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Prevalence and Intensity of Intestinal Helminths among Pregnant Women Attending Antenatal Clinic in Ebonyi State Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. Authors CAI and J. E. Eyo designed the study, carried out the hospital and the laboratory analyses of the study. Authors JCO and J. E. Ekeleme performed the statistical analysis, wrote and proof-read the manuscript. Authors OPO, GUA, SCE and MIA managed the literature searches and wrote the protocols. All authors thoroughly proof read and approved the final manuscript.

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ABSTRACT

Aim: This present study was conducted to determine the prevalence and intensity of intestinal parasites among pregnant women attending antenatal clinics in Ebonyi State Nigeria.
Methodology: The study was carried out from April 2011 to March 2012 at two purposively selected hospitals in Ebonyi State, Nigeria. Three hundred and sixty pregnant women were randomly selected for this study. Stool samples were examined for intestinal helminths using

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macroscopic and the microscopic methods. The intensity of the ova was determined directly and graded. Data analysis was performed using Statistical software for social sciences version 20.
Results: Out of the 360 sampled pregnant women, 18.6% was found positive for intestinal helminthic parasites. Three intestinal helminthic parasites isolated were; *A. lumbricoides* (8.9%), hookworm (6.1%) and *T. trichiura* (3.6%). The prevalence and intensity were higher during the rainy season than the dry season. First trimester, secundigravidae and (15-20 yrs) age group had the highest prevalence of intestinal helminthic parasites. Pregnant women that ate raw vegetables had a higher prevalence of Ascariasis, trichuriasis and hookworm infection than those that ate cooked vegetables. In relation to source of drinking water, those that got drinking water from river had the highest prevalence of all the parasites. On the type of toilet used, pregnant women who use bush method had the highest prevalence 7(10.9%) for *A. lumbricoides* and *T. trichuria* was more prevalent with those who use pit toilet 6(3.8%) while hookworm 12(8.7%), was seen among women using water cistern. In relation to washing of hands after toilet, pregnant women that do not wash hands had higher prevalence of 6(11.5%), 2(3.8%) 6(11.5%) for *A. lumbricoides*, *T. trichuria* and hookworm respectively than those that do wash their hands after toilet. Those that ate raw meat had higher prevalence of *A. lumbricoides* 3(15.8%), *T. trichuria* 2(10.5%) and hookworm 3(15.79%) than those that did not eat raw meat. Those who walk barefooted had higher prevalence of *A. lumbricoides* 5(8.3%), *T. trichuria* 4(6.7%) and hookworm 8(13.3%) than those who do not walk barefooted.
Conclusion: From this study, it is concluded that helminthic parasites are still present in pregnant women at Ebonyi state, therefore there is need to control and prevent their infection so as to eradicate its effects on pregnant women. The creation of awareness on the preventive measures of helminthic infections amongst people in Ebonyi state is urgently needed. Consequently, health education in local languages should be vigorously mounted to create awareness on helminthic diseases.

Keywords: Prevalence; intensity; helminths; pregnant women; Ebonyi state.

1. INTRODUCTION

Human intestinal helminth infections are frequently seen throughout the developing countries [1,2]. These infections are mainly due to insufficient water supply, poor sanitation, poverty and ignorance. It is projected that about one billion people are infected annually with human intestinal helminths globally [3,4]. Several reports from various parts of Nigeria showed widespread of human intestinal parasites [4,5,6,7]. These reports disclosed that the most significant human intestinal parasites in Nigeria are *Ascaris* and hookworms and to a lesser extent *Trichuris* and *Schistosoma mansoni*. It also exposed other important epidemiological features of the diseases and recognized *Ascaris lumbricoides* as the major species in all part of the country. The most common types of intestinal parasites of man and animals are helminths (like *A. lumbricoides,* hookworms, *Entamoeba histolytica, Giardia lamblia* etc) which are usually in excess of 50% in all age groups within each endemic area [8,9,10]. Though human intestinal helminths are seen in many areas, *A. lumbricoides* and hookworms are the major known parasites. Hookworms are usually the second most imperative infection in most endemic places. *S. mansoni* is more frequent in the northern parts of the country than the southern part although the prevalence is rising in parts of the south particularly the Western States [11]. Parasitic diseases particularly soil transmitted intestinal helminths infections have been known to be a significant public health challenge in many developing nations [12,2]. Intestinal parasitic diseases in the tropical zones have endured despite several efforts at combating them [13,6]. This may be because of the insufficient attention given to sanitation and personal hygiene in the tropical zones. Intestinal parasitic infections which are very common in Nigeria have become so significant due to the high rates of morbidity and sometimes mortality among patients in most parts of Nigerian [14,12]. The objective of this study was to determine the prevalence and intensity of helminthic parasites among pregnant women attending antenatal clinic in Ebonyi State Nigeria.

2. MATERIALS AND METHODS

2.1 Study Area

The study was carried in Ebonyi State, which is one of the thirty-six states of Nigeria. It has a

projected population of about 2.3 million and a total land area of about 5935 km^2 [15,16]. Like most parts of Nigeria, it has two main seasons; rainy and dry seasons. The rainy season which is the main farming season commences around late April and could last up to October [17]. The annual rainfall is over 1600 mm while the daily rainfall is over 150 mm. The daily maximum and minimum temperatures are 32°C and 25°C respectively. The dry season commences around November and last up to early April. However, there could be occasional rains in January, February and March. The dry season is punctuated by a brief period of dry and chilly, wind and dust haze, known as the harmattan period. This usually occurs around late December through January although in recent times it seems to have extended up to February. The climate of Ebonyi State is temperate in nature and the temperature of Ebonyi ranges from 8 – 40°C. The humidity of Ebonyi State ranges from 22 – 80%.

2.2 Study Design and Population

The study was a cross-sectional, hospital-based study to investigate the prevalence and intensity of intestinal helminths among pregnant women attending antenatal clinic in Ebonyi State Nigeria**.** The hospitals that were selected include Mile Four Hospital and Federal Medical Centre Abakaliki. The study lasted for twelve months, from April 2011 to March 2012. The study employed such tools as informed conversation to raise awareness on the study, administration of questionnaire and parasitological examination of the parasite. Pregnant women attending antenatal clinics in their different trimesters were selected for the research. Three hundred and sixty pregnant women were selected from two hospitals.

2.3 Ethical Approvals

Ethical review and clearance was obtained from the Ministry of Health, Ebonyi State and University of Nigeria Nsukka Ethical Research Committee. Ethical consideration was also obtained from the two hospitals selected for the study from antenatal division and research department. The permission to use hospital facilities was also obtained from management. Informed consent was also obtained from the pregnant women before collection of the sample. The approval was on the agreement that patient anonymity must be maintained, good laboratory practice and that findings would be treated with utmost confidentiality and for the purpose of this research only. All work was performed according to the international guideline for human experimentation clinical research [18].

2.4 Administration of Questionnaire

A structured pretested questionnaire was administered to the randomly selected pregnant women through participatory approach. By this the researchers discussed each question and their options with the pregnant women in a manner that facilitates effective recall of experiences. The questionnaire sought information on age, gravidity, trimesters among others.

2.5 Sampling Method

The hospitals used were purposively selected for the study based on the availability of active antenatal clinic. Random sampling through balloting was employed for the selection of pregnant women for the study. Pieces of papers written either ‘yes’ or ‘no’ were picked by the pregnant women attending antenatal clinics. Those that picked ‘yes’ were chosen for the study. Pregnant women who were chosen but could not provide the specimen was excluded from the study. One hundred and eighty pregnant women were chosen for each hospital.

2.6 Collection of Stool Samples

A sample of fresh stool specimen was collected from all the randomly selected pregnant women. These pregnant women were provided with a labeled leak proof stool container, toilet paper and applicator stick. Approximately 5 gm of stool specimen was collected into the container, using applicator sticks.

2.7 Macroscopic Examination

All stool specimens were examined to detect the presence of adult worms, or segment, the consistency, colour, presence of mucus and blood was also noted [19]. Microscopic examination techniques employed in the microscopic examination of the samples were direct microscopy and formol-ether concentration method as described by [19].

2.8 Direct Examination of Faecal Sample

A drop of fresh physiological saline was placed on one of a clean slide and a drop of iodine was on the other end of the slide. The iodine

preparation is particularly suitable for the identification of protozoan cysts. The 8.5% saline and iodine wet mount allow for the detection and identification of both protozoan and helminthic human gut parasites [20]. Using an application stick a small amount of stool specimen was emulsified in saline and another in iodine solution. Each preparation was covered with cover slip and examined under the microscope for the presence or absence of intestinal parasites, larvae, ova or cysts. The preparation was observed under the microscope using X10 and X40 objectives, respectively with the condenser iris adequately regulated to give good contrast [19].

2.9 Formol-ether Concentration Technique

Using the applicator, one gram of each faecal specimen was emulsified in about 7 ml of 10% formol saline into a centrifuge tube. The emulsified faeces were sieved into a beaker. The suspension was labeled transferred into a glass centrifuge tube and about 3 ml of diethyl ether added. The tube was stoppered and shaken vigorously for 1 minute and then centrifuged at 3,000 rmp for five minutes. The layer of fecal debris was loosened from the side of the tube using applicator stick and the supernatant ether, debris and formalin poured away, allowing a few drops of the sediment to remain which was well mixed and a drop made on a clean glass slide covered with cover slip and examined at x10 and x40 objectives of the microscope [19]. All eggs in each preparation were counted to determine the number of eggs per gram of faeces. The egg count were classified as light, moderate and heavy infections as follows: *Ascaris* :light infection (1 - 499 EPG), moderate infection (500 - 49,999 EPG) and heavy infection (>50,000 EPG); hookworm: light infection (1 - 999 EPG), moderate infection (1000 - 9,999 EPG) and heavy infection (> 10,000 EPG), *Trichuris*: light infection (1 - 999 EPG), moderate infection (1000 - 9999 EPG) and heavy infections (10,000 EPG).

2.10 Data Analysis

Results were analyzed using SPSS version 20.0. Chi-square test was used to determine significant differences of prevalence of intestinal helminths. Intensity of transmitted helminths between groups was compared using independent T-test/ one-way ANOVA as appropriate. Statistical significance was set at ($P < 0.05$).

3. RESULTS

3.1 Seasonal and Monthly Prevalence of Intestinal Helminths among Pregnant Women in Ebonyi State

The seasonal and monthly prevalence of intestinal helminths among pregnant women in Ebonyi State, Nigeria indicated that rainy season had the highest prevalence 36(20.0%) compared to dry season which had 31(17.2%). No statistically significant association (χ^2 = 0.46, P = 0.498) in the prevalence due to seasons was observed. Three intestinal parasites were isolated in the study of which *A. lumbricoides* 32(8.9%) and *T. trichuria* 13(3.6%) had the highest prevalence in the rainy season with 20(11.1%) and 7(3.1%) respectively while hookworm had the highest prevalence in the dry season 12(6.7%). There was no statistically significant difference association (χ^2 = 2.20, P= 0.14; χ^2 = 0.08, P = 0.78 and χ^2 = 0.19, P =0.66) in the prevalence due to seasons. In the monthly prevalence, disease cases occurred in all the mouths and prevalence was highest in May 8(26.7%). The least prevalence was observed in November 4(13.3%). There was no statistically significant association (χ^2 = 0.46, P = 0.50) between months and prevalence of intestinal helminths (Table 1).

3.2 Prevalence of Intestinal Helminths in Relation to Trimester, Gravidity and Age Groups among Pregnant Women in Ebonyi State, Nigeria

The prevalence of intestinal helminths in relation to trimester, gravidity and age groups indicated that the 1st trimester had the highest prevalence which is 5(27.8%). This was followed by 3rd trimester with 38(18.6%) while 2nd trimester had the least prevalence which is 24 (17.4%). There is no statistically significant association (χ^2 = 1.13, P = 0.57) observed in the prevalence of intestinal helminths due to trimester. In gravidity, secundigravidae had the highest prevalence of 22(25.9%), followed by primigravidae 20(19.8%) and multigravidae which had the least prevalence of 25(14.45). There was no statistically significant association (χ^2 =5.13, P = 0.07) between intestinal helminths and gravidity. Age groups, (15-20 years) had the highest

Table 1. Seasonal and monthly prevalence of intestinal helminths among pregnant women in Ebonyi state, Nigeria

Variables	Numbers examined	Number infected	*Ascaris lumbricoides*	Hookworm	*Trichuris trichuria*
Overall	360	67(18.6)	32(8.9)	22(6.1)	13(3.6)
Seasons					
Rainy	180	36(20.0)	20(11.1)	10(5.6)	7(3.9)
Dry	180	31(17.2)	12(6.7)	12(6.7)	6(3.3)
χ^2		0.46	2.20	0.19	0.08
P value		0.498	0.14	0.66	0.78
Months					
April	30	5 (16.7)	1(3.3)	1(3.3)	2(6.7)
May	30	8(26.7)	3(10.0)	2(6.7)	3(10.0)
June	30	5(16.7)	3(10.0)	2(6.7)	1(3.3)
July	30	6(20.0)	3(10.0)	2(6.7)	1(3.3)
August	30	5(16.7)	3(10.0)	1(3.3)	1(3.3)
September	30	6(20.0)	4(13.3)	2(6.7)	0(0.0)
October	30	6(20.0)	4(13.3)	1(3.3)	1(3.3)
November	30	4(13.3)	2(6.7)	2(6.7)	0(0.0)
December	30	5(16.7)	3(10.0)	2(6.7)	0(0.0)
January	30	5(16.7)	2(6.7)	1(3.3)	2(6.7)
February	30	6(20.0)	2(6.7)	3(10.0)	1(3.3)
March	30	6(20.0)	2(6.7)	3(10.0)	1(3.3)
χ^2		0.46	3.57	3.29	8.54
P value		0.50	0.98	0.99	0.66

Figures in parentheses indicate %.

prevalence of 14(34.1%), followed by (21 – 25 years) age group 31(24.8%) while the least was (≥ 36 years) age group 1(7.1%). There was statistically significant association (χ^2 = 16.86, P = 0.002) in the prevalence of intestinal helminths in relation to age groups (Table 2).

3.3 Intensity of Intestinal Helminths among Pregnant Women in Ebonyi State, Nigeria

The intensity of intestinal helminths showed that in seasons, *A. lumbricoides* (291.67 ± 108.36) and *T. trichuria* (360.00 ± 207.36) had the highest intensities in dry season while hookworm (340.00 ± 165.65) had the highest in rainy season. There was no statistically significant association (P < 0.05) between intensities and season of intestinal helminths. In relation to trimester, third trimester had the highest intensities in *A. lumbricoides* (289.47 ± 144.89) and *T. trichuria* (383 ± 204.12) while Hookworm had the highest intensity in second trimester (300.00 ± 126.49). There is no statistically significant association observed between trimester and intensities of intestinal helminths. In gravidity, primigravidae had the highest intensity with Hookworm (333.33 ± 103.28); secundigravidae had the highest intensity as seen with *T. trichuria* (466.67± 152.75) while *A. lumbricoides* (289.47± 144.89) had the highest intensity in multigravidae. There was also no statistically significant association (P < 0.05) between gravidity and intensities of intestinal helminths. Age showed no statistically significant association (P < 0.05) with intensity of intestinal helminths.

3.4 Responses of Pregnant Women Infected with *Ascaris lumbricoides*, *Tricharis trichuria and* Hookworm in Ebonyi State, Nigeria

Table 4 showed responses of pregnant women in Ebonyi State infected with intestinal helminths. Pregnant women that ate raw vegetable had higher prevalence of Ascarisis, trichuriasis and hookworm infection than those that ate cooked vegetables. Statistically, there was no significant association (P < 0.05). In relation to source of drinking water, those that got drinking water from river had the highest prevalence in all the parasites with *A. lumbricoides* 5(10.4%), *T. trichuria* 4(8.3%) and hookworm 16(33.3%). Statistically there was no significant difference

Table 2. Prevalence of intestinal parasites in relation to trimester, gravidity and age groups among pregnant women in ebonyi state, Nigeria

Variables	Numbers examined	Number infected	*Ascaris lumbricoides*	Hookworm	*Trichuris trichuria*
Trimester					
1st trimester	18	5(27.8)	2(11.1)	2(11.1)	1(5.6)
2nd trimester	138	24(17.4)	11(8.0)	6(4.3)	6(4.3)
3rd trimester	204	38(18.6)	19(9.3)	14(6.9)	6(2.9)
χ^2		1.13	0.30	1.73	0.67
P value		0.57	0.86	0.42	0.71
Gravidity					
Primigravidae	101	20(19.8)	10(9.9)	6(5.9)	3(3.0)
Secundigravidae	85	22(25.9)	11(12.9)	7(8.2)	4(4.7)
Multigravidae	174	25(14.4)	11(6.3)	9(5.2)	6(3.4)
χ^2		5.13	3.27	0.94	0.43
P value		0.07	0.20	0.63	0.81
Age groups (yrs)					
15-20	41	14(34.1)	7(17.1)	7(17.1)	0(0.0)
21-25	125	31(24.8)	13(10.4)	8(6.4)	9(7.2)
26-30	142	17(12.0)	10(7.0)	5(3.5)	3(2.1)
31-35	38	4(10.5)	2(5.3)	1(2.6)	1(2.6)
36 and above	14	1(7.1)	0(0.0)	1(7.1)	0(0.0)
χ^2		16.68	6.32	11.09	7.71
P value		0.002*	0.18	0.03	0.10

Figures in parentheses indicate %

Table 3. Intensity of *Ascaris lumbricoides*, hookworm and *Trichuris trichuria* ova among pregnant women in ebonyi state, Nigeria

Variables	*Ascaris lumbricoides*	Hookworm	*Trichuris trichuria*
Season			
Rainy	270.00 + 144.79 [a]	340.00 + 165.65 [a]	257.14 + 190.24 [a]
Dry	291.67+ 108.36 [a]	241.67 + 124.01 [a]	360.00 + 207.36 [a]
Trimester			
First	200.00 + 0.00 [a]	300.00 + 0.00 [a]	
Second	272.73 + 100.37 [a]	300.00 + 126.49 [a]	216.67 + 160.2 [a]
Third	289.47 + 144.89 [a]	278.57 + 171.77 [a]	383.33+ 204.12 [a]
Gravidity			
Primigravidae	200.00 + 0.001 [a]	333.33 + 103.28 [a]	133. 33 + 57.74 [a]
Secundigravidae	272.73 + 110.37 [a]	242.86 + 139.73 [a]	466.67 + 152.75 [a]
Multigravidae	289.47 + 144.89 [a]	288.89 + 183.33 [a]	300.00 + 200.00 [a]
(Age group yr)			
15-20	257.14 + 78.68 [a]	285.71 + 157.35 [a]	
21-25	323.08+136 .34 [a]	262.50 + 106.07 [a]	300.00 + 185.16 [a]
26 – 30	250.00 + 0.00 [a]	380.00 + 192.35 [a]	366.67 + 251.66 [a]
31 – 35	200.00 + 0.00 [a]	200.00 + 0.00 [a]	100.00 + 0.00 [a]
≥ 36		100.00 + 0.00 [a]	

NB: mean values with same alphabets as superscripts are not significantly different (P < 0.05)

(χ^2 = 0.53, 7.82, 6.04, df = 4, P < 0.05) in the prevalence of parasites due to sources of drinking water. On the type of toilet used, pregnant women who used bush method had the highest prevalence 7(10.9%) for *A. lumbricoides*, *T. trichuria* was more prevalent with those who used pit toilet 6(3.8%) while hookworm 12(8.7%), was seen among women that used water cistern. There was no statistically significant association (χ^2 = 0.42, 0.59, 0.20, df = 2, P < 0.05) between

the prevalence of parasites and the types of toilet used. In relation to washing of hands after toilet, pregnant women that didn't wash hands had higher prevalence of 6(11.5%), 2(3.8%) 6(11.5%) for *A. lumbricoides*, *T. trichuria* and hookworm respectively than those that washed their hands after toilet. There was no statistically significant association (χ^2 = 0.53, 0.01, 3.12, df = 1 P < 0.05) between the prevalence of parasites and hand washing after toilet. Those that ate raw meat had higher prevalence of parasites, *A. lumbricoides* 3(15.8%), *T. trichuria* 2(10.5%) and hookworm 3(15.79%) than those that did not eat raw meat. Statistically, there was no significant association (χ^2 = 1.18, 2.76, 2.51, df = 1, P < 0.05) between eating raw meat and intestinal parasites. Those who walk bare footed had higher prevalence of *A. lumbricoides 5*(8.3%), *T. trichuria* 4(6.7%) and hookworm 8(13.3%) than those who do not walk bare footed. Statistically,

Table 4. Responses of pregnant women infected with *Ascaris lumbricoides*, *Trichuris trichuria and* Hookworm in Ebonyi state, Nigeria

Questions	Responses	Number of subject	Number positive for *A. lumbricoides*	Positive for *T. trichuria*	Number positive Hookworm
Do you eat raw vegetables?	Yes	69	7(10.1)	6(8.7)	5(7.2)
	No	291	25(8.6)	7(2.4)	15(5.2)
	χ^2		0.66	6.34	2.57
	P value		0.68	0.19	0.11
What is the source of your domestic water?	Tap	134	13(9.7)	7(5.2)	5(3.6)
	River	48	5(10.4)	4(8.3)	16(33.3)
	Pond	11	1(9.1)	0(0.0)	1(9.1)
	Bore hole	73	6(8.2)	0(0.0)	6(8.1)
	well water	94	7(7.4)	2(2.1)	4(3.3)
	χ^2		0.53	7.82	6.04
	P value		0.97	0.09	0.20
What type of toilet do you use?	water cistern	138	12(8.7)	5(3.7)	12(8.7)
	Pit	158	13(8.2)	6(3.8)	7(4.4)
	Bush method	64	7(10.9)	2(3.1)	3(4.7)
	χ^2		0.42	0.59	2.61
	P value		0.81	0.97	0.27
Do you wash hand after toilet?	Yes	308	26(8.4)	11(3.6)	16(5.2)
	No	52	6(11.5)	2(3.8)	6(11.5)
	χ^2		0.53	0.01	3.12
	P value		0.47	0.92	0.07
Do you eat raw meat?	Yes	19	3(15.8)	2(10.5)	3(15.79)
	No	341	29(8.5)	11(3.2)	30(8.80)
	χ^2		1.18	2.76	2.51
	P value		0.28	0.10	0.15
Do you walk bare footed	Yes	60	5(8.3)	4(6.7)	8(13.3)
	No	300	17(5.7)	16(5.3)	23(7.7)
	χ^2		0.18	1.21	3.41
	P value		0.06	0.09	0.02*

Figures in parentheses indicates %. Significant difference at P < 0.05*

there was no significant association ($P < 0.05$) between *A. lumbricoides* and *T. trichuria* in relation to walking bare footed but it was associated with hookworm infection.

4. DISCUSSION

4.1 Prevalence and Intensity of Intestinal Helminths Infection among Pregnant Women

The prevalence and intensity of intestinal helminths infection among diverse groups depend on many criteria like the environmental, parasitic and host factors [21]. Helminthic parasites identified in this present study are *A. lumbricoides*, hookworm, *T. trichiura* and many other parasites have been reported in various parts of Nigeria [22,23,4,7] and other parts of the world [24,25]. This study revealed an overall prevalence of 67(18.6%) which is however higher than that previously reported by [26] in Kenya who found 13.7%. The variation may be attributed to lack of efficient environmental factor, life style and occupation of the subjects, which may truly expose them to infection likewise personal habits like ingesting food and water contaminated with infective larva or ova of these parasites. The overall prevalence was lower compared to finding from other studies. In a related study various worker reported previously as prevalence of intestinal helminthic infections in pregnant women were 76.2% in Kenya [25], 32.45% in Ebonyi State Nigeria [2] and 23% in Kassena-Nankana district of Ghana [27]. Variation in the prevalence could be attributed to differences in sample size used and geographic area of study. Our present finding agreed with the overall prevalence reported by other authors in previous studies in Nigeria. An overall prevalence of 23.6% with intestinal parasitic infection was reported in south-east Nigeria [28] while 20.0% in Borno State, Nigeria [29]. Our findings, differed slightly with what was reported by [26] in Kenya. Contrary to the finding of this study, some researchers in Nigeria had earlier reported much higher intestinal helminths prevalence. A prevalence of 50.4% among school children in Igboora, a rural community of Oyo State, Nigeria was reported by [30]. In Ibadan, 43.4% prevalence of intestinal helminth from pregnant women was reported by [13]. Similarly, prevalence of same was recorded in Ishiage, Abia State (34.6%), [31] and in Mkpor, Anambra State (30.8%) [32] in Nigeria. Also studies elsewhere outside Nigeria reported higher prevalence than what was reported in this study. Higher prevalence of 76.2% was reported from Kenya [25]. Such variation could be due to environmental and behavioral practices related. Among the helminths parasites detected in this study, *A. lumbricoides* was the most predominant 32(8.95%) followed by hookworm infection 22(6.1%) while the least was *T. trichiura* 13(3.6%). This pre-dominance of *A. lumbrioides* agreed with some previous reports by [30,33,31,13,1]. The 8.9% prevalence value reported for *A. lumbricoides* in our study was however; lower compared to what was reported in other areas by different workers [13] reported a prevalence of 55.5%; [34] reported a value of 12.3%, likewise [31] reported a prevalence of (17.80%). The 8.9% prevalence reported for *A. lumbricoides* in this study compared favourably with the prevalence reported by some other authors. From Kenya, [26] reported a prevalence of 13.7% value for *A. lumbricoides*. [28] reported a prevalence of 8.7% in Enugu State, Nigeria and 11.1% for *Ascaris* in Benin City, Edo State, Nigeria [35] as was reported. Also the 8.9% prevalence reported for *A. lumbricoides* in this study was however higher when compared with what obtained in other areas by different workers. [36] reported 7.4% in their study. However, our value is significantly higher than what was reported by [37] who reported a prevalence of 1.8% in Markurdi, Benue State, Nigeria. [38] reported a prevalence of 0.7 in another rural community in Mexico and [39] reported 4.9% in Nsukka, Enugu State, Nigeria. The high prevalence of ascariasis may be ascribed to poor personal hygiene and low economic status. These findings showed that accessibility of appropriate sanitary facilities play a significant role in lowering the prevalence and control of helminthic diseases.

Human ascariasis was a more frequent infection due to the spread of fecal pollution of soil and so the intensity of infection is a function of the degree of soil pollution [40,34,13]. Man acquires infection by unintentionally ingesting embryonated eggs in contaminated food, drink or soil. *A. lumbricoides* ova are spread by coprophagous animals and can also be moved to locations far from the defecation sites [13]. The well-protected egg can survive drying and can stay for very long duration in soil. This clarified why the infection is dispersed throughout most places, compared to other human intestinal geo-helminth infection. Besides, *A. lumbricoides* eggs are coated with mucopolysaccharide substance that permits them to stick well to diverse surfaces. Hookworm infection was comparatively the second most frequent parasite recognized in

the study. This result agreed with previous studies from many areas of Nigeria [40,39,34,13]. The prevalence of 6.1% was lower when compared with the value from other studies from various parts of the Africa. Some other researchers observed the prevalence of ascariasis at Ibadan in Oyo State (35.8%) [13] and in Borno State (50.0%) [29], Nigeria, in Kenya (11.2%) [24] and in endemic African countries (74.7%) [41].

Hookworm infections occur by skin penetration of the third stage infective larvae. Poor sanitary disposal of human faeces and unselective defecation are the main aspects in the transmission of hookworm [40]. The variations in sample size in various studies perhaps led to differences in the prevalence observed comparatively. In the study *T. trichiura* had a prevalence value of 3.6%. This was comparable to 4.6% among pregnant women in Nyanza province of Kenya [24]; 3.5% in Nigeria [8]. It was also comparable to work done by [36] who found a prevalence of 2.2% in Enugu State Nigeria. In a related study [35] found a prevalence of 3.8% in Benin City, Edo State, Nigeria. This value was quite low when compared with previous reports [42] reported prevalence of 14.0% Owerri, Imo State, Nigeria; [43] reported a prevalence of 20.0% in Eku, Delta State, Nigeria. It was however higher than 1.7% reported by [41]. The prevalence was also higher than 0.9% reported among pregnant women in Ghana,[44]; 2.2% in Enugu, Enugu State, Nigeria, [36]; 0.7.5% in Nsukka, Enugu State, Nigeria [39] and 2.9% in Ibadan Oyo State, Nigeria [13]. Trichuriasis is precisely prevalent in the warm humid tropics where faecal contamination of the soil and water sources is a main factor in the transmission of the infection in the community. Transmission occurs through poor sanitary habits of unselective defecation. Infection usually occurs through ingestion of infective ova from contaminated hands, food or drinks. Flooding and coprophagous animals play some part in the movement of the ova to locations other than defecation places. The low prevalence of trichuriasis reported in the present and related studies supports the view that trichuriasis was less frequent in tropical region.

4.2 Seasonal and Monthly Distribution of Intestinal Helminths Infection among Pregnant Women in Ebonyi State

The prevalence of intestinal helminths infection among pregnant women in Ebonyi State, Nigeria clearly showed that the months of rainy season had higher prevalence than months of dry season. The highest prevalence was recorded in May with prevalence of 26.7%, while the least prevalence was recorded in November with prevalence of 13.3%. In other words, rainy season had higher prevalence than dry season. This report agreed with the report by different authors; [39] who reported higher prevalence in rainy than dry season in Enugu, Nigeria and [40] who reported higher prevalence in rainy season than dry season in Edo State, Nigeria. During this season, sources of drinking water may become easily polluted due to runoff water and erosion contaminated with eggs of intestinal helminths. Thus, disposing users of contaminated water to infection with eggs of intestinal helminths. Additionally, during rainy season, conditions are wet and warm and these are suitable for the survival and embryonation of helminths eggs [2,13].

4.3 Prevalence of Intestinal Helminths in Relation to Trimester, Gravidity and Age Groups among Pregnant Women in Ebonyi State

In relation to trimester, 1st trimester had the highest prevalence of intestinal helminths. This was followed by 3rd trimester. In the present study, there was no statistically significant relation between intestinal helminths and trimester among pregnant women. This result was in contrast with work done by [13] who reported significantly higher prevalence in 2nd trimester than other trimesters among pregnant women attending antenatal clinics in Ibadan, Oyo State, Nigeria. In this study secundigravidae had highest prevalence than other gravidity and there was no significant difference between intestinal helminths and gravidity among pregnant women. This agreed with work done by [28] in Enugu, Nigeria who found no significant difference between intestinal infections and gravidity among pregnant women. Younger age groups had highest prevalence when compared to other age groups. In this study there was sequential decrease in infection rate as the age increases. Age groups (15 – 20 yrs) had the highest prevalence, while least prevalence was observed at age groups (36 and above) and infection occurred in all age groups. This agreed with work done by [28] who found highest prevalence among younger age group (16 – 20yrs) in pregnant women. Higher infection of intestinal parasites was recorded in younger age groups in Ishiage, Abia State, Nigeria [31]. This disagreed

with the work done by [10,13] who reported higher prevalence in old age groups in their different studies than young age groups. In this study there was statistically significant difference between intestinal parasites and age groups. This was in contrast with the work done by [28], [13]. Age group was highly correlated with intestinal parasites among pregnant women in the study.

4.4 Responses of Pregnant Women Infected with *Ascaris lumbricoides*, *Tricharis trichuria and* Hookworm in Ebonyi State, Nigeria

Questionnaire administration and the examined subjects showed that, pregnant women who eat raw vegetables and meat had higher prevalence of intestinal parasites. This was in agreement with work done by [26,25]. The eggs of the parasite adhere to dust, fruit, even vegetables, pregnant women inadvertently get infected by eating these contaminated food items [40]. In many agricultural communities, women frequently obtain helminth infections in the process of growing family's food [25]. In this present study there was no significant association between eating these foods with the parasites. This may be as a result of hygienic practices shown by these pregnant women. In relation to sources of domestic water, pregnant women who use river as their source of domestic water had higher prevalence with prevalence of 10.4%, 8.3% and 12.5% respectively for *A. lumbricoides, T. trichuria* and hookworm. The reason for this has been reported by several authors. The high rate of infection among pregnant women was due to faecal pollution of soil and domestic water supply around homes [41]. Other authors such as [45] had similar reports on the association of intestinal helminth with sources of water. Faecal pollution of water has been reported to be the reason behind high prevalence of intestinal parasites [40,27,13] among pregnant women. In this present study, there was no significant association between intestinal parasites and sources of water. This may be because majority of pregnant women used tap water instead of water from runoff. In relation to types of toilet and washing of hand after toilet, pregnant women who made use of bush method, pit toilet and water cistern had the highest prevalence for *A. lumbriciodes, T. trichuria* and hookworm respectively with the prevalence of 10.9%, 3.8% and 8.7% respectively. Many authors have ascribed the high prevalence to socio-cultural practices such as using water for cleaning after defecation [40], [27,13]. Other issues that could explain this high prevalence include poor personal hygiene, poor environmental care and lack of proper awareness on the transmission mechanisms and life-cycle pattern of these parasites [30,32,13]. In this present study, pregnant women who do not wash their hands after toilet had higher prevalence of intestinal parasites when compared to those who wash their hands, this could also account for the high prevalence of the diseases. Pregnant women in many rural areas depend on pit latrines and bush method for waste disposal with no facilities for hand washing after defecation. Such scenario accompanied by season flooding and likely overflow of human waste into drinking water sources and gardens are likely to cause the high prevalence of intestinal parasites [24,40,27]. Those who walked bare footed had higher prevalence than those who did not walk bare footed.

5. CONCLUSION

From the outcome of this study, the helminthic parasites studied are still present in pregnant women in Ebonyi state, therefore there is need to control and prevent their infection so as to eradicate its effects on pregnant women. The creation of awareness on the preventive measures of helminthic infections amongst people in Ebonyi state is urgently needed. Consequently, health education in local languages should be vigorously mounted to create awareness on helminthic diseases vis-à-vis the cause, life cycle, mode of transmission and possible preventive measures. The government should provide good drinking water, drugs and diagnostic facilities in the hospital for the diagnosis and treatment of infected women.

CONSENT AND ETHICAL APPROVAL

Ethical review and clearance were obtained from the Ministry of Health, Ebonyi State and University of Nigeria Nsukka Ethical Research Committee. Ethical consideration was also obtained from the two hospitals selected for the study from antenatal division and research department. The permission to use hospital facilities was also obtained from management. Informed consent was obtained from the pregnant women before collection of the samples. The approval was on the agreement that patient anonymity must be maintained, good laboratory practice and findings would be treated with utmost confidentiality and for research purpose only.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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