades; poor nutrition, poor sanitary conditions, poor housing, lack of potable water and inadequate or non-existent primary health facilities perpetuate the occurrence and spread of helminths infections especially amongst children and women.

Children between the ages of 1-12 are the most vulnerable group [9-11] due to their unsanitary dispositions which include; geophagy and finger biting [5]. According to [12], a third of all cases of soil transmitted helminthiasis occur in sub Saharan Africa with victims being infected with at least one of the quartet of nematodes; *Ascaris lumbricoides*, *Trichuris trichiura*, Hookworms (*Ancylostoma duodenale* and *Necator americanus*) and *Strongylus stercoralis*. The subliminal clinical presentations of these worms often make them asymptomatic, undetected thus neglected by the infected. The apparent asymptomatic presentation of gastrointestinal helminths encourage the accumulation of parasites in the victim through repeated infections and aggressive larva migration. The arrant larval migration results to severe tissue damage and overt expression of lymphokines [13,14] stated that gastrointestinal nematodes interference with absorptive surfaces, physical obstruction in the lumens, production of proteolysis substances, loss of macro-nutrient fluid and electrolytes, direct depletion of red blood cells and consumption of nutrients intended for the body aggravate the pathology of helminthiasis. To establish this assertion several researchers including [15,16]; discovered that de-wormed children recorded normal growth patterns than the untreated. In their study [17], associated high worm load with impaired fat digestion and depressed cell-mediated immunity in Hookworm infected adults. Hookworm is also associated with pernicious anemia, increased basal metabolic rate, anorexia and diarrhea in the infected.

Over time nutritional anthropometric measures have remained one of the most practical and useful means of assessing the nutritional status of a population particularly children and their growth patterns [18]. Investigating the impact of helminthiasis on growth markers of a population [19] established that high load of gastrointestinal nematodes negatively affected the serum retinol levels in infected victims. This nutritional debt in severe helminthiasis

results to growth faltering and anemia that inhibit the mental development of pre-school children [20-24]. This reason is why retardation in height and weight are used as useful indicators in identifying and evaluating the health status of a child [24-26]. In view of the foregoing, this study intends to establish the influence of helminthiasis on health markers; weight, height, packed cell volume, hemoglobin differentials and leukocyte count of school aged children in Emouha Local Government Area of Rivers state.

## **2. MATERIALS AND METHODS**

### **2.1 The Study Area**

The study area is Emohua; the headquarters of Emohua Local Government Area of River State, Niger Delta, Nigeria. It falls within latitude 4°52'N and longitude 6°52'E, and enjoys the tropical rain forest vegetation. The region is ramified with the dendrite drainage system which predisposes it to regular flooding between the months of August to October. The area is typically rural in structure and is dominated by the Ikwerre ethnicity indulging in subsistence farming and artisanal fishing. Drinking water is usually sourced from ground and surface reservoirs in the area.

### **2.2 Sample Collection**

The study is a cross sectional study of pupils in public primary schools. Properly designated sterile vials were handed out to randomly selected pupils in selected schools with specific instructions on stool specimen collection procedures. These vials were returned a day later; samples fixed with 10% formalin and stored in an iced vat. 2ml venule blood samples of the respondents were taken by a trained medical personnel into properly designated EDTA bottles. Bio-data of respondents were taken including height (cm) and weight (g). Blood and stool samples were analyzed within 24 hours after collection.

### **2.3 Laboratory Examination of Faecal Sample**

The formal-ether concentration method was used to examine the stool samples. Thin blood smears were prepared, fixed and stained with Giemsa stained for the determination of differential white blood cell count (WBC). The Packed cell volumes (PVC) of the blood samples were determined using the micro hematocrit procedure according to [27].

### **2.4 Microscopy**

Gastro intestinal worm burden of each of the school aged children were determined with the binocular light microscope using the x4, x10 and x40 objectives. The differential leukocyte count or white blood cell count was achieved using the oil immersion objective.

### **2.5 Data Analysis**

Anova was used to analyze the data

## **3. RESULTS**

Table 1 shows the prevalence of gastro intestinal helminthiasis in school aged children in relation to age and sex in a select population in Rivers State, Niger Delta of Nigeria. Data

showed that the overall helminthes infections were more in females than in males. Out of the two hundred and sixty four, 264(76.7%) infected pupils, one hundred and twenty two 122(46.21%) were females and one hundred and forty two, 142(53.78%) were males. Sex related prevalence varied greatly in terms of percentage worm burden within and across the sexes. However, the gastro intestinal worm burden was not significantly different ( $p>0.05$ ) within the age groups but was significantly different ( $p<0.05$ ) between the sexes. There was great variability in helminthes infection within the age groups however, the 5-6 years aged pupils expressed more helminths in terms of the total percentage parasitic load per pupil than in the other age groups Table 1.

**Table 1. Gastro intestinal helminths in school aged children in the study area**

Age group	Over number examined	Female		Male		Overall infection (%)
		No examined (%)	No infected (%)	No examined (%)	No infected (%)	
5-7	28	16(57.1)	16(100)	12(42.8)	6 (50.0)	22(78.5)
8-10	106	55(51.8)	44(80.0)	51(48.1)	34(66.6)	78(73.58)
11-16	194	100(51.5)	70(70.0)	94(48.45)	70(74.46)	140(72.2)
14-16	32	16(50.0)	12(75.0)	16(50.0)	12(75.0)	24(75.0)
Total (%)	360	187(51.94)	142(53.7)	173(48.05)	122(46.21)	264(73.3)

### 3.1 Effect of Helminthiasis on the Hematological Parameters of Pupils

The mean Total White Blood Cell (TWBC) count of the infected females ( $6.55\pm1503.74$ ) and males ( $6.4548\pm1333.41$ ) were higher than that of the uninfected females ( $6.36\pm1259.19$ ) and males ( $6.80\pm1331.20$ ) in the study Table 2. This trend was replicated in the percentage values of eosinophils and basophils in the sampled population. However, the packed cell volume (PCV) of the uninfected was higher in relation to the infected. Data revealed a consistent discrepancy in the hematological values of the females from that of the male in the study.

**Table 2. Hematological values of uninfected and infected males in the study area**

Hematological parameters	Sex	Uninfected Mean±S.D	Infected Mean±S.D
TWBC ( $\times 10^9/l$ )	Male	6.80±1331.28	6.45±1333.41
	Female	6.36±1259.19	6.55±1503.74
LYMPHOCYTE (%)	Male	52.41±10.21	44.71±10.82
	Female	47.17±10.88	47.14±11.37
EOSINOPHILS (%)	Male	2.0±0.80	3.25±2.15
	Female	1.63±1.06	3.56±1.96
BASOPHILS (%)	Male	0.04±0.19	0.02±0.13
	Female	0.0±0.0	0.01±0.12
PCV (%)	Male	35.23±3.67	32.16±4.77
	Female	36.62±3.23	32.42±4.54
HB (g/dl)	Male	11.74±1.22	10.72±1.59
	Female	12.21±1.07	10.81 1.51

### 3.2 Age Specific Helminthiasis

Age related specific worm burden showed four nematodes namely; *A. lumbricoides*; Hookworm; *S. stercoralis* and *T. trichuris* in the study area. *A. lumbricoides* (53.3%) was the most prevalent amongst the infected. Overall mixed infection was (23.4%) however, the 8-9 age range recorded the highest prevalence (28.2%) of poly infection in the study. Age related specific nematodiasis revealed that the 11-13 age range had the highest load of *A. lumbricoides* (75.1%) while the 14-16 age range recorded the highest load of Hookworm (41.6%) in the sampled population Fig. 1.

### 3.3 Effects of Helminthiasis on the Growth Parameters of Pupils in the Study

Fig. 2 shows the effect of helminthiasis on the weight and height of school aged pupils in the sampled population. There was great variability in the weights and heights of infected pupils in relation to the uninfected. This variability in growth parameters (weight and height) in the studied group was statistically significant ( $p < 0.05$ ) across the age ranges but was not statistically different ( $p > 0.05$ ) within the age ranges.

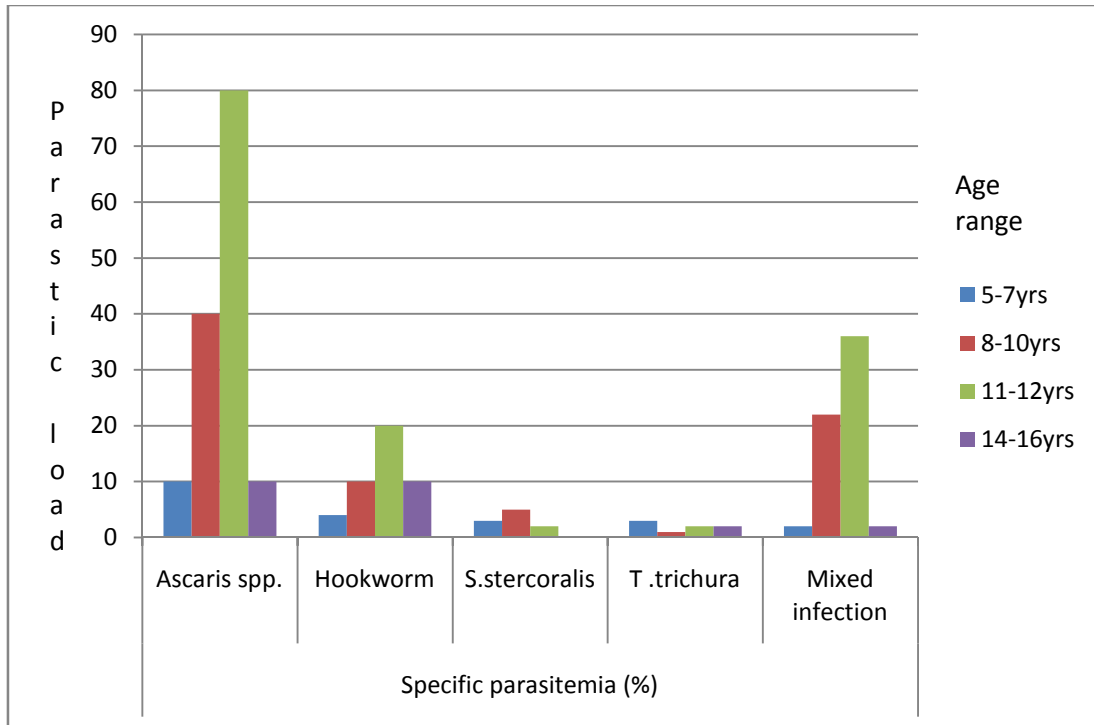
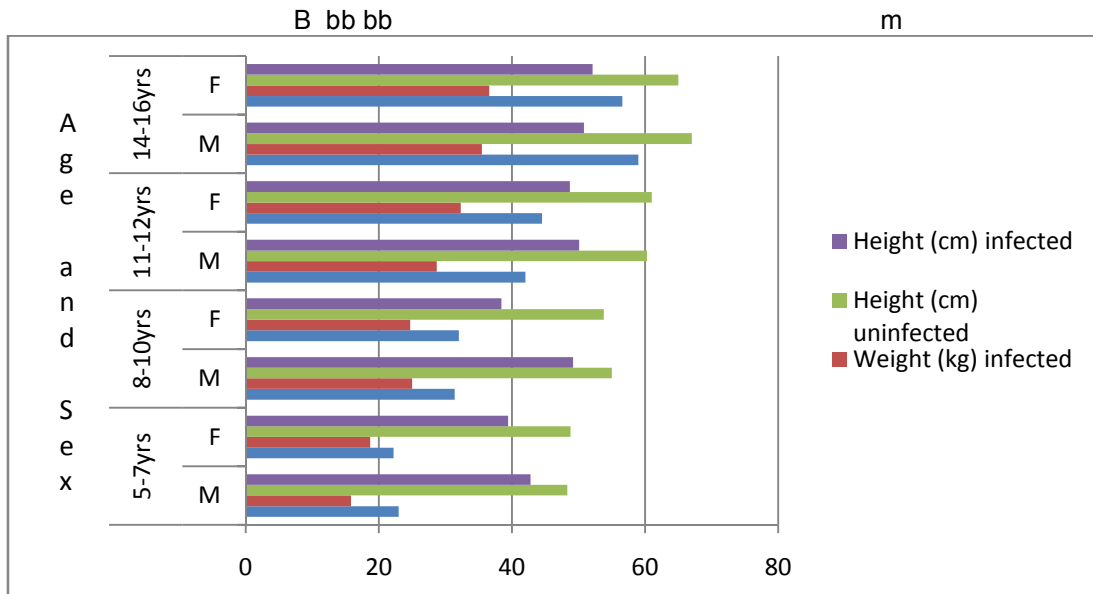


Fig. 1. Specific helminthes infections in school aged pupils in the study area



**Fig. 2. Effect of gastrointestinal helminthes on the weight (kg) and height of school aged children in the study area**

#### 4. DISCUSSION

The high worm burden recorded in the study Fig. 1 could be attributed to favorable ecological conditions that promote the transmission of soil transmitted helminthes such as unsanitary living conditions and poor hygienic disposition of the studied set. The variability within the age groups is in line with studies by [4,5,11,14]. The reveal that geophagy and finger biting associated with the high prevalence observed in the 5-7 age group. It was discovered that all the age groups showed appreciable levels infections, a factor associated with the suitable environmental conditions and host specific factors that transmission of the disease in the study area.

Sex related prevalence also varied greatly in the studied population with females expressing more parasites than males; a situation that contradicts previous studies by [2,4,9,11]. However, the 14-16 age group had the highest worm burden; a situation that contradicts previous studies by [9,11]. Studies by [2,3,4,11] had revealed that children above the age of 13 usually express low worm burden. However, the study observed increased worm burden in the 14-16 age range; a situation that is attributed to the overt exposure to outdoor activities which predispose them to repeated infections.

Four nematodes *A. lumbricoides*, Hookworm, *T. trichura* and *S. stercoralis* were observed in the sampled population with *A. lumbricoides* being relatively more prevalent than Hookworm. However, age associated specific helminths infection varied greatly across the age groups. The 11-13 age group had more of *A. lumbricoides* while the 14-16 age group had more of Hookworm. Poly parasitism was relatively high in the study which was similar to the result of the study by [28] in school age children in Honduras. However, the high mixed helminth infection evident in the 8-10 age group deviates from result of [28]. This age related

prevalence could be attributed to a myriad of factors such as overt outdoor disposition of this age group, unsanitary practices and poor living conditions.

## **5. CONCLUSION**

The study shows that gastrointestinal infections stimulated specific immune reactions that affected the hematological characteristics in the infected. The mean TWBC values of the infected varied significantly from that of the uninfected. This trend was replicated in the other lymphocyte proportions in relation to the infected. Ironically, all the subjects in this study showed hematocrit levels that were below the normal range which indicates a general nutritional deficiency in the population. This could be attributed to the socio-economic status of the parents or guardians of the pupils. It could also be due to lack of nutritional awareness leading to imbalanced diet. The relatively low hematocrit values recorded in this study could also be due to the rapid growth often witnessed in children within the examined age groups. Consequently, this growth surge places a high demand on bio-available iron in order to sustain the increasing red cell masses notwithstanding their nutritional status of the pupils [22,29-31]. The study therefore, recommends regular de-worming of school aged children by parents and guidance to forestall the negative pressure increased worm burden have on the nutritional status of the children.

## **CONSENT AND ETHICAL APPROVAL**

The ministry of the Health River State in conjunction with the Local Government Health Department of Emuha Local Government Area gave ethical clearance for the study. Advocacy visits were also paid to the Heads of Schools in consultation with the Parents Teachers Association to obtain permission for sampling.

## **COMPETING INTERESTS**

Authors have declared that no competing interests exist.

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