High Prevalence of Human Gastrointestinal Parasitic Infections in an Internally Displaced Persons (IDPs) Camp in Nasarawa State, Nigeria: A Cross-Sectional Study

Abstract

Human gastrointestinal parasites are significant agents of intestinal infections with public health implication worldwide. Internally displaced persons (IDPs) are known to be vulnerable to myriad of parasitic infectious agents due to their socioeconomic conditions especially in Nigeria. However, paucity of published information about gastrointestinal parasitic infection exists among refugees in Nigeria. In a cross-sectional study, the prevalence and probable factors of human gastrointestinal parasitic infections in a IDPs camp in Nasarawa State, Nigeria were evaluated. Faecal samples were aseptically collected from 332 recruited refugees who gave informed consent and completed self-administered questionnaires. The samples were examined using standard parasitological techniques. Overall, 264 (79.5%) were infected with human gastrointestinal parasites. The parasite species identified and their respective prevalence were *Entamoeba histolytica* (23.5%), *Schistosoma mansoni* (22.0%), *Ascaris lumbricoides* (19.7%), *Enterobius vermicularis* (14.4%), Hookworm (6.1%), *Hymenolepis nana* (6.1%), *Giardia lamblia* (1.1%) and *Taenia* species (1.1%). All the risk factors studied were not statistically significant to the parasitic infections ($p > 0.05$). To our knowledge, this is the first study to find cases of double and triple parasitism among IDPs in Central Nigeria. Our findings have enhanced the epidemiologic understanding of gastrointestinal parasitic infections among IDPs in Nigeria with implications for continual surveillance and advanced control measures.

Keywords: *Gastrointestinal Parasite, Prevalence, Parasitism, Internally Displaced Person, Nigeria*

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Introduction

Human gastrointestinal parasitic infections have greatly affected public health in developing nations, and are responsible for major morbidity and mortality worldwide (Oti *et al*., 2017a; Asires *et al*., 2019). Parasitic infections are mostly caused by intestinal protozoan and helminthes parasites. Helminthes also known as parasitic worms, they are large macroparasites characterized by elongated, flat or round bodies (Castro, 1996). Protozoan parasites are microscopic, one-celled organisms that are only able to multiply in the human body (Haque, 2007). *Ascaris*

lumbricoides (A. lumbricoides), Entamoeba histolytica (E. histolytica) /dispar, hookworm, *Trichuris trichiura* and *Schistosoma* species are among the most common parasites in the world (Barazesh *et al*., 2016).

Globally, 3.5 billion people are affected of which 450 million people are infected by this parasitic agents, most of which are children (Magdi *et al*., 2018; Butera *et al*., 2019). Fifty (50) million people worldwide alone, suffer from invasive amoebic infection each year according to the World Health Organization (WHO), resulting in 40-100 thousand deaths (Petri *et al*., 2000).These infections are widespread in tropical and subtropical regions of the developing world where there is poverty, inadequate and unsafe water supply, inadequate sanitation amenities, and lack of health education (Savioli and Albonico, 2004; Hamidu *et al*., 2016; Oti *et al*., 2017a). Transmission of gastrointestinal parasites to human is chiefly through food, water, and unhygienic environment via faecal- oral route (Bayoumi *et al*., 2016; Oti *et al*., 2017a).

Internally displaced persons (IDPs) are people who have been forced to leave their homes of habitual residence in order to avoid the effects of armed conflict, situations of generalized violence, violations of human rights, natural or human-made disasters, and who have not crossed an internationally recognized state border. It has been estimated that between 70 and 80% of all IDPs are women and children (Hamidu *et al*., 2016; UNHCR, 2018). Findings have reported that the prevalence of intestinal parasites among internally displaced persons is attributable to lack of wholesome and portable water supply, poor sanitation among others (Geltman *et al*., 2003; Mohamed *et al*., 2009; Hamidu *et al*., 2016).

Nigeria is amongst the most densely populated countries in Africa and the seventh largest population in the world. Due to these factors, it is very difficult for everyone to access basic health services, and in some remote areas harsh environmental conditions and poor public health facilities enhances the dissemination and prevalence of intestinal parasitic infections (Afolabi *et al*., 2016; Oti *et al*., 2017a). Myriad of environmental and socio-economic factors have been pin-pointed as probable factors for the continued persistence of intestinal parasites among IDPs (Aher and Kulkarni, 2011; Idu *et al*., 2015; Hamidu *et al*., 2016; Alsubaie *et al*., 2016). ~~Undoubtably~~Undoubtedly, there is need for the creation of good preventive and control measures (Geltman *et al*., 2003; Dada and Aruwa, 2015; Alsubaie *et al*., 2016). One way of contributing to the above cause would be the constant monitoring and generations of baseline data on the prevalence of intestinal parasites in different areas such as data on gastrointestinal parasitic

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infections among IDPs in and outside Nigeria (Chandrasena *et al*., 2007; Gbakinna *et al*., 2007; Mohamed *et al*., 2009; Aher and Kulkarni, 2011; Hamidu *et al*., 2016).

Therefore, in this study we evaluated the prevalence and probable factors of human gastrointestinal parasitic infections among IDPs in Nasarawa State, Nigeria. We found that the prevalence of gastrointestinal parasitic infections was high and no probable factors for its transmission, denoted by the prevalence of the parasite in this population, was significant statistically but there were arithmetic differences between risk factors studied. Our findings will enhance epidemiologic understanding of gastrointestinal parasites among IDPs in Nigeria with implications for surveillance and control measures.

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2.0 MATERIALS AND METHODS

Study Area and Population

The study area for this research was Kutara Luvu Refugees Camp, Karu, Nasarawa State, Nigeria. The camp is situated outskirts of the town. In this study, 332 consented IDPs were randomly selected representing both sexes and different ages that have lived in the camp from November 2016 through January 2017. Socio-demographic data of the participants was obtained through structured questionnaires. Participants who could not read or write in the English Language were interviewed orally in Hausa. Representative sample size was determined using the formula propounded by Swinscow and Campbell, (2002). Such information includes; age, sex, occupation, sources of drinking water, types of toilet facility and handwashing habits.

Sample Collection

A single faecal specimen was collected from each consenting refugee. The participants were instructed to collect fresh stool specimen into labelled specimen bottles and was submitted not more than one hour after collection. The specimens were taken to the Zoology Laboratory of the Bingham University Karu for microscopic examination and identification of gastrointestinal parasites.

Laboratory Investigation

The stool samples were examined for trophozoites and cysts of protozoans and the ova and larvae of helminthes under the light microscope.

Wet Mount Technique

Specimens containing blood and mucus and those that are unformed were examined immediately because these may contain motile trophozoites. A drop of fresh physiological saline was placed on one end of a slide and a drop of iodine on the other end. A small amount of specimen about 2mg was mixed with saline and a similar amount was mixed with the iodine using a wire loop or piece of stick. Smooth thin preparations of the specimen were made and covered with a cover glass. The entire saline preparation was examined systematically for larvae, ciliates, helminthes eggs, cysts, and oocysts. X10 objective with the condenser iris closed sufficiently was used to give good contrast. The X40 objective was used in the identification of eggs, cysts, and oocysts. The iodine preparation was used to assist in the identification of cysts as described by Cheesbrough, (2009).

Formalin–Ether Concentration Technique

An application stick was used to emulsify 1g of stools in about 10ml of normal saline contained in a tube. The emulsified stools were sieved, and the suspension was collected in another tube. The suspension was centrifuged at 3000 rpm for 5 minutes. The supernatant was discarded leaving the deposit. 7ml of 10% formaldehyde was added to the deposit and mixed. 3ml of diethyl ether was further added and mixed well by shaking. The layer of fecal debris was loosed from the side of the tube using a stick or stem of a plastic bulb pipette, and the tube was inverted to discard the ether, fecal debris and formaldehyde. The sediment was retained. The tube was returned to its upright position and the fluid from the side of the tube was allowed to drain to the bottom. The bottom of the tube was tapped to resuspend and the sediment was mixed. A drop of the sediment was transferred to one end of a slide and another to the other end. A drop of iodine was mixed with one of the sediment parts and a cover glass was used to cover each preparation. The entire preparation was examined microscopically using ~~X~~10 X objective with the condenser iris closed sufficiently to give good contrast while the ~~X~~40 X objective was used to examine small cysts and eggs (Abah and Arene, 2015).

Administrative Clearance

Introduction letter for the study was obtained from the Department of Microbiology, Nasarawa State University, Keffi, Nigeria to the Chairman of the refugee camp for access to the IDPs camp. Formal consents were retrieved from the Chairman of the camp and refugees directly while children below 16 years old consent were obtained from their parents/guardians using a consent form prior sample collection.

Statistical Analysis

The data gathered were analyzed by Smith's Statistical Package (SSP version 2.80, Claremont, California-USA). Chi-square statistical test was used to determine differences and values obtained were considered statistically significant at $p \leq 0.05$.

3.0 RESULTS

Out of 332 internally displaced persons examined, 264 (79.5%) were infected with at least one parasite. These parasites *Giardia lamblia* 16 (6.1%), *Entamoeba histolytica* 62 (23.5%), *Ascaris lumbricoides* 52 (19.7%), Hookworm 16 (6.1%), *Taenia* species 6 (2.3%), *Enterobius vermicularis* 38 (14.4%), *Hymenolepis nana* 16 (6.1%) and *Schistosoma mansoni* 58 (22.0%) were identified in this study using the normal saline and formalin-ether concentration methods (Table1).

Table 2 shows ~~the~~ The distribution of human gastrointestinal parasitic infections in relation to socio-demographic information given in Table 2. It showed that the prevalence of gastrointestinal parasitic infection was higher in males (81.8%) than females (77.5%) being non significant~~. More so, this difference was not statistically significant (p> 0.05)~~. In this study, the infection was high among IDPs aged <10 years (93.1%), students (85.3%), those that use well as source of drinking water (82.4%), those that defecate in pit latrine (83.8%) and those that do not wash their hands (82.2%). All the risk factors studied did not show any statistical significant association with the prevalence of the parasitic infections ($p > 0.05$).

During the survey, multiple infections were recorded by formalin-ether concentration technique but none of the refugees had more than three parasites at once. Prevalence of ~~double~~ dual and ~~triple~~ multiple infections was 29.5% and 18.2%, respectively. ~~Double~~ Dual infections reported in

this study were ~~those~~ consist of ~~Hookworm~~ hookworm + *H. nana* (46.2%); *E. histolytica* + *A. lumbricoides* (30.8%) and *S. mansoni* + *H. nana* (23.1%) while the ~~triple~~ multiple infections were those of Hookworm + *A. lumbricoides* + *H. nana* (56.3%) and *A. lumbricoides* + *E. histolytica* + *S. mansoni* (43.8%) (Table 3).

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Table 1: Distribution of Human Gastrointestinal Parasites (Number Examined=332)

Protozoans	**Number Infected**	**Prevalence (%)**
Giardia lamblia	16	6.1
Entamoeba histolytica	62	23.5
Nematodes		
Ascaris lumbricoides	52	19.7
Hookworm	16	6.1
Enterobius vermicularis	38	14.4
Hymenolepis nana	16	6.1
Taenia species	6	2.3
Trematode		
Schistosoma mansoni	58	22.0

Table 2: Distribution of human gastrointestinal parasitic infections in a IDPs Camp in Nasarawa State in relation to demographic Information

Risk factors	**No. Examined**	**No. Infected**	**Prevalence (%)**	**P value**
Gender				
Male	154	126	81.8	
Female	178	138	77.5	**0.7444**
Age (Years)				
<10	144	134	93.1	
11-20	76	56	73.7	
21-30	14	11	78.6	
31-40	92	60	65.2	**0.4369**
>40	6	3	50.0	
Occupation				

Students	224	191	85.3	
Civil servants	6	3	50.0	
Farmers	88	63	71.6	**0.6682**
Traders	2	1	50.0	
Artisans	**12**	**6**	**50.0**	
Sources of Drinking Water				
Well	284	234	82.4	
Borehole	48	30	62.5	**0.2658**
Types of Toilet Facility				
Pit latrine	272	228	83.8	
Open field	60	36	60.0	**0.1433**
Handwashing Habit				
Yes	186	144	77.4	
No	146	120	82.2	**0.7183**

Table 3: Pattern of single and multiple intestinal parasitisms in IDPs

Types of Infection	**No. Infected**	**Prevalence (%)**
Single	138	50.8
Dual	78	29.5
Eh+As	24	30.8
Hw+Hn	36	46.2
Sm+Hn	18	23.1
Multiple	48	18.2
Hw+As+Hn	27	56.3
As+Eh+Sm	21	43.8

~~**Key:**~~**Abbrebiation:** As (*Ascaris lumbricoides*), Eh (*Entamoeba histolytica*), Hn (*Hymenolepis nana*), Hw (Hookworm), Sm (*Schistosoma mansoni*)

Discussion

Internally displace persons (IDPs) living in camps has been reported to provide ideal ground for the breeding of gastrointestinal parasitic infections. An overall prevalence of 79.5% was recorded among refugees in Nasarawa State which is in consonance with the reports of Hamidu *et al*. (2016) in Maiduguri, Gimba and Dawam (2015) in Abuja, Oti *et al.* (2017a) in Keffi, Abah and Arene (2015) in Rivers state and Iduh *et al*. (2015) in Sokoto. Prevalence rates compared to findings in this study have been reported in other countries such as 64.3%, 64.4% and 17% in Sudan (Mohamed *et al*., 2009; Gabbad and Elawad, 2014; Magdi *et al*., 2018), 61.9% in Ethiopia (Asires *et al*., 2019), 44.8% in Rwanda (Butera *et al*., 2019), 40.2% in Sri Lanka (Chandrasena *et al*., 2007), 75.7% in India (Dhanabal *et al*., 2014), 0.5% in Saudi Arabia (Amer *et al*., 2018) and 41% in Colombia (Aranzales *et al*., 2018). The high prevalence of human gastrointestinal parasitic infections reported in this study is unconnected with the fact that the socioeconomic and environmental conditions of the IDPs enhance transmission of the parasitic agents. This report is a strong indicator that faecal contamination is prevalent in the camp environment due to poor sanitation and improper waste disposal.

The study has reported the presence of eight different gastrointestinal parasites among the IDPs in which *E. histolytica* (23.5%), *S. mansoni* (22.0%) and *A. lumbricoides* (19.7%) were the most prevalent parasites in the area. *E. histolytica* is known to cause human morbidity and it is transmitted via feacal-oral means especially among children below 10 years (Oti *et al*., 2017b). This correlates with other published studies and reports in Nigeria and other countries (Oti *et al*., 2017a; Dhamabal *et al*., 2014; Amer *et al*., 2018; Asires *et al*., 2019).

In this study, there was no statistically significant association between the prevalence of gastrointestinal parasites and gender of the IDPs ($p > 0.05$). The infection was higher in male (81.8%) than female counterparts (77.5%). This finding is similar with reports of some of the research carried out in this field (Hamidu *et al*., 2016; Magdi *et al*., 2018) but disagrees with other studies (Oti *et al*., 2017a; Amer *et al*., 2018). The lack of statistical association reported in this study might be linked to the fact that both genders were exposed to the same sources of infection at the same rate, they both take part in related camp chores that could jeopardize them to infection with the parasitic agents.

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This study further revealed that prevalence of intestinal parasites was highest among refugees aged <10 years old (93.1%). This is in agreement ~~supported by~~with similarpublished reports

~~studies~~ (Oti *et al*., 2017a; Magdi *et al*., 2018; Hamidu *et al*., 2016; Amer *et al*., 2018). The high prevalence of intestinal parasites in children of age less than 10 years ~~among this low age group~~ might be due to the low~~ir~~ level of personal hygiene and un aware of health education ~~and personal hygiene~~. There was no statistically significant association between occupation and the prevalence of the infection ($p > 0.05$). The highest prevalence was recorded among students (85.3%), followed by farmers (71.6%) and least prevalence was among IDPs that were civil servants, traders and artisans (50.0%). This might be because the great pool of infected refugees was below 20 years and are thought to be students in various educational levels. This report agrees with Hamidu *et al*. (2016) on IDPs in Maiduguri. In a related development, the source of drinking water and the prevalence of gastrointestinal parasitic infections among the refugees showed a higher prevalence among those that use water from wells (82.4%) than those that depend on boreholes (62.5%). This report correlates with Hamidu *et al*. (2016) and Oti *et al*. (2017a) but disagrees with Dada and Aruwa (2015). Water, irrespective of its sources can easily be contaminated during handling and when left uncovered especially where there is poor sanitation and improper personal hygiene of the handlers.

In this study, no statistically significant association was observed among IDPs in relation to types of toilet facility and handwashing habit and the infections prevalence ($p > 0.05$). Those that uses pit latrine and do not wash their hands had higher prevalence of 83.8% and 82.2%, respectively. Lack of proper sewage and defecation facilities within the camp might necessitate transmission of the parasites and other infectious agents in the area~~.~~ ~~This was also reported by some researchers~~ (Oti *et al*., 2017a; Magdi *et al*., 2018; Asires *et al*., 2019).

~~The~~ Dual and multiple parasitic infections revealed in this was 29.5% and 18.2% ~~,double and triple parasitism reported~~ respectively. ~~in this study is~~ Ssimilarly with reports elsewhere but among different study population (Houmsou *et al*., 2009; Damen *et al*., 2011; Gabbad and Elawad, 2014; Asires *et al*., 2019). These findings highlight the urgency for providing treatment of multiple parasitic agents when administering drugs to IDPs.

Conclusion

This study reported a high prevalence of human gastrointestinal parasitic infection among refugees in Nasarawa State with potential health problems. All the risk factors studied were not statistically significant to the parasitic infections ($p > 0.05$). To our knowledge, this is the first

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study to find cases of double and triple parasitism among IDPs in Central Nigeria. Efficient and proper deworming of population, health advocacy and provision of basic public services such as water supply for domestic use at the IDPs camp should be encouraged.

For further studies, it may also be of interest to look at a wide range IDPs camps scattered in the State and environs and also genotype the identified parasites to assess the type more prevalent in the country.

Conflict of Interest

The authors declare that they have no conflict of interest.

References

1. Abah AE, Arene FOI. Status of Intestinal parasitic infections among primary school children in Rivers State, *Nigeria. Journal of Parasitology Research.* 2015; article ID 937096 7 pages.

2. Afolabi OJ, Simon-Oke IA, Bakare PT. The Prevalence of Intestinal parasites among students in Federal University of Technology Akure, Nigeria. *International Journal of Tropical Diseases.* 2016; 14(2):1-9.

3. Aher A, Kulkarni S. Prevalence of intestinal parasites among internally displaced persons in a rural community. *International Journal of Biomedical Research.* 2011; 2: 605-607.

4. Alsubaie ASR, Azazy AA, Omer EO, Al-shibani LA, Al-mekhlafi AQ, Al-khawlani FA. Pattern of parasitic infections as public health problem among school children: A comparative study between rural and urban areas. *Journal of Taibah University Medical Sciences.* 2016; 11(1): 13-18.

5. Amer OSO, Al-malki ES, Waly MI, AlAgeel A and Lubbad MY. (2018). Prevalence of intestinal parasitic infections among patients of King Fahd Medical city in Riyadh Region, Saudi Arabia: A 5-year retrospective study. *Journal of Parasitology Research.* 2018; Article ID 8076274, 8 pages.

6. Aranzales AF, Radon K, Froeschl G, Rondon AMP, Delius M. Prevalence and risk factors for intestinal parasitic infections in pregnant women residing in three districts of Bogota, Colombia. *BMC Public Health.* 2018; 18: 1071.

7. Asires A, Wubie M and Reta A. Prevalence and associated factors of intestinal parasitic infections among food handlers at Prison, East and West Gojjam, Ethiopia. *Advances in Medicine.* 2019; Article ID 2101089, 8 pages.

8. Barazesh A, Fouladvand M, Tahmasebi R, Heydari A, Kooshesh F. Prevalence of Intestinal parasitic infections among primary school children in Bushehr, Iran. *Aricenna Journal of Clinical and Microbiology Infections.* 2016; (InPress) e34335.

9. Bayoumi M, Nykwac O, Kardaman M, Ullberg M, Alshammari EM, Sandstrom G, Saeed A, Abd H. Intestinal parasitic infections in school students in Malakal city, Upper Nile State, South Sudan. *SOJ Microbiology and Infectious Diseases.* 2015; 4(1): 1-5.

10. Butera E, Mukabutera A, Nsereko E, Munyanshongore C, Rujeni N, Mwikarago IE, Moreland PJ, Manasse MN. Prevalence and risk factors of intestinal parasites among children under two years of age in a rural area of Rutsiro district, Rwanda-a cross-sectional study. *Pan African Medical Journal.* 2019; 32:11.

11. Castro GA. Helminths: Structure, Classification, Growth, and Development. In: Baron S, editor. Medical Microbiology. 4th edition. Galveston (TX): University of Texas Medical Branch at Galveston; 1996. Chapter 86. Available from: https://www.ncbi.nlm.nih.gov/books/NBK8282/

12. Chandrasena TGAN, Hapuarachchi HC, Dayanath MYD and de Silva NR. Intestinal parasites and the growth status of internally displaced children in Sri Lanka. *Tropical Doctor.* 2007; 37:163-165.

13. Cheesbrough M. *District Laboratory Practice in tropical countries.* Part 1. 6th ed. Cambridge University Press. 2009; Pp 350.

14. Dada EO, Aruwa CE. Prevalence of Human Intestinal helminth parasites among undergraduate students at the off campus (North gate area), Federal University of Technology, Akure (FUTA), Nigeria. *Open Access Library Journal.* 2015; 2: e1399.

15. Damen JG, Luka J, Biwan EI, Lugos M. Prevalence of intestinal parasites among school pipils in Rural North Eastern, Nigeria. *Nigerian Medical Journal*. 2011; 52(1): 4-6.

16. Dhanabal J, Selvadoss PP, Muthuswamy K. Comparative study of the prevalence of intestinal parasites in low socioeconomic areas from South Chennai, India. *Journal of Parasitology Research.* 2014; Article ID 630968, 7 pages.

17. Gabbad AA, Elawad MA. Prevalence of intestinal parasite infection in primary school children in Elengaz Area, Khartoum, Sudan. *Academic Research International*. 2014; 5(2): 86-89.

18. Gbakinna A, Konteh C, Kallon M, Luckay A. Intestinal Protozoan and Intestinal Helminthic infections in displaced camps in Sierra Leone. *African Journal of Medicine and Medical Sciences.* 2007; 36(1):1-9.

19. Geltman PL, Cochran J, Hedgcock C. Intestinal parasites among African refugees resettled in Massachusetts and the impact of an overseas pre-depature treatment program. *American Journal of Tropical and Medical Hygiene.* 2003; 69: 657-62.

20. Gimba UN, Dawam NN. Epidemiological status of intestinal parasitic infection rates in children attending Gwagwalada Township Clinic, FCT-Abuja, Nigeria. *American Journal of Research and Communication*. 2015; 3: 97-110.

21. Hamidu IM, Habiba JB, Nathan D, Saleh AH, Mohammed AU, Kankop WJ. Incidence of intestinal parasites among internally displaced persons (IDPs) in Maiduguri, Borno State. *International Journal of Applied Research.* 2016; 2(10): 220-224.

22. Haque R. Human intestinal parasites. *Journal of Health, Population, and Nutrition*, 2007; 25(4), 387–391.

23. Houmsou R, Amuta E, Olusi T. Prevalence of intestinal parasites among primary school children in Makurdi, Benue State-Nigeria. *Internet Journal of Infectious Disease.* 2009; 8(1): 200-208.

24. Iduh MU, Isaac IZ, Mustapha S. Prevalence of Intestinal parasites among the "Almajiris' in Sokoto Metropolis, Sokoto, Nigeria. *International Journal of Novel Research in Life Sciences.* 2015; 2(5): 11-17.

25. Magdi B, Hadi A, Mohamed K, Huda AT, Sami AA, Ali FMN, Ramy YHEM, Mahir EME and Amir S. Prevalence of intestinal parasitic infections in Abugota Province, Gezira State, Sudan. *European Academic Research.* 2018; 6(6): 2902-2906.

26. Mohamed MM, Ahmed AI, Salah ET. Frequency of intestinal parasitic infections among displaced children in Kassala town. *Khartoum Medical Journal.* 2009; 02(01): 175-177.

27. Oti BV, Jibreel H, Abimiku AT, Ajegena SA, Pennap RG. Prevalence and Risk factors of Human Intestinal Parasitic Infections among students of a Tertiary Institution in Central Nigeria. *Annals of Tropical Medicine and Public Health.* 2017a; 189 (17).

28. Oti BV, Galleh PR, Ezhim IM, Tsaku AP, Ajegena SA, Oti CA, Oti BI. Prevalence of *Entamoeba histolytica* using Microscopy and adhesin detection among school children in Central, Nigeria. *Asian Journal of Biology*. 2017b; 2(4):1-9

29. Petri WA, Jr., Haque R, Lyerly D, Vines RR. Estimating the impact of amebiasis on health. *Parasitology Today*. 2000; 16:320–21

30. Savioli L, Albonico M. Soil- transmitted helminthiasis. *Nature Reviews Microbiology.* 2004; 2: 618-619.

31. Swinscow TDV, Campbell MJ. Statistics at Square. 10th Edition, BMJ Books, London. 2002.
32. UNHCR. Nigeria refugees and internally displaced persons. Index Mundi. 2018