

Original Research Article

Helminthiasis in School Aged Children in a select population in the Niger Delta.

Foghi, Blessing O¹., Eze, N.C¹ . and Nzeako, S.O^{1*}.

¹*Department of Animal and Environmental Biology, Faculty of Biological Sciences, College of Natural and Applied Sciences, University of Port, Harcourt, P.M.B.5323, Choba, Rivers State, Nigeria;*

Authors's Contribution

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

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 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.

Key words: Age specific gastro-intestinal worm load, helminthes transmission, mixed infection, gastrointestinal parasitism, nutritional status.

38 1. INTRODUCTION

39 Intestinal helminths are amongst the array of parasitic infections that have impacted negatively on
40 the health and socio-economic status of individuals in the sub tropical and tropical regions of the
41 globe [1,2,3,4,5]. Globally, an estimated 3.5 billion people are affected with 450 million showing
42 various degrees of morbidity and an annual mortality of 135,000 individuals [6,7,8]. It is believed
43 that this figure will increase exponentially as world population surges except the millennium
44 development goals are not realized especially in the developing world. Poverty in its variable
45 shades; poor nutrition, poor sanitary conditions, poor housing, lack of potable water and
46 inadequate or non-existent primary health facilities perpetuate the occurrence and spread of
47 helminths infections especially amongst children and women.

48 Children between the ages of 1-12 are the most vulnerable group [9,10,11] due to their unsanitary
49 dispositions which include; geophagy and finger biting [5]. According to [12], a third of all cases of
50 soil transmitted helminthiasis occur in sub Saharan Africa with victims being infected with at least
51 one of the quartet of nematodes; *Ascaris lumbricoides*, *Trichuris trichiura*, Hookworms
52 (*Ancylostoma duodenale* and *Necator americanus*) and *Strongylus stercoralis*. The subliminal
53 clinical presentations of these worms often make them asymptomatic, undetected thus neglected
54 by the infected. The apparent asymptomatic presentation of gastrointestinal helminths encourage
55 the accumulation of parasites in the victim through repeated infections and aggressive larva
56 migration. The errant larval migration results to severe tissue damage and overt expression of
57 lymphokines [13]. [14] stated that gastrointestinal nematodes interference with absorptive surfaces,
58 physical obstruction in the lumens, production of proteolysis substances, loss of macro-nutrient
59 fluid and electrolytes, direct depletion of red blood cells and consumption of nutrients intended for
60 the body aggravate the pathology of helminthiasis. To establish this assertion several researchers
61 including; [15 and 16] discovered that de-wormed children recorded normal growth patterns than
62 the untreated. In their study, [17] associated high worm load with impaired fat digestion and
63 depressed cell-mediated immunity in Hookworm infected adults. Hookworm is also associated
64 with pernicious anemia, increased basal metabolic rate, anorexia and diarrhea in the infected.

65 Over time nutritional anthropometric measures have remained one of the most practical and useful
66 means of assessing the nutritional status of a population particularly children and their growth
67 patterns [18]. Investigating the impact of helminthiasis on growth markers of a population [19]
68 established that high load of gastrointestinal nematodes negatively affected the serum retinol
69 levels in infected victims. This nutritional debt in severe helminthiasis results to growth faltering and
70 anemia that inhibit the mental development of pre-school children [20, 21, 22, 23, 24]. This reason
71 is why retardation in height and weight are used as useful indicators in identifying and evaluating
72 the health status of a child [24, 25, 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 x 40 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	No examined (%)	Female No Infected (%)	No examined (%)	Male No Infected (%)	Overall Infection (%)
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 ± 1503.74) and males (6.4548 ± 1333.41) were higher than that of the uninfected females (6.36 ± 1259.19) and males (6.80 ± 1331.20) 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 $\pm$ S.D	Infected Mean $\pm$ 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.

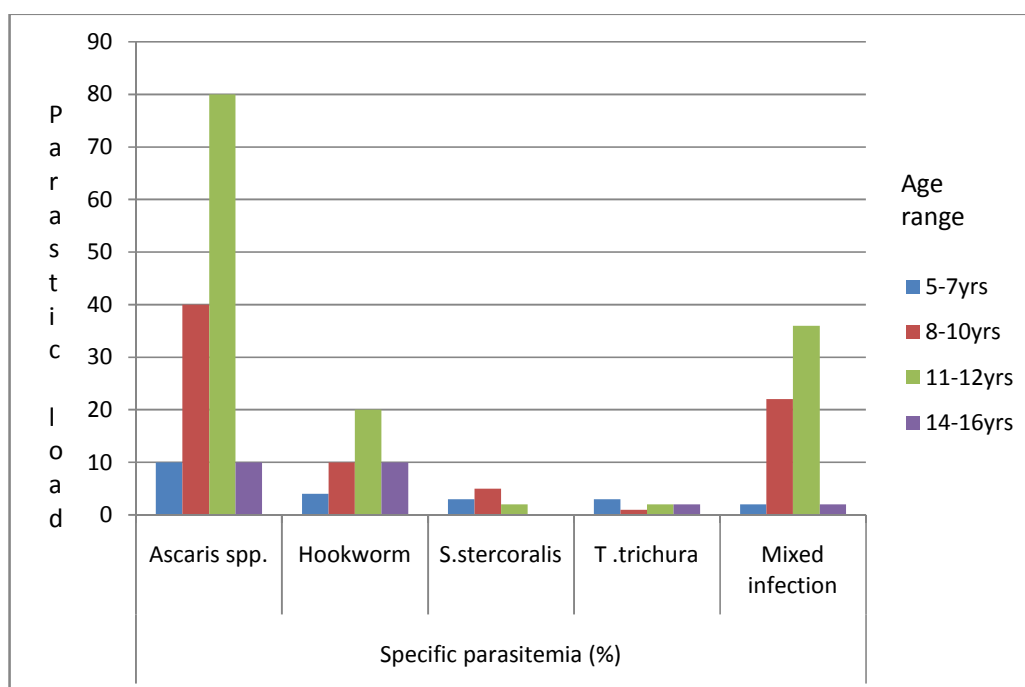


Figure 1., Specific helminthes infections in school aged pupils in the study area.

3.3. Effects of Helminthiasis on the growth parameters of pupils in the study

Figure 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.

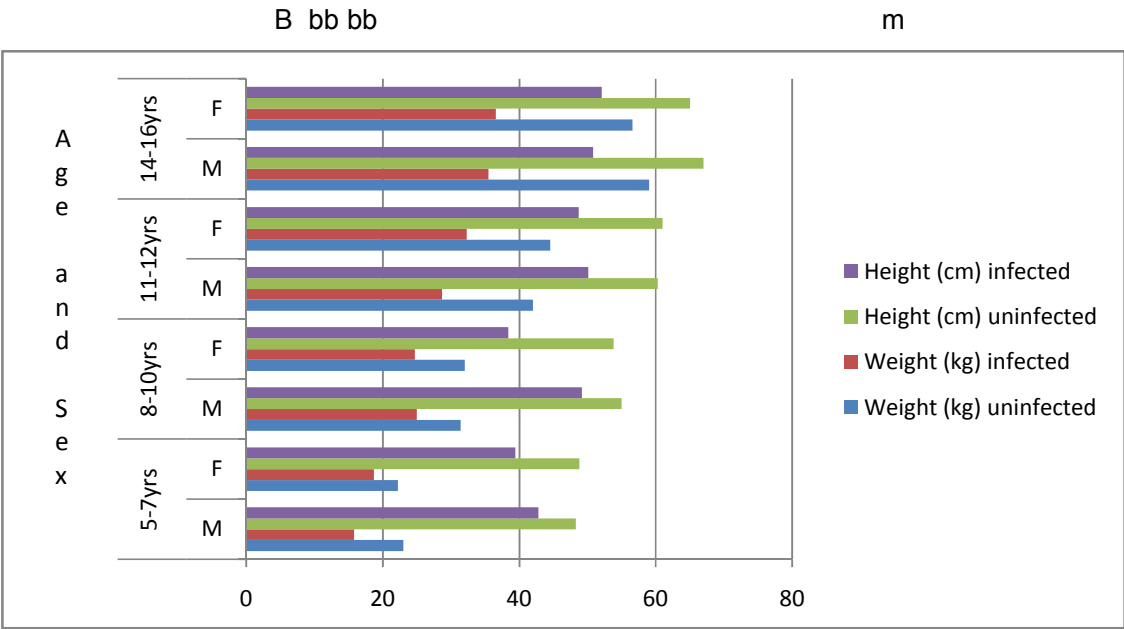


Figure 2: Effect of gastrointestinal helminthes on the weight (kg) and height of school aged children in the study area.

4. DISCUSSION

The high worm burden recorded in the study 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, 30]. 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.

ETHICAL CONSENT AND APPROVAL:

The ministry of the Health River State in conjunction with the Local Government Health Department of Emuoha 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:

Corresponding Author: +2348038752713
Email: sidney.nzeako@yahoo.com

Authors hereby declare that no competing interests exist in the publishing this work

REFERENCES

1. Egger, R J, Hofluis, E H, Bloem, MW and Chusilp, K. Association between Intestinal Parasitoses and Nutritional state in 3-8 year old Children in Northeast Thailand. *Tropical Geogeria Medicine*. 1990, 42:312-23.
2. Obiamiwe, BA and Nmorsi, P. Human gastro-intestinal helminthes in Bendel State. *Nigerian Angew. Parasitol*. 1991, 32: 177-183.
3. Ekpenyong, EA and Eyo, JE. Prevalence of Intestinal Helminths infections among Schooling Children in Tropical Semi Urban Communities. *Animal Research International*. 2008, 5(1): 804 – 810 804.
4. Eze. NC and Nzeako, SO. Intestinal Helminthes amongst the Hausa and Fulani settlers at Obinze, Owerri, Imo State, Nigeria. 2011, *Nigeria J of Parasitology*, 32(2) 225-229.
5. Nwaneri, DU, Ibadin, MO, Ofovwe, GE, Sadoh, AE. Intestinal helminthiasis in children with chronic neurological disorders in Benin City, Nigeria: intensity and behavioural risk factors. *World Journal of Pediatrics*. 2013. 9(2)152-157.
6. Murray, CJI and Lopez, AD. *The Global Burden of Disease Vol II, Global Health Statics, A Compendium of Incidence, Prevalence and Mortality estimates for over 202 conditions*, Harvard School of Public Health on behalf of the WHO and World Bank Cambridge M.A. (1996).
7. WHO. Soil transmitted helminthiasis. Eliminating soil transmitted helminthiasis as a public health problem in children: Progress report 2001-2010 and strategic plan 2011-2020, Geneva. WHO/HTM/NTD/PCT/2012.4. WHO/HTD/NTD/PCT/2012.4. 2012.
8. Ukpai, OM and Ugwu, CD. The prevalence of gastro-intestinal tract parasites in primary school children in Ikwuano Local Government Area of Abia State, Nigeria. *The Nigerian Journal of Parasitology*. 2003, 24:129-136.
9. Arani, SA, Alaghebandan, R, Akhlaghi, L, Shahi, M and Laria, R. Prevalence of intestinal parasites in a population in South of Tehran, Iran, *Rev. Inst. Med. Trop. S. Paulo*, 2008. 50 (3):145-149.
10. Mordi, RM, Evelyn, UE, Fredrick, OA and Okafor, FU. Intestinal Nematode Infection amongst school children in Aniocha South Local Government Area of Delta State, Nigeria. *Nig. J. Parasitology*, 2011, 32 (2): 203-207.
11. Nwaneri, DU, Omuemu, VO. Intestinal Helminthiasis and Nutritional Status Of Children Living In Orphanages In Benin City, *Nigeria. Niger J Clin Pract*. 2013; 16:243-8
12. Webb, EL, Ekii; AO and Pala; P. Epidemiology and Immunology of helminthes=HIV interactions. Walter Kluwers Health, Lippincolt williams and winlkins.2012, 1746-630x.www.cohivandaids.com

Corresponding Author: +2348038752713

Email: sidney.nzeako@yahoo.com

13. Adedoyin, MA, Awogun, IA, Juergensen, T. Prevalence of intestinal parasitoses in relationship to diarrhoea among children in Ilorin. *West African Journal of Medicine*, 1990, 9:83-88.
14. Jelliffe, DB. *Ascaris lumbricoides* and Malnutrition in Tropical Children. *Doc Med Geog Trop*. 1953, 5:314-20.
15. Lani, SS, Latham, MC and Heather, KM. Treatment with a single dose of Albendazole improves growth of Kenyan school children with hookworm, *Trichuris trichiura* and *Ascaris lumbricoides* infection. *American Journal of Tropical Medical Hygiene*. (1989), 41(11):78-87.
16. Micheal, CL. *Ascaris* and Hookworm disease: their impact on Human Nutrition. *Post Graduate Doctor Africa*. 1990, 12 (5):114-120.
17. Onyemelukwe, GC and Musa, BOPT. Lymphocytes subsets in Patients with Hookworm Infestation in Zaria, Nigeria, *Africa Journal Medical Science*. 2001. 30:255-259.
18. Heald, FP and Gong, EJ. Diet. Nutrient and Adolescence *In: Modern Nutrition in Health and Disease*, William and Wilkins Maryland, USA. 1999.
19. Diana, K, Greiner, T and Gebre-Medlin, M. Five year follow-up of a food based Vitamin A intervention in Tanzania *Public Health Nutrition*. 2000, 3 (4): 425-431.
20. Reinthaler, FF, Mascher, F, Klem, G and Sixl, W. A survey of gastrointestinal parasites in Ogun State, Southwest Nigeria. *Annals of Tropical Medicine and Parasitology*. 1988, 82:181-184.
21. De Onis, M. and Habicht, J. Anthropometric references Data for International use: Recommendation from a WHO expert committee. *American Journal of Clinical and Nutrition*. (1996), 64:650-8
22. Van Stuijvenberg, M.; Elizabeth, JDK, Mieke Faber, MK, Diane GK and Spinnler Benad, AJ. Effect of Iron-, Iodine and β -carotene- fortified biscuits on the micronutrient states of primary school children a randomized controlled trial. *Am. J. Clinical Nutrition*, (1999), 69:497-503.
23. Ike. OS, Thomas N, Ukaejiofor, EO, Nubila I, Shu EN and Ezema I. Comparison of hematological parameters determined by the Sysmex KK-2IN Automated Haematology Analyzer and the manual counts. *BMC Clinical Pathology*. 2010 10:3 doi: 10: 1186/1472-6890-10-3. <http://www.biomedcentral.com/1472-6890/10/>.
24. Habicht, JP, Martorell, R, Yarbrough, C, Malina, MR and Klein, R and Weight, FH Standards for Preschool Children, and there really ethnic differences in Growth Potentials? *Lancet*, 1994, 1:1611-5.
25. Delgado, H, Plama, P and Fischer, M. The use of the Height Census of School Children in Central America and Panama. *Food Nutrition Bulletin*. 1991, 13 (1): 17-29.
26. Kafafi, A and Abdel-Mottaleb, AM. Effect of Socio-economic Standard on Growth of School Children in Cairo. *Alazhar Medical Journal*. 1992, 21 (B): 53-64.
27. Cheesbrough, M. *District Laboratory Practice in Tropical Countries*, part 2, (Cambridge low price edition) Cambridge Universal Press, New York. pp. 2005, 256-347.

Corresponding Author: +2348038752713

Email: sidney.nzeako@yahoo.com

28. Sanchez, AL, Jose AG, Mary- TU, Maria, MR; Maritza, C and Theresa, WG. Soil transmitted helminthes infections and Nutritional status in School Age Children from Rural Communities in Honduras, *PloS Negl, Trop. Dis.* 2013, 7 (8) e 2378. Doi 10:1371/journal pntd. 0002378.
29. Lusfigma, S; Prichard, RK, Gazzinelli, A, Grant, WN, Boatn, BA, McCarthy, JS and Basanez, MG. A research agenda for helminth Diseases of Human: The problem of Helminthiasis. *PloS Negl. Trop. Dis.* .2012, 6(4) e 1582. doi: 10:1371/journal pntd 0001582.
30. Ojo, Y. and Flickety. How to study Haematology. Cancer treatment center. Sweden Ghana Medical Centre. 2013, www.sgmcltd.com
31. Ahmed, SG and Uraka, J. Impacts of intestinal parasites on hematological of sickle cell anaemia patients in Nigeria. *Eastern Mediterranean Health Journal.* Vol. 2011, 17(9) 710-713.