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Prevalence of intestinal nematode infection among pregnant women attending antenatal clinic at the University College Hospital, Ibadan, Nigeria

Alli JA[1*], Okonko IO[2], Kolade AF[1], Nwanze JC[3], Dada VK[1], Ogundele M[1]

[1]*Department of Medical Microbiology and Parasitology, University College Hospital, Ibadan, Oyo State, Nigeria*
[2]*Department of Biochemistry & Microbiology, Lead City University, Ibadan, Nigeria*
[3]*Department of Pharmacology and Therapeutics, Igbinedion University, Okada, Edo State, Nigeria*

ABSTRACT

The prevalence of intestinal nematode infection was studied among 350 pregnant women attending antenatal clinic at the University College Hospital, Ibadan, over a period of 4 months, from November 2007 to February 2008. Macroscopic, wet preparation and the 2 methods of concentration, i.e, brine (floatation) and formol-ether (sedimentation) concentration methods were used to examine the stool for ova and the larvae of intestinal parasites. Of the 350 samples examined, 152 (43.4%) had parasites. A total of five parasites species were identified. Of the five (5) parasite species observed in the study, Hookworm and Ascaris lumbricoides had the highest prevalence of 35.8% (n=62) and 55.5% (n=96) respectively. This was followed by Enterobius vermicularis 6(3.5%), Trichuris trichuira 5(2.9%) and Strongyloides stercoralis had 4(2.3%) respectively. Also, an overall prevalence of co-infection was 13.8%, of which co-infection of A. lumbricoides + Hookwoorm was most predominant 18(85.7%). This was followed by A. lumbricoides +T. trichuria 2(9.5%) and Hookworm + Trichuris trichuria 1(4.8%). No co-infection of A. lumbricoides + Hookworm + T. trichuria and Enterobius vermicularis with any other parasites was found. However, the overall prevalence of the parasitic infection among pregnant women was 152(43.4%). The prevalence was significantly higher in 2nd trimester ($p<0.05$); than other trimester of the pregnancy. Comparing the three methods used the concentration methods were more sensitive when carried out on negative stool samples while comparing the concentration methods formol-ether proves more sensitive to Brine floatation method. Though, there was not much difference only that the density and quantity of the parasite was detected. The prevalence of intestinal nematode with age shows no significant difference ($p>0.05$), but the prevalence with occupation and with pregnant women with little children shows a significant difference ($p<0.05$). There was a higher prevalence of parasitic infections in this study. Routine examinations of stool of pregnant women for parasite and health education on simple hygiene are recommended to all antenatal clinics to prevent parasitic complications and unexplained loss of pregnancy.

Keywords: *Ascaris lumbricoides, Enterobius vermicularis, Hookworm,* intestinal nematode, *Trichuris trichuira* and *Strongyloides stercoralis.*

INTRODUCTION

Medical helminthology is concerned with the study of parasitic worms. They are responsible for an enormous burden of infection throughout the world and they are threats to human health [1]. There are three major phyla of helminthes namely: Nematoda, Trematoda and Cestoda. Intestinal nematode are as follows; *Ascaria Lumbricoides, Ancylostoma duodenale, Necator americanus, Enterobius vermicularis, Trichuris trichuira, Strongyloides stercoralis* [2]. Parasitic diseases are common in the developing counties and are of major health hazard because of their high prevalent rate, and their effect on both nutritional and immune status of the population. Parasitic diseases of blood and gastro-intestine of human are rampant in the tropics because there are favourable climatic, environmental and sociocultural factors which permit transmission of these parasitic diseases for greater part of the year [3-4]. These parasitic diseases, whether water-borne, vector-borne, soil transmitted or those that result from some poor sanitary or social habits provide some of the many public health problems in the tropics [4].

Intestinal parasitic infections are distributed throughout the world. Infection with intestinal round worms is generally associated with condition of poor hygiene. The life cycle of parasitic nematodes is clinically important. Some of these infections can be transmitted directly from infected to uninfected people; in others, eggs must undergo a process of maturation outside the human host in a third category, the parasites may spend a part of their life cycle in the soil before becoming infective to humans [5-6]. As with other parasitic infections, definitive diagnosis depends on demonstration of the stage of the life cycle in the host.

Parasitic diseases create morbidity and sometimes mortality. The present strategy for most infections realistically seeks to control or reduce morbidity rather than disrupt transmission [7]. Previous studies elsewhere in Nigeria have been along these lines. Among such studies are those of Taiwo and Agbolade [8], Gundiri et al. [9], Adeyeba and Akinlabi [10], Onyido et al. [11], Agbolade et al. [12], Eguwunyenga et al. [13], Omudu et al. [14], Odikamnoro and Ikeh [15], Anosike et al. [16-18], Shitta and Akogun [19], Nwosu et al. [20], Dada-Adegbola et al. [21], Mordi and Ngwodo [4], Ajero et al. [22], Okolie et al. [23], Tohon et al. [24], Chukwuma et al. [25], Awolaju and Morenikeji [26] and Okonko et al. [27]. Estimates of these parasitic diseases thus become a matter of necessity for the surveillance of public health, proper health-care delivery and people's welfare [4]. Therefore, the need to have accurate, comprehensive, valid, and reliably documented information on parasitic diseases cannot be overemphasized. The aims of this study were to determine the prevalence of intestinal nematode infections among pregnant women attending antenatal clinic of the University College Hospital, Ibadan; to compare the prevalence with their life style; and to compare the efficiency of Brine floatation and Formol-ether concentration methods for the diagnosis of intestinal nematodes. It is believed that this study provided the opportunity to recommend the prevention, control and treatment of the infection caused by these parasites.

MATERIALS AND METHODS

Source of specimens

Clinical specimens of stool from pregnant women attending antenatal clinic at the University College Hospital, Ibadan were used for this study. The selected subjects were given a dry clean bottle for faeces and a total of three hundred and fifty (350) pregnant women were used for this study.

Collection of samples

The selected subjects that were given dry clean bottle for faeces were instructed to collect in the morning and a total of three hundred and fifty (350) pregnant women were used for the study. Stool samples were collected and examine for the presence of larvae, cysts or ova of parasites.

Macrocopic Examination

All specimen were mainly examined to detect the presence of adult worms, or segment, the consistency, colour, presence of mucus and blood were also noted.

Microscopic Examination (Saline and iodine Preparation)

These were carried out on the faecal sample collected using wet preparation. A drop of fresh physiological saline was placed on one end of a clean slide and a drop of iodine was placed on the other end of the slide. Using an applicator stick, a small amount of stool specimen was emulsified in saline and another iodine solution. Each preparation was covered with cover slip and examined under the microscope from the presence or absence of intestinal parasite, larvae, ova or cysts. The preparation was observed under the microscope using X 10 and x40 objectives respectively with the condenser iris close sufficiently to give good contrast [28-29].

Saturated Sodium Chloride (Brine Floatation Concentration Method)

A universal bottle was filled to about one quarter with saturated sodium chloride solution (brine), about 1g of faeces was then added, emulsified and mixed thoroughly using a glass rod. The universal bottle was then filled with saturated sodium chloride solution and was allowed to stand vertically. Using a Pasteur pipette saturated sodium chloride was further added to ensure that the bottle was filled to the brim. A clean cover slip was placed on the top of the bottle and left fro 30minutes; the cover slip was removed using forceps, placed on a slide and examined under the microscope using x10 and x40 objectives [28-29].

Formol-Ether Concentration Technique for Rapid and Wide Range Concentration

Using a rod, about 1g from each of the faecal specimen was emulsified in about 7ml of 10% formol saline contained in a screw-cap bottle. The emulsified faeces were sieved into a beaker. The suspension was later transferred into a glass centrifuge tube and about 3ml of diethyl ether was added. The tube was stoppered and shaken vigorously for 1munite and then centrifuged at 3,000rpm for one 1munite. The layer of faecal debris was loosened from side of the tube using an applicator stick and the supernatant poured away. The deposit was re-suspended by tapping the bottom of the tube with finger. The deposit was transferred to a slide using a Pasteur pipette; the slide was covered with a cover slip and examined under x10 and x40 objectives of the microscope [28-29].

RESULTS

Of 350 samples of stool collected from pregnant; 152(43.4%) were positive for helminthic infection. Table 1 shows the risk factors for intestinal nematodes infections. Prevalence of nematodes infection in relation to ages showed that pregnant women within the age group 33-37 years of age had the highest prevalence value (46.9%). This was followed by age group 28-32 years (45.8%), 38-42 years (43.9%), 18-22 years (42.5) and age group 23-27 years had the lowest prevalence value (38.9%). However, the prevalence of intestinal nematode in relation to age shows no significant difference ($p<0.05$) and did not follow any regular pattern (Table 1). Table 1 also showed the prevalence of Intestinal nematode infections of different stages of the pregnancy. The prevalence of intestinal nematode was higher among pregnant women in their 2nd trimester (65.4%). This was followed by those in their 3rd trimester (21.9%) and those in their 1st trimester had lower prevalence value of 11.8% as shown in Table 1. The prevalence of intestinal nematode in relation to occupation showed that farmers (67.7%) had higher prevalence value for parasites. This was closely followed by traders (65.6%) and artisans (64.4%) while lower prevalence value was found among civil servants (29.1%). However, these difference was significant ($p<0.05$) as shown in Table 1. The prevalence of parasite among pregnant women with children less than 8 years of age (49.5%) was significantly ($p<0.05$) higher than those with children ages 8-12 years (42.6%) and ages 13 years and above (23.8%). However, the prevalence of intestinal nematode in relation to nursing mothers also showed significant difference ($p<0.05$) as shown in Table 1.

Table 1: Risk factors for Intestinal nematode infections among pregnant women

Risk factor	No. Tested (%)	No. Positive (%)
Age (year)		
18-22	87(24.9)	37(42.5)
23-27	77(22.0)	30(38.9)
28–32	83(23.7)	38(45.8)
33-37	62(17.7)	29(46.8)
38–42	41(11.7)	18(43.9)
Trimester (different stages of the pregnancy)		
1st	51(14.6)	06(11.8)
2nd	185(52.9)	121(65.4)
3rd	114(32.6)	25(21.9)
Occupation		
Civil servants	213(60.9)	62 (29.1)
Artisan	45(12.9)	29 (64.4)
Trade	61(17.4)	40 (65.6)
Farmer	31(8.9)	21 (67.7)
Pregnant women with children		
Women with children less than 8 years of age	186(53.1)	92 (49.5)
Women with children ages 8-12	101(28.9)	43 (42.6)
Women with children ages 13 and above	63(18.0)	15 (23.8)
Total	**350(100.0)**	**152(43.4)**

Table 2 shows the frequency of occurrence of intestinal nematodes in 152 positive stool samples. A total of 173 (49.4%) parasites belonging to five helminthic genuses were detected and identified as *Ascaris lumbricoides, hookworm, Trichuris trichiuria, Enterobius vermicularis* and

Strongyloides stercoralis. The prevalence of helminth species found in positive stool samples showed that *Ascaris lumbricoides* was the most predominant 96(55.5%). This was followed by *Hookworm* 62(35.8%), *Enterobius vermicularis* 6(3.5%), *Trichuris trichuiria* 5(2.9%) and *Strongyloides stercoralis* had 4(2.3%) respectively (Table 2). Table 2 also shows the frequency of co-infections between nematodes in 152 positive stool samples. Overall prevalence of co-infection was 13.8% (n=21). It was also observed that 13.8% of the samples were found with co-infection of at least two parasites. The prevalence of the co-infection showed that co-infection of *Ascaris lumbricoides* and Hookworm was most predominant (85.7%). This was followed by *Ascaris lumbricoides and Trichuris trichiura* (9.5%). Co-infection of Hookworm and *Trichuris trichiura* was the least predominant (4.8%). No co-infection of the three parasites, *A. lumbricoides*, Hookworm and *T. trichuria* was found (Table 2).

Table 2: Frequency of occurrence of intestinal nematodes in 152 positive stool samples and the co-infections

Parasites	**No. (%)**
Ascaris lumbricoides (Ova)	96 (55.5)
Hookworm	62 (35.8)
Strongyloides stercoralis	04 (02.3)
Enterobius vermicularis	06 (03.5)
Trichuris trichuria	05 (02.9)
Total	**173 (49.4)**
Co-Infections	
A. lumbricoides + Hookwoorm	18 (85.7)
Hookworm + *Trichuris trichuria*	01 (04.8)
A lumbricoides +*T. trichuria*	02 (09.5)
A. lumbricoides +Hookworm + *T. trichuria*	00 (00.0)
Total	**21 (13.8)**

Table 3 shows the comparison of the efficiency of direct smear of wet preparation, Brine floatation and formal either concentration. Comparing the three methods used, generally the brine floatation method (86.7%) proves more sensitive to formal-ether (86.1%) and wet preparation methods (50.3%). However, on the basis of individual parasites detection, formal-ether method and brine floatation methods proved more sensitive for *T. trichuria* (100.0%). For *A. lumbricoides* and *S. stercoralis*, formal-ether (100.0%) was more sensitive to the other two concentration methods. For hookworm, brine floatation method was more sensitive (100.0%). Though, there was no much difference only on the density and quantity of the parasite was detected.

Table 3: Comparison of the efficiency of direct smear of wet preparation, Brine floatation and formal ether concentration in detection of parasites

Parasite	**No.**	**Direct smear (%)**	**Brine floatation (%)**	**Formal either (%)**
A. lumbricoides	96	60 (62.5)	83 (86.5)	96 (100.0)
Hookworm	62	18 (29.0)	62 (100.0)	43 (69.4)
S. stercoralis	04	03 (75.0)	00 (00.0)	04 (100.0)
E. vermicularis	06	06(100.0)	00 (00.0)	00 (00.0)
T. trichuria	05	03 (60.0)	05 (100.0)	05 (100.0)
Total	**173**	**87(50.3)**	**150(86.7)**	**149(86.1)**

DISCUSSION

The prevalence of parasitic infection among different population is a function of many different factors. Most importantly the environmental factors, parasitic factors and host factors [28-29]. Three hundred and fifty (350) pregnant women attending the antenatal clinic of University College Hospital, Ibadan were used for this study, out of the 350 stool samples collected from these pregnant women, 152 (43.4%) were found with helminthic parasites. These helminthic parasites were identified as *Ascaris limbricoides,* Hookworm infestation, *Trichuris trichuira*, *Enterobius vermicularis* and *Strongyloides stercoralis.* All these parasites have been reported in various parts of Nigeria [4, 8, 12, 16, 17, 23, 25, 26]. The study revealed an overall prevalence rate of 43.4%. This is however higher than was previously reported by Egwunyenga *et al.* [30] in Nigeria who found 33.3% prevalence value among 816 pregnant women and Alison et al. [31] in Uganda who found 17.0% among 201 samples from pregnant women. This higher prevalence reported in our study may be attributed to lack of efficient environmental sanitation observed in Ibadan, Oyo State.

Elsewhere in Nigeria, there have been studies along these lines. Among such studies are those of Obiamiwe and Nmorsi [3], Okonji and Okaka [32], Okon and Boco [33], Mafiana [34], Elekwa and Ikeh [35], Ukpai and Ajaku [36] and Mordi and Ngwodo [4]. Though, 43.4% prevalence reported in our study was however; higher when compared with results obtained in other areas by different workers; it is somewhat higher than what was reported in other areas by different workers. Mordi and Ngwodo [4] reported a value of 0.7% in all the eighteen local government areas of Edo State, Nigeria. The difference in the percentage may be due to environmental factor, life style and occupation of the subjects, as seen in this project, which may truly expose them to infection also personal habits like ingesting food and water, contaminated with infective larvae or ova of these parasites. Moreover, the occurrence of helminths infection at high rates among pregnant women is indicative of faecal pollution of soil and domestic water supply around homes due to poor sanitation, ignorance of the mode of transmission of these worms and improper sewage disposal has been found to be a predisposing factor to infection.

Our present finding agrees with the overall prevalence reported by other authors in previous studies in Nigeria. Anosike et al. [16] reported an overall prevalence value of 42.4% among the nomadic Fulanis of south-eastern Nigeria. Our finding also differs slightly with what was reported by some authors. Gundiri et al. [9] reported a prevalence value of 33.3% in Adamawa State in northern Nigeria. They also recorded a value of 33.3%, 37.5% and 33.3% for Imo, Abia and Enugu states encampments of nomadic Fulanis respectively. Jimenez-Gonzalez et al. [37] reported a value of 34.0% among inhabitants of a rural community in Mexico. Chukwuma et al. [25] also reported prevalence of geohelminth eggs/larvae in soil with respect to Obuno primary school (32.5%).

Contrary to our findings, some workers in Nigeria had earlier on reported higher values. Adeyeba and Akinlabi [10] reported a value of 50.4% among school children in Igboora, a rural community of Oyo State. In Ibadan, a 68.2% prevalence rate of intestinal helminthes from stool samples of children aged 0 -17 years was reported by Dada-Adegbola et al. [22]. Okolie et al. [23] reported a prevalence value of 75% among patients with appendicitis in Oguta, Imo State.

Awolaju and Morenikeji [26] reported a value of 48.4% among primary and post-primary schools children Ilesa West, Osun State and 50.80% among school children in Ilaje, Osun State. Chukwuma et al. [25] in their study on the prevalence of parasitic geohelminth infection of primary school children in Ebenebe Town, Anambra State, reported a prevalence value of 53.6% in soil and 87.7% in stool. Chukwuma et al. [25] also reported prevalence of geohelminth eggs/larvae in soil with respect to schools to be Umuji primary school 52.5% and Umuogbuefi primary school 83.3% and overall prevalence in stool samples in the three schools to be 87.7% with distribution as follows; Umuji primary school, 87.5%, Umuogbuefi primary school, 97.5% and Obuno primary school, 75%. Also, studies elsewhere outside Nigeria reported higher prevalences than what was reported in our study. From primary school pupils in Buea district of Cameroon, a 59.1% prevalence rate of soil-transmitted nematode was reported [38]. Such variation could be related to the local environmental factors of the different areas or the behavioural practices of the people concerned [16].

Studies in many parts of Nigeria [3, 13, 39] have highlighted the hyperendemicity of soil transmitted helminthes, especially among children. Maternal women are at high risk of infection because of their close relationship with children. The most important cause of pathological chronic loss of blood and iron in tropics is hookworm and other soil transmitted helminths, especially among children [3]. The higher prevalence of intestinal nematode at the 2nd trimester and at age range 18 to 32 respectively support the suggestions of some authorities that all women of childbearing age, including pregnant women in the 2nd and 3rd trimester could benefit from periodic autihelminthic treatment much as presumptive therapy for malaria infection is advised during late pregnancy [40-42].

Among the helminthic parasites detected in this study, *Ascaris limbricoides* was the most predominant [96(55.5%)], followed by Hookworm infestation [62(35.8%)], *Enterobius vermicularis* [6(3.5%)], *Trichuris trichuira* [5(2.9%)], and *Strongyloides stercoralis* [4(2.3%)]. This predominance of *Ascaris lumbricoides* than any other intestinal nematode agreed with some previous report by Adeyeba and Akinlabi [10] as well as Agbolade et al. [12]. The 55.5% prevalence value reported for *Ascaris lumbricoides* in our study was however; low compared with what was reported in other areas by different workers. Recently, an examination of 2,394 stool samples from Indonesia showed the prevalences of *A. lumbricoides* as 73.7% [43]. In Nigeria, Observations in Zaria, Northern Nigeria showed that 70% of the soil samples collected in a school compound was contaminated with geohelminth eggs showing the level to which the soil can be contaminated with faeces [44].

The 55.5% prevalence value reported for *A. lumbricoides* in this study compared favourably with the prevalence values reported by some other authors. From Cameroon, Ndamukong et al. [45] reported a prevalence value for *A. lumbricoides* to be 54.9%. Eguwunyenga et al. [30] reported a prevalence of 55.0% in Eku Delta State. Nwosu et al. [20] reported a prevalence of 52.0% in school children in Abia and Imo States. Odikamnoro and Ikeh [15] reported a prevalence of 51.5% among the Kpiri-kpiri community of Abakiliki of Ebony State. Chukwuma et al. [25] reported a value of 54.1% (in stool) and 24.0% (in soil) for Ascaris spp. in Ebenebe Town, Anambra State. Also, the 55.5% prevalence value reported *A. lumbricoides* in our study was however; higher when compared with what obtained in other areas by different workers.

Adeyeba and Akinlabi [10] reported 24.2% in their study. Shitta and Akogun [19] reported a prevalence of 48.0% among the nomadic Fulanis of Northern Nigeria. Obiamiwe and Nmorsi [3] reported a value of 46.7% in the defunct Bendel State of Nigeria. It is also higher compared with the prevalence value of 30.0% reported by Mordi and Ngwodo [4] in a similar study. However, our value is significantly higher than what was reported by Omudu et al. [14], who reported a prevalence of 1.8% in Markurdi, Benue State; Ramos et al. [46] who reported a value of 0.7% in another rural community in Mexico; Elekwa and Ikeh [33] reported a prevalence of 10.4% in Jos metropolis in Plateau State, Nigeria; and Okolie et al. [23] who reported a prevalence value of 14.3% for *A. lumbricoides* with *E. vermicularis* in Oguta, Imo State. Awolaju and Morenikeji [26] reported a prevalence value of 39.10% *A. lumbricoides*. In a recent study by Jimenez-Gonzalez et al. [36] found no *A. lumbricoides* among inhabitant of a rural community in Mexico. The presence of helminth in the stool is of great public health concern. The high prevalence of *A. lumbricoides* reported in this study may be due to faecal pollution of the soil/environment where the patients whose stool samples were used for this study. Soil pollution is thus a major factor in the epidemiology of human ascariasis. Infection with *A. lumbricoides* could also be spread through eggs, which are swallowed as a result of ingestion of contaminated soil or contact between the mouth and the various objects carrying the adherent eggs. Contamination of food or drink by dust or handling is another source of infection [4]. Human ascariasis is spread through faecal pollution of soil, and so the intensity of infection depends on the degree of soil pollution [4]. Infection is spread through eggs, which are swallowed as a result of ingestion of contaminated soil or contact between the mouth and the various objects carrying the adherent eggs. Contamination of food or drink by dust or handling is another source of infection. Ascaris ova are spread through the agents of flood and coprophagous animals, and can thus be transported to locations far from the defecation sites [3-4]. The eggs are passed unaltered through the intestine of coprophagous animals. The well-protected eggs can withstand drying and can survive for very lengthy periods. Soil pollution is thus a major factor in the epidemiology of human ascariasis [4].

Hookworm was relatively the second most common parasite species identified in the study. The prevalence value was 35.8%. This value is low when compared with the value from other studies in various parts of the country both now and in the past. Egwunyega et al. [30] reported infection rate of 22.5% at Eku in Delta State of Nigeria. Nwosu et al. [20] reported 25.8% in Aba, Abia State, Nigeria. Cowper and Woodward [47] reported infection rate of 25.9% in the Western State of Nigeria while Gilles [48] reported a prevalence value of 71%. Hookworm infections occur by skin penetration of the L3 stage infective larvae. Poor sanitary disposal of human faeces and indiscriminate defecation are the principal factors in the aetiology of hookworm infections [4]. However, the high prevalence of intestinal namatode recorded in this study indicates high level of unhygienic practices among some group of occupation which enhanced transmission in the communities.

The prevalence of *Enterobius vermicularis* (3.5%) reported in this study was very low. This however is close to the values recorded in the past in the country. Recently other workers reported varying values from various part of the country. Mordi and Ngwodo [4] reported a value of 1.0% in Edo State. This infection is distributed throughout the world but less common in the tropics than in the countries of the Temperate Zone [4]. Most previous studies recorded low

prevalence values in the country. Odikamnoro and Ikeh [15] reported a value of 2.3% among children in Kpiri-kpiri community in Abakiliki in Ebonyi State while Egwuyenga et al. [30] reported a value of 0.13%. The low prevalence value generally recorded for this organism supports the claim that it is less common in the tropics than in the temperate regions [4]. The very low value recorded in this study attests to the good sanitary conditions in Ibadan, Oyo State. In the study *T. trichiura* had a prevalence value of 2.9%. This value is quite low when compared with the reports of both past and current studies in other parts of the country and in the world. Anosike et al. [17] reported a value of 14.0% amongst post primary school children in Owerri, Imo State, Nigeria. Onyindo et al. [11] reported a value of 5.3% among the inhabitant of Amaechi-Idodo community in Nkanu East local government area of Enugu State. Egwuyenga et al. [30] reported a value of 20.8% in Eku, Delta State of Nigeria while Nwosu et al. [20] reported a prevalence value of 19.4% among children in Aba, Abia State. Ejezie [49] reported a value of 75.8%, Obiamiwe and Nmorsi [3] reported 77.6%. It is however higher than what was reported by Alakija [50] who reported a value of 1.7%. *T. trichuria* popularly known as whipworm because of the whip like form of the adult worm has a cosmopolitan distribution. It is however, prevalent in the warm humid tropics [4]. Soil pollution is a major factor in the transmission of the infection in a community [4]. Transmission occurs through poor sanitary habits of indiscriminate defecation. Infections usually occur through ingestion of infective ova from contaminated hands, food or drinks. Flood and copraphagous animals play some part in the transportation of the ova to locations other than the defecation site [4].

The prevalence of *S. stercoralis* (2.3%) was very low. This prevalence value of 2.3% however is close to the values recorded in the past in the country. Nwosu et al. [20] reported a value of 2.5%. Akoh [52] reported a prevalence value of 2.8%. Recently other workers reported varying values from various part of the country. Mordi and Ngwodo [4] reported a value of 1.0%. Egwuyenga et al. [30] reported a prevalence value of 0.2%. Obiamiwe [51] reported a value of 1.8% while while Nwosu [53] reported 0.4%. However, the 2.3% prevalence value reported for *S. stercoralis* in this study is very much lower compared to what had been reported in other parts of the country. Anosike et al. [17] reported a value of 6.0% while Shitta and Akogun [19] reported a value of 25.3% among the nomadic Fulani in Adamawa State, Nigeria. This helminth generally has low prevalence as observed in most studies. This reason for low prevalence may not be unconnected to its vulnerability to adverse environmental conditions hence its alternate mode of infection, auto-infection [4]. This parasite was found in 6 samples collected in Ibadan, Oyo State. The low prevalence of *S. stercoralis* may not be unconnected with the climate and weather at the time of study. The ground was so dry which may have contributed to the unlivable infective stage which were unable to penetrate the unbroken skin, the portal of infection. However, based on [5-6] classification, the intensity of intestinal nematode infection in this study was moderate.

In this study, over all prevalence of co-infections was 13.8%. Though no co-infection of the three parasites, *A. lumbricoides*, Hookworm and *T. trichuria* was found in this study, Ogbe et al. [54] reported co-infection of *A. lumbricoides, Trichuris trichiura* and hookworm in stool examination done in five LGAs in Delta State. Also, although no co-infection of *A. lumbricoides* with *E. vermicularis* was reported in our study, Okolie et al. [23] who reported a prevalence value of 14.3% for *A. lumbricoides* with *E. vermicularis* in Oguta, Imo State. In most of the surveys in

tropical Africa, it has been shown that co-infections of intestinal nematodes is very common, such that cases of multiple infections with nematodes (Ascaris, hookworms, and Trichuris) have been reported [4, 16, 21-23]. Kionti reported that the combination of Ascaris and hookworm, Ascaris and Trichuris, Ascaris, hookworm and Trichuris accounted for more than 76% of all multiple infections in school children in the Kano plain in Kenya [23].

This study successfully achieved the objective for which it was set. The study identified eleven parasite species and their prevalence among pregnant women in Ibadan, Oyo State. The study also determined the pattern of distribution of these parasite species. This was clearly demonstrated in both the age, occupational, and trimester distribution of the parasite species. The data obtained from this study provides information on the various parasitic diseases associated with blood and gastro-intestines of pregnant women in Ibadan, Oyo State. The study also provides data for understanding the epidemiological status of the human blood and gastrointestinal parasites in Ibadan. The information on the age, occupational and trimester distribution of these parasites is very useful in the control strategy [4]. In response to these high prevalences and incidences of gastro-intestinal parasites, World Health Organization (WHO) has outlined strategies to combat the problem of parasitism. In this regards, the current deworming programme by some agencies and NGOs should be cost effectiveness and use of potent but safe anti-helminthic drugs. Measures directed at ensuring that heavy parasite infestations in humans are reduced include: 1) maintaining high standards of personal and domestic hygiene. 2) Avoiding contact with contaminated water, food and clothing. 3) High standard of education and adequate health education and 4) Presence of modern public restaurants hygienically kept and maintained [23].

Although, the findings of this study may have minor discrepancies with others from different countries, it still indicates that gastro-intestinal parasites in the body system can provoke disease burden such as appendicitis [23], amoebiasis, human ascariasis and haematuria [4]. Discrepancies observed in the findings of this study and previous studies by other researchers and could be attributed to differences in place of study i.e. geographical location, and other conditions which can affect the research finding so that slight discrepancies could occur. Because the impact of parasitic infections may extend far beyond visible human disease into the spheres of chronic non-perceived unwellness or socio-economic losses and missed development opportunities [37, 56] and supported by the findings of this present study, and in accordance to the assertion by Jimenez-Gonzalez et al. [37], we however recommend and consider that the health authorities should incorporate in their control programs aspects of health education, anti-protozoa drugs and control of natural water sources.

In conclusion, the effect of parasitic infection on pregnant women and their foetus varies greatly for asymptomatic infection to severe infection that may result in malnutrition; anaemia retarded intrauterine growth and spontaneous abortion. The effect depends on parasite load and immune status of the pregnant woman. Due to the fact that the prevalence of intestinal nematode is relatively high base on this study, control and prevention of this infection is necessary. Based on the result obtained from this study, we would like to recommend to all antenatal clinics and health centers a routine examination of stool of pregnant women for parasite to prevent anaemia in pregnancy. More importantly, Mebendazole therapy has not been found to be hazardous to

mother and infant after completion of the 1st trimester of pregnancy [58]. The findings from this study thus support the need for the establishment of a health programme for the control of the gastro-intestinal parasites in the community. For this reason, measures should be adopted to monitor, control or prevent this tendency of parasites and/or their eggs/cysts from invasion of the body system. The obvious preventive measures would include: the improvement of general standards of sanitation through the installation of suitable sewage treatment and disposal facilities, and provision of pipe-borne water supply as pre-requisites for successful prevention and control. In terms of implementing control, the WHO urges member states to ensure access to good quality anthelminthic drugs at all levels of the health care system in endemic areas [59]. In line with Anosike et al. [16-18], provision of prophylactics, prevention, treatment and control of parasitic infections amongst people in this part of Nigeria is necessary. Health education in local languages should be vigorously mounted to highlight the principles of basic personal or community Parasitic diseases in Nigeria hygiene, vis-à-vis the life cycle, mode of transmission (vector), as well as possible preventive measures of some the prevalent parasitic infections in the area [16-18]. In agreement with Mordi and Ngwodo [4], there should be toilet facilities to discourage indiscriminate defecation and urination in public places. Social amenities in form of recreation centres, amusement parks, schools, and commercial establishments should be provided with toilet facilities and water to improve the quality of life for the people. There should be good drinking water, drugs, and diagnostic facilities in the hospitals for the diagnosis and treatment of infected individuals. However, further studies are therefore advocated.

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