Prevalence and risk factors of intestinal parasitoses among residents of Ekemkpon and Idim Ita of Cross River State, Nigeria

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Informed consent: only people who lived in the study communities and gave their consent were enlisted in this study. However, those who were not living in study communities and never gave their consent were excluded from the study.

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Summary

Background: intestinal parasitic infections are the most common infections in the world, with the most prevalent burden occurring in poverty-stricken areas. Intestinal parasitic infections are endemic in certain parts of Nigeria as a result of poor hygiene practices and pollution, which result in contamination of food and water. In semi-urban and rural communities where the dwellers are generally poor and uneducated and lack basic amenities like potable water supply and good sanitary facilities, intestinal parasitic infections cause major health problems. This study was to evaluate the influence of socio-demographic factors in the transmission of intestinal parasitoses among the residents of Ekemkpon and Idim Ita Communities of Cross River State, Nigeria.

Materials and Methods: this was a cross-sectional survey between April 2019 and August 2019. Samples were obtained from 359 participants in the study areas and examined for stool analysis using direct microscopy and brine floatation technique. Socio-demographic data of the study subjects were obtained using questionnaires.

Results: the prevalence of intestinal parasites was higher in Ekemkpon (41.0%) than in Idim Ita (14.9%). Participants with mixed infections in Ekemkpon were 7.9%, while those in Idim Ita were 2.2%. The study has shown that level of education had an influence on the transmission of intestinal parasites in Ekemkpon ($p<0.05$). Open defecation played a major role as a source of contamination of domestic water and farm products in the Ekemkpon community. The overall helminthic infections in the two study areas were higher than the protozoan infections observed in this study. The only intestinal protozoa in Ekemkpon was *Entamoeba histolytica/dispar* while hookworm species were the commonest helminthic parasites in Ekemkpon. *Balantidium coli* (4.4%) was the most prevalent intestinal protozoan parasites in Idim Ita while hookworm and *Ascaris lumbricoides* (2.8%) were the most occurring helminthic parasites in Idim Ita.

Conclusions: it is recommended that strategies aimed at health education, diagnosing and treating those positive for intestinal parasite infections, and improving the general well-being of the masses be encouraged.

Introduction

Among the most common infections globally are intestinal parasitic infections, with the most prevalent burden occurring in poverty-stricken areas with a global mortality rate of 33% [21]. Most intestinal parasite diseases have been categorized as Neglected Tropical Diseases (NTDs) [14,15]. The sub-Saharan

region is reported to be the most affected, resulting in high socio-economic and public health effects [37].

According to Stephen, Latham, and Ottesen *et al.* (2000), intestinal parasitic diseases cause almost 39 million Disability-Adjusted Life Years (DALYs) worldwide. These parasitic infections are associated with approximately 9.0 million DALYs annually, thereby increasing morbidity and mortality [15,22].

Intestinal parasitic infections are endemic in certain parts of Nigeria as a result of poor hygiene practices and pollution, which result in contamination of food and water [11]. In semi-urban and rural communities where the dwellers are generally poor, uneducated, and lack basic amenities like potable water supply and good sanitary facilities, intestinal parasitic infections cause major health problems [27,28]. The high prevalence of intestinal parasites in those areas may not necessarily be a result of unsanitary conditions of the people but due to the tropical environment, which allows the rapid growth of those parasites in those areas [1]. The endemicity of intestinal parasites in Nigeria is a vital source of high morbidity rates and oftentimes high mortality, particularly those associated with podiatry [19,24,29].

Studies have identified factors that affect gastrointestinal infections with parasites, including lack of good toilet facilities, geophagia, level of sanitation in households, occupation, and socioeconomic status [8,25,35]. The semi-urban and rural Nigerian environments are poor in hygiene and conducive to the development of these parasites [36]. Intestinal parasites are known to trigger immune responses in man and suppress the immune system, thereby making the affected individuals more prone to co-infection. These parasites have negative effects on the survival, growth, general fitness, and performance of children. A reduction in the widespread potency of parasites that cause gastrointestinal infections via the supply of potable water and improved sanitary practices in communities have been reported by the Centers for Disease Control & Prevention (CDC) (2020) [9]. Chemotherapy is mostly used to tackle the issue of parasitosis in humans, targeted at annihilating the parasites in a short time and improving the level of sanitation over a prolonged period of time [8]. Despite the availability of many factors in both rural and urban areas that have put public health at risk and predispose people to intestinal parasites, there is limited data about the recent trend of human infections caused by intestinal parasites.

Therefore, constant evaluation of the widespread intestinal parasitosis among communities in Cross River State is needed. This study evaluated the occurrence of intestinal parasitoses among the residents of the Ekemkpon and Idim Ita Communities of Cross River State, Nigeria.

Materials and Methods

Area of study

The area of study was Cross River State. It borders to the North through Benue state, to the West through Ebonyi state and Abia state, and to the Southwest through Akwa Ibom state, while its eastern border forms part of the national border with Cameroon [5]. The study sites were Ekemkpon in Odukpani Local Government Area and Idim Ita communities in Calabar South Local Government Area, all in Cross River State, in the South-South region of Nigeria. In the North, Calabar (the administrative seat of Cross River State, comprising of Calabar Municipality and Calabar South Local Government Areas) is bordered by Odukpani Local Government; in the East by Akpabuyo Local Government Areas and the Great Qua River; and in the South by the Atlantic Ocean, swamps and creeks [2,26].

Calabar South Local Government Area has a population of 191,515, with a total of 94,584 males and 96,931 females, while Odukpani Local Government Area has a population of 192,884, with 100,697 males and 92,187 females, respectively [23]. The people of Ekemkpon are predominantly farmers while most people in Idim Ita are predominantly business owners.

Ethical considerations

The request for ethical clearance was granted and approved by the Cross-State Health Research Ethics Committee (CRS–HREC). Brief information about the study was given to the participants, and their consent to take part in the study was obtained.

Study design

The design used in this study was a cross-sectional description carried out between April to August 2019 in Ekemkpon Community in Odukpani Local Government Area and in Idim Ita Community in Calabar South Local Government Area, both of Cross River State. The study subjects were randomly selected from those living in those two communities.

Inclusion criteria and exclusion criteria

Only people who lived in the study communities and gave their consent were enlisted in this study. However, those who were not living in study communities and never gave their consent were excluded from the study.

Sample size

The minimum sample size used in the study was 334, based on the formula as was described by Jegede, Oyeyi, Bichi, Mbah & Torpey (2014) [16]:

$$n=\frac{z^2(pq)}{m^2}$$

where:
n=sample size
z=confidence level at 95% standard (1.96)
p=32% (the prevalence of intestinal parasites in the study area as was previously described by Effanga & Imalele, 2018) [12]
m=margin of error at the standard value of 0.05

However, a total of 359 samples were collected for convenience.

Collection of stool samples and processing

Sample collection

Early morning urine samples were collected from the study subjects in a labeled sterile universal container and transported immediately to the University of Calabar Teaching Hospital Laboratory for parasitological analysis. Samples that were not used immediately were stored in the refrigerator until they were used.

Sample analysis

Macroscopic examination

The stool samples were checked macroscopically for possible disease conditions, color, and consistency of the stool samples.

Microscopic analysis

The samples were analyzed microscopically using wet preparation and brine floatation techniques to detect the enteric parasites, as described by Cheesbrough (2009) [10].

A wet mount was carried out by mixing a small portion of the stool sample, about 2 mg, with a few drops of freshly prepared normal saline. A smear of the homogenized mixture was placed at one end of a clean, grease-free slide, and another smear of the same mixture was placed at the other end of the slide. The mixture was viewed under the microscope using the X10 objective and confirmed using the X40 objective.

Brine floatation was used to detect the eggs in low quantities, which were not detected using wet preparation. A universal container with the homogenized sample was filled to the brim with brine solution. A grease-free slide was superimposed on top of the container, avoiding overflow of the fecal suspension. After 15 minutes, the slide was removed and viewed under the microscope using X10 and X40 objectives.

Socio-demographical data collection

Questionnaires were administered to the study subjects to obtain socio-demographic data such as age, sex, residence, marital status, level of education, and occupation. Parents/guardians of children give their consent and provide the information on behalf of the children.

Statistical analysis

The data collected were analyzed using SPSS Statistics 20 manufactured by International Business Machines (IBM) Corporation. Proportion was used to describe categorical variables, and the proportion of infections was determined using the Chi-square test. A p-value <0.05 was considered significant.

Results

Table 1 presents the demographic data of participants based on their socio-demographic characteristics. Out of the 178 participants in Ekemkpon who took part in this study, most of them, 19.7% (35/178), were between the ages of 20-29 years, while most participants in Idim Ita, 21.7% (49/181) were between the ages of <9 years. Most participants in the study were males in both communities. Most participants in Ekempkon, 48.3% (86/178), had primary education, while most participants in Idim Ita, 41.4% (75/181), had post-primary education. The majority of the participants in

Table 1. Socio-demographic characteristics of participants (N=359) in Cross River State, Nigeria, from April to August 2019.

Characteristics	No. (%) examined in Ekemkpon (N=178)	No. (%) examined in Idim Ita (N=181)
Age (years)		
≤9	17 (9.6)	49 (27.1)
10-19	29 (16.3)	22 (13.1)
20-29	35 (19.7)	29 (16.0)
30-39	26 (14.6)	31 (17.1)
40-49	22 (12.4)	18 (9.9)
50-59	24 (13.5)	16 (8.8)
60-69	16 (9.0)	11 (6.1)
≥70	9 (5.1)	5 (2.8)
Gender		
Male	95 (53.4)	97 (53.6)
Female	83 (46.6)	84 (46.4)
Level of education		
No education	59 (33.1)	23 (12.7)
Primary	86 (48.3)	68 (37.6)
Post-primary	31 (17.4)	75 (41.4)
Tertiary	2 (1.1)	15 (8.3)
Occupation		
Unemployed	19 (10.7)	23 (12.7)
Schooling	40 (22.5)	65 (35.9)
Farming	104 (58.4)	0 (0.0)
Business	12 (6.7)	77 (42.5)
Public servant	0 (0.0)	16 (8.8)
Clergy	3 (1.7)	0 (0.0)
Marital status		
Single	53 (29.8)	97 (53.6)
Married	95 (53.4)	53 (41.7)
Divorced	11 (6.2)	8 (4.4)
Widowed	19 (10.7)	23 (12.7)
Type of toilet used		
Latrine	126 (70.8)	151 (83.4)
Bush	52 (29.2)	0 (0.0)
Water cistern	0 (0.0)	30 (16.6)
Source of drinking water		
Stream	178 (100)	0 (0.0)
Borehole	0 (0.0)	181 (100)

Ekemkpon, 58.4% (104/178), were farmers, while most participants in Idim Ita, 42.5% (77/181), were business operators. Most of the participants in Ekemkpon, 53.4% (95/178), were married, while most participants in Idim Ita, 53.6% (97/181), were single. Most participants in Ekemkpon and Idim Ita defecated in the latrine. All the participants in Ekempkon had their water source from the stream, while those in Idim Ita had their water source from the borehole.

The prevalence of intestinal parasites in Ekemkpon was 41.0% (73/178). The most common parasites were hookworms, at 12.4%. *Strongyloides stercoralis* was 7.3%, while *Trichuris trichiura* and *Balantidium coli* were the least common parasites, at 1.1% each. The prevalence of intestinal parasites in Idim Ita was 14.9% (27/181). The most common parasites in Idim Ita were *B. coli*, at 4.4%, while *S. stercoralis* was the least common, at 1.7% (Table 2).

Out of the 178 study participants in Ekemkpon, 25.3% (45/178) had single infections, and those infected with single infections of S. stercoralis were the majority at 7.3%, while those with single *B. coli* infections at 1.1% were the least infected. Out of the 181 study participants in Idim Ita, 10.5% (19/181) had single infections. Participants with single infections of *E. histolytica/dispar* and *A. lumbricoides* were the majority at 2.8% each, while those with hookworms were the least infected at 1.1%.

In Ekemkpon, 7.9% (14/178) of the study participants presented with mixed infections of intestinal parasites. Participants who had mixed infections of *E. histolytica/dispar* and hookworms were the majority at 3.4%, while those who had mixed infections of *E. histolytica* and *S. stercoralis* at 0.6% were the least infected. Out of the 181 study participants in Idim Ita, 2.2% (4/181) presented with mixed infections of intestinal parasites. Participants who had mixed infections of *B. coli* and hookworms were the most infected at 1.7%, while those with *B. coli* and *E. histolytica/dispar* at 0.6% were the least infected (Figure 1).

Hookworms were the most common helminths found in Ekemkpon, and they infected every age range, but they were highest in the ages of 20-29 years. *E. histolytica* were the most common protozoan parasites in Ekemkpon, and they were mostly found in ages between <9, 30-39, and 40-49 years, respectively (Table 3).

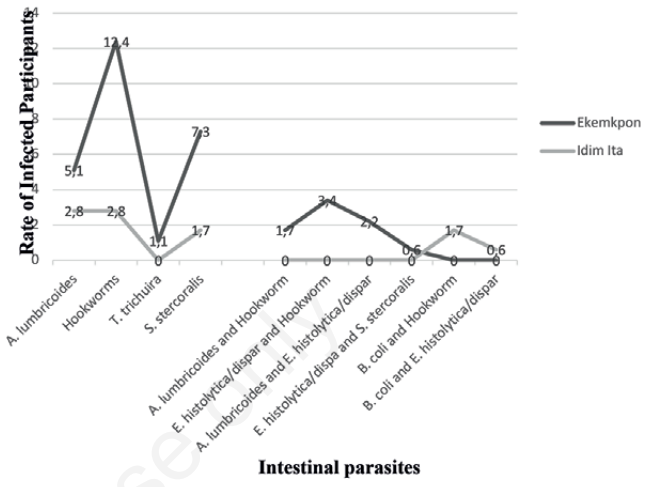

Figure 1. Mono-infections and co-infections among the study participants, March to June 2019.

Table 2. Prevalence of intestinal parasites in Ekemkpon and Idim Ita, Cross River State, Nigeria, April to August 2019.

Types of parasites	Number of intestinal parasites (%) in Ekemkpon (N=73)	Number of intestinal parasites (%) in Idim Ita (N=27)
Helminth		
Ascaris lumbricoides	16 (9.0)	5 (2.8)
Strongyloides stercoralis	13 (7.3)	3 (1.7)
Hookworm	22 (12.4)	5 (2.8)
Trichuris trichiura	2 (1.1)	0 (0.0)
Protozoa		
Entamoeba histolytica/dispar	18 (10.1)	6 (3.3)
Balantidium coli	2 (1.1)	8 (4.4)
Total	73 (41.0)	27 (14.9)

Table 3. Prevalence of intestinal parasites according to age groups of the study participants in Ekemkpon, Cross River State, April to August 2019.

Type of parasites	Age in years (%)								
Helminths (N=55)	**0-9**	**10-19**	**20-29**	**30-39**	**40-49**	**50-59**	**60-69**	**>70**	**Total**
Hookworm	4 (2.2)	4 (2.2)	6 (3.4)	2 (1.1)	2 (1.1)	1 (0.6)	2 (1.1)	1 (0.6)	22 (12.4)
Strongyloides stercoralis	3 (1.7)	0 (0.0)	4 (2.2)	1 (0.6)	2 (1.1)	2 (1.1)	1 (0.6)	0 (0.0)	13 (7.3)
Ascaris lumbricoides	3 (1.7)	1 (0.6)	3 (1.7)	2 (1.1)	3 (3.2)	2 (1.1)	2 (1.1)	2 (1.1)	18 (10.1)
Trichuris trichiura	0 (0.0)	1 (0.6)	0 (0.0)	1 (0.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (1.1)
Subtotal	10 (5.6)	6 (3.4)	13 (7.3)	6 (3.4)	7 (3.9)	5 (2.8)	5 (2.8)	3 (1.7)	55 (30.9)
Protozoa (N=18)	**0-9**	**10-19**	**20-29**	**30-39**	**40-49**	**50-59**	**60-69**	**>70**	
Entamoeba histolytica/dispar	3 (1.7)	2 (3.2)	2 (1.1)	3 (1.7)	3 (1.7)	1 (0.6)	0 (0.0)	2 (1.1)	16 (9.0)
Balantidium coli	1 (0.6)	0 (0.0)	1 (0.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (1.1)
Subtotal	4 (2.2)	2 (1.1)	3 (1.7)	3 (1.7)	3 (1.7)	1 (0.6)	0 (0.0)	2 (1.1)	18 (10.1)
Grand total	14 (7.9)	8 (4.5)	16 (9.0)	9 (5.1)	10 (5.6)	6 (3.4)	5 (2.8)	5 (2.8)	73 (41.0)

A. lumbricoides and hookworms were the most common helminth parasites found in Idim Ita. *A. lumbricoides* were mostly found in those between the ages of 0-9 years, while hookworms were mostly found in those between the ages of 10-19 years, respectively. *B. coli* were the most common protozoan in Idim Ita, and they were highest (2.2%) among those between the ages of 10-19 (Table 4).

Out of the 178 study participants in Ekemkpon, 33.1% (59/178) participants were infected with 41.0% (73/178) intestinal parasites (Table 5). The most infected participants were those between the ages of 20-29 years at 6.7% (12/178); the ages with the least infection were 60-69 and >70 years at 2.8% (5/178). Out of the 181 study participants in Idim Ita, 12.7% (23/181) participants were infected with 14.9% (27/181) intestinal parasites. The most infected participants were those between the ages of 10-19 years at 5.0% (9/181). Those in the ages of 50-59 years recorded no infection. The relationship between age and intestinal parasite infections in Ekemkpon was not statistically significant ($\chi^2_{Ekemkpon}$=9.3337, df=7, p=0.2296), while the relationship between age and intestinal parasite infections in Idim Ita was statistically significant ($\chi^2_{IdimIta}$=20.5518 df=7, p=0.0045).

Out of the 178 participants in this study in Ekemkpon, 18.5% (33/178) males were infected while 14.6% (26/178) females were infected. Out of the 181 participants in this study in Idim Ita, 7.2% (13/181) males were infected, while 5.5% (10/181) females were infected. The relationship between gender and intestinal parasites in the study communities was not statistically significant ($\chi^2_{Ekemkpon}$=0.0831, df=2, p=0.7731; $\chi^2_{IdimIta}$=0.0910 df=7, p=0.7629) (Table 6).

Discussion

Intestinal parasites are associated with many cases of global infections and are sources of public health challenges [17]. The prevalence and severity of these infections mostly affect developing countries, particularly populations with poor environmental sanitation [3]. However, the prevalence and epidemiologic fea-

Table 4. Prevalence of intestinal parasites according to age groups, in Idim Ita, Cross River State, April to August 2019.

Type of parasites	Age in years							
Helminth (N=13)	**0-9**	**10-19**	**20-29**	**30-39**	**40-49**	**50-59**	**60-69**	**>70**
Hookworm	2 (1.1)	3 (1.7)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Strongyloides stercoralis	0 (0.0)	1 (0.6)	2 (1.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Ascaris lumbricoides	3 (1.7)	1 (0.6)	1 (0.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Trichuris trichiura	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Subtotal	5 (2.8)	5 (2.8)	3 (1.7)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Protozoa (N=14)	**0-9**	**10-19**	**20-29**	**30-39**	**40-49**	**50-59**	**60-69**	**>70**
Entamoeba histolytica	2 (1.1)	1 (0.6)	1 (0.6)	1 (0.6)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.6)
Balantidium coli	2 (1.1)	4 (2.2)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.6)	1 (0.6)	0 (0.0)
Subtotal	4 (2.2)	5 (2.8)	1 (0.6)	1 (0.6)	0 (0.0)	1 (0.6)	1 (0.6)	1 (0.6)
Grand total	9 (5.0)	10 (5.5)	4 (2.2)	1 (0.6)	0 (0.0)	1 (0.6)	1 (0.6)	1 (0.6)

Table 5. Distribution of infected subjects in Ekemkpon and Idim Ita based on their ages, April to August 2019.

Ages (years)	Number examined in Ekemkpon (N=178)	Number infected (%) in Ekemkpon	Number examined in Idim Ita (N=181)	Number infected (%) in Idim Ita	Statistics
≤9	17	10 (5.6)	49	6 (3.3)	
10-19	29	7 (3.9)	22	9 (5.0)	$\chi^2_{Ekemkpon}$=9.3337,
20-29	35	12 (6.7)	29	3 (1.7)	df=7,
30-39	26	8 (4.5)	31	2 (1.1)	p=0.2296
40-49	22	6 (3.4)	18	1 (0.6)	$\chi^2_{IdimIta}$=20.5518,
50-59	24	6 (3.4)	16	0 (0.0)	df=7,
60-69	16	5 (2.8)	11	1 (0.6)	p=0.0045
≥70	9	5 (2.8)	5	1 (0.6)	
Total	178	59 (33.1)	181	23 (12.7)	

Table 6. Distribution of infected subjects in Ekemkpon and Idim Ita based on their gender, Cross River State, Nigeria, April to August 2019.

Gender	Number examined in Ekemkpon (N=178)	Number infected (%) in Ekemkpon	Number examined in Idim Ita (N=181)	Number infected (%) in Idim Ita	Statistics
Male	95	33 (18.5)	97	13 (7.2)	$\chi^2_{Ekemkpon}$=0.0831, df=2, p=0.7731
Female	83	26 (14.6)	84	10 (5.5)	$\chi^2_{IdimIta}$=0.0910 df=7, p=0.7629
Total	178	59 (33.1)	181	23 (12.7)	

tures of intestinal parasites differ significantly in different regions of the world [7].

The overall prevalence of intestinal parasites in this study in Ekemkpon and Idim Ita was 41.0% and 14.9%, respectively. The prevalence of these infections from the two study areas differed from 13.9% reported by Punsawad *et al.* (2017) [31] in Thailand, 17.5% reported by Muhammad *et al.* (2014) [20] in Maiduguri, and 6.2% reported by Zaglool *et al*. (2011) [38] in India. The disparity in the prevalence of intestinal parasites in this study from the previous studies could have been due to variations in climatic conditions, hygiene conditions, economics, food, water sources, and educational status of study subjects.

In a similar study conducted by Etefia & Inyang-Etoh [13] in people on antiretroviral combination therapy in General Hospital and Lawrence Henshaw Memorial Hospital, both in Calabar, intestinal parasite prevalence of 11.14% was reported, and this was lower than 41.0% reported, at Ekemkpon in Odukpani and Idim Ita in Calabar (2019). This difference could have been due to the level of hygiene in the study areas and the age ranges in the two studies. Also, the HIV carriers, due to their immunocompromised status, pay attention to their health status, which could have also resulted in lower intestinal parasite prevalence in those individuals.

In the present study, the prevalence of intestinal parasites was higher in Ekemkpon (a typical rural community) than in Idim Ita (a semi-urban community). This was similar to the report of Mareeswaran *et al*. (2018) [18] in India, where 50.8% of intestinal parasites in rural communities were higher than 23.4% in urban communities. This could have been due to improper hygiene and the agricultural background of the rural communities of which Ekemkpon is inclusive. As observed in this study, residents engage in open defecation. This is capable of contaminating the stream, which is the major source of domestic water in the community, as well as contaminating farm products. In Idim Ita, there was no reported case of open defecation, and a borehole was the main water source which could have resulted in the low rate of fecal-oral contamination when compared to Ekemkpon. Participants with mixed infections in Ekemkpon were 7.9% while those in Idim Ita were 2.2%. This could have been due to the difference in the level of education, personal health, and hygiene of the participants between these two study areas.

Participants between the ages of 20-29 years in Ekemkpon were the most infected (6.7%) with intestinal parasites. This could have been due to the fact that the majority of the participants in that study area were within that age range, were predominantly farmers, and had a greater risk of exposure to hazardous factors in an agricultural working environment. However, most participants infected (5.0%) in Idim Ita were between the ages of 10-19 years. This could be due to the fact that most intestinal parasite infections are asymptomatic and are capable of spreading from children of these ages to others or even within their homes and may contribute to high epidemic rates in their communities.

Among the two study areas, females recorded a slight decrease in the prevalence of intestinal parasites than males in the two study areas. The disparity of the infections between the two gender groups could have been due to the population sizes of those two gender groups that participated in the study. These were similar to previous studies by Sayyari *et al*. (2011) [34] in Iran, Quihui *et al*. (2006) [32] in Mexico, Al-zain & Al-hindi (2005) [6] in Pakistan, and Okon *et al*. (2013) [27,28] in Nigeria but differ from Saab *et al*. (2004) [33] in Lebanon and Okyay *et al*. (2004) [30] in Turkey.

The overall helminth infections in the two study areas were higher than the protozoan infections observed in this study. Hookworm infections (12.4%) were the most common intestinal parasite infections, followed by *Ascaris lumbricoides* infections (9%), while the least infections were *Trichuris trichiura* and *Balantidium coli* (1.1%) in Ekemkpon. *Balantidium coli* (4.4%) infections were the most common intestinal parasite infections, followed by *Entamoeba histolytica* (3.3%), while the least common infection was *Strongyloides stercoralis* (1.7%) in Idim Ita. This was different from Akinbo *et al*. (2011) [4], who reported that *Ascaris lumbricoides* (51.4%) was the most prevalent organism, followed by hookworm (32.4%) in Benin and Zaglool *et al*. (2011) [38], who reported that *Giardia lamblia* (9%) was the most frequent intestinal parasites followed by *Entamoeba histolytica* (4.5%) in Saudi Arabia.

Conclusions

These results have shown that there was a high prevalence of intestinal parasites among people of Ekemkpon in Odukpani Local Government Area while there was a low prevalence of intestinal parasites among people of Idim Ita in Calabar South Local Government Area both in Cross River State. The nature of toilet facilities could be a possible source of water and farm product contaminants in the two localities. Multiple infections were more common in Ekemkpon than in Idim Ita, and age had a major influence on the prevalence of infection in the study areas. *Entamoeba histolytica* were the only intestinal protozoan parasites, while hookworms were the commonest helminth parasites in Ekemkpon. *Balantidium coli* were the most common protozoan parasites, while hookworm and *Ascaris lumbricoides* were the most common helminth parasites in Idim Ita. Therefore, there should be mass education on hygiene, provision of potable water supply, good refuse disposal system and construction of good toilet facilities, routine diagnosis and treatments of intestinal parasites, and more detailed studies in a greater subject size and in a study location far from the present study locations.

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