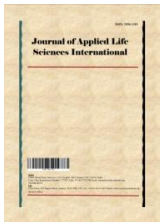

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Prevalence and Risk Factors Associated with Polyparasitism in Okpokwu Benue State, Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. Authors JOA and EAO designed the study. Authors VUO and GNI performed the statistical analysis. Authors JOA, IAA and EAO wrote the protocol and wrote the first draft of the manuscript. All Authors managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Intestinal and urinary parasitic infections represent one of the challenges of public health in the tropics and developing countries. A study was designed to determine the prevalence and distribution of polyparasitic infections as well as the impact of health education and treatments .Stool and urine samples from 350 participants were analysed macroscopically and microscopically by direct stool examination of wet and lugol'siodine preparations and formal-ether concentration techniques and microscopic examination of simple centrifuged samples of urine. One hundred and forty two (142) participants out of the three hundred and fifty (350) examined were infected with one parasite or more with an overall prevalence of 40.6%. *Entamoeba histolytica* had the highest frequency of occurrence both in the female and male participants (52 and 45 respectively). Out of 350 participants, 36 (10.3%) of them had co-infection (polyparasitism), the result of polyparasitism in the Local Government was not significant ($p>0.05$). Age group 1- 10 had the highest prevalence of 55.6%. Farmers were mostly infected than the other occupations examined. Proper hygiene and sanitary conditions will go a long way to reduce the level of infections.

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1. BACKGROUND

One of the major problems of developing countries and the tropics is intestinal and urinary parasitism. Most of the developing countries are faced with parasitic diseases which are closely related to poor sanitary behaviours and/ or poor personal hygiene [1]. Among the infants, intestinal parasitic infections are a major public health problem worldwide. According to World Health Organization, approximately 3.5 billion people are infected by intestinal parasites and about 450 million children are ill due to these infections [1,2]. Iron deficiency anaemia, growth retardation in children and other physical problems, can be traced to intestinal parasitic infections [3,4]. Sometimes man and animals are infected with two or more parasites causing some severe public health concerns. This often times make accurate diagnosis to be difficult. 'Multiple species parasitic infections are the norm rather than the exception,' and therefore that polyparasitism deserves much more attention [5]. Schistosomiasis and intestinal parasitic infections have been described as diseases of poverty and underdevelopment because there is association between them and lack of basic amenities and poor sanitary practices [6]. These parasitic diseases deny poorest of the poor access to good health, thereby making them to be less productive and contributing to economic instability and social marginalization; and the poor people of under developed nations experience a cycle where under nutrition and repeated infections [7]. The school age children suffer the impact much as they are mostly the ones infected by Drake and Bundy [8] and Tchuente, et al. [9]. The study is aimed at determining the prevalence and risk factors associated with polyparasitism in Okpokwu Benue Nigeria

2. METHODOLOGY

2.1 Study Areas

Okpokwu Local Government experiences a typical climate with distinct seasons, the wet and the dry season. The wet season lasts from April to October with annual rainfall of 150-180 mm. The dry season begins in November and ends in March. Temperature fluctuates between 23ºC and 31ºC in the year. The Local Government has moderate relative humidity. The soil in most areas is loamy.Okpokwu Local Government which derives its name from the River Okpokwu has its headquarter at Okpoga. The Local Government area is located about one hundred and seventy (170 km) kilometers Southwest of Makurdi, the State capital. It shares land borders with Ohimini Local Government area on the North.Ogbadibo Local Government area on its Western end, Ado and Otukpo Local Government on the East, Isiuzo Local Government of Enugu State on the South and Olamaboro Local Government area of Kogi State on the North West. The vegetation of the Local Government is that of a transition between the deciduous rain forest of Eastern Nigeria on the Southern part of the Local Government, and the grassland Savannah towards the North. The Local Government is surrounded by uphill stretching through the Northern part, while the lowland has fadamas fit for wet cultivation. This makes the Local Government home for the cultivation of arid tubers and grain crops found in the middle belt. This natural blessing makes the adoption of the veritable occupation of farming a general occupation in the area.

2.2 Collection and Examination of Faecal and Urine Samples

The participants were educated on the causes of intestinal helminthic infections and other parasitic infections. Thereafter, wide mouthed screw-cap sterile sample containers were given to the participants for the collection of their stool and urine samples at home and structured questionnaires were distributed among the participants for the collection of demographic information such as age, sex, source of water and occupation. They were instructed to bring their early morning stool and urine samples the next day. The samples produced by participants were received at designated point. The collected samples were transported to the General hospital laboratories and Primary Health Care (PHC) centres in the Local Government Area (LGA) for examination. The samples were examined by using direct smear, lugol's iodine and formalin-ether concentration techniques for stool samples [10] and simple centrifugation technique for urine samples [11].

2.3 Stool Examination

2.3.1 Direct wet mount

Saline or iodine wet mount were made by mixing a small quantity (about 2 mg) of faeces in a drop

of saline or iodine placed on a clean glass slide with applicator stick. Gross fibres or particles were removed and the preparation was covered with cover-slips. Air bubbles were avoided by drawing one edge of cover-slip slightly into the suspension and lowering it almost to the slide before letting it fall. The smear was then examined under the microscope using x 10 objective and confirming any parasite seen with x 40 objective for ova, larvae or cyst of parasite and motile parasites [10].

2.3.2 Formalin-ether Concentration

The formol-ether concentration was used for the preparation of stool for examination [10]. Using an applicator stick, about 1 gm of the stool samples were added to centrifuge tubes to which normal saline were added. They were thoroughly emulsified and filtered through two layers of gauze into another centrifuge tubes. Three milliliters (3 ml) of ether were added and 7 ml of 10% formal saline were also added into the faecal sample suspension, and stoppered and shaken vigorously to mix. The stoppers were removed and the tubes were centrifuged at 2000 rpm for 2 minutes.

After the centrifugation, four distinct layers were formed. The layers were; ether at the top-most, second a plug of debris, third a clear layer of formal saline and the fourth sediment. The plugs of debris were detached from the side of the tubes with the aid of applicator sticks and the liquid were poured off leaving a small amount of formal saline for suspension of the sediment.

A drop of the deposit were pipetted onto a clean microscope slides, covered with clean cover-slips avoiding air bubbles and over floating. The sediments were also mixed with iodine where they were need. Examinations were made with x10 and x40 objective lens of light microscope for ova and other forms of parasites.

2.3.3 Urine examination

Simple centrifugation sedimentation method.

The urine samples were processed by ordinary centrifugation sedimentation techniques [11]. The urine samples were thoroughly mixed and 10ml of each were taken into centrifuge tubes and centrifuged at 2000 rpm. The supernatant were discarded and the deposits were examined with x10 objective and any parasites seen were confirmed with x40 objective.

3. RESULTS

A total of three hundred and fifty (350) male and female participants were examined from the Okpokwu Local Government Area. One hundred and forty two (142) participants were infected with at least one parasite giving an overall prevalence of 40.6%. *Entamoeba histolytica* occurred highest (97) followed by *Entamoeba coli* (29) while *Ascaris lumbricoides* and *Taenia solium* had the least occurrences (2 each) as shown in Table 1.

Infection rate was higher in female participants (42.3%) than in male participants (38.5%) as shown in Table 2.

Table 3 shows the prevalence of polyparasitism in Okpokwu L.G.A. Thirty six (36) Participants out of 350 of them were co-infected with two or three parasites with a prevalence of 10.3%, 6 (1.7%) had co-infection by three parasites and 30 (8.57%) had co-infection by two parasites. There is no significant difference in this observation; ($p>0.05$).

Combined age- related prevalence of parasites amongst the participants shows that there was a significant difference in the infection of parasites in the L.G.A, P=0.01, 1-10 years had the highest prevalence (55.6%), while the least was in age

Table 1. Distribution of parasites species among participants

Parasite species	Male	Female	Total Species
Entamoeba histolytica	45	52	97
Entamoeba coli	10	19	29
Chilosmastix mesnilli	8	8	16
Trichomonas hominis	12	16	28
Hookworm	4	4	8
Ascaris lumbricoides	0	2	2
Taenia solium	0	2	2
Total	**79**	**103**	**182**

Table 2. Distribution of infection rate among according to gender

Gender	Number examine	Number infected	Prevalence
Male	161	62	38.5
Female	189	80	42.3
Total	350	142	40.6

Table 3. Repartition of polyparasitism by gender

Parasite combination	Male	Female	Total
C.mesnilli+T.hominis+E.histolytica	2	2	4
T.solium+T.hominis+E. histolytica	0	2	2
C. mesnilli+E. histolytica	2	4	6
T. hominis+E. histolytica	10	12	22
Hookworm+E. histolytica	2	0	2
Total	**16**	**20**	**36**

C. = Chilosmastix; T. hominis = Trichomonas hominis; E. = Entamoeba ; T. solium = Taenia solium

Table 4. Age related prevalence of intestinal and urinary parasites in Okpokwu L. G A

Age group	Number examined	Number infected (prevalence)
1-10	36	20 (55.6)
11-20	55	20 (36.4)
21-30	56	24 (42.9)
31-40	41	17 (41.5)
41-50	44	19 (43.2)
51-60	55	22(40)
61-70	37	10 (40.5)
71-80	26	10 (38.5)
Total	**350**	**142(40.6)**

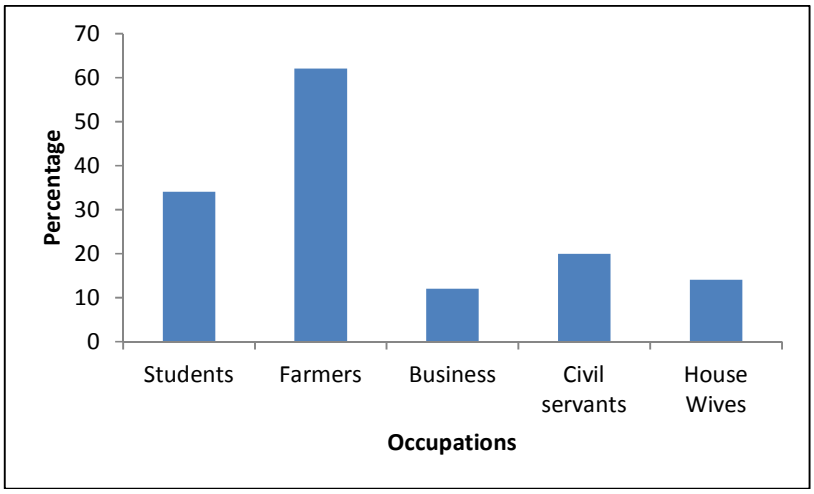

Fig. 1. Prevalence of infection in relation to occupation

group 11-20 years (36.4%). There was an overall prevalence of 142 (40.6%) (Table 4).

Prevalence of infection in relation to occupation, shows that there was no significant difference in level of infection based on occupation (p = 0.061).

Infection rate was highest among farmers compared to the other occupations (farmers 62>

students 34> civil servants 20> house wives 14> business 12) as shown in Fig. 1.

Those who adopted usage of bush/pit toilet and bush (open defecation) had the highest prevalence 2 (50%) and 37 (48.1%) respectively. while pit toilet users had the least 73 (4.2%). With respect to source of water there was also significant difference in record (P=0.001). Well/Stream source recorded the highest 28 (53.9%), while least was bore-hole source 3 (10.7%) (Table 5).

4. DISCUSSION

The rate of occurrence of *Entamoeba* species was very high in this study. This suggests a very poor level of hygienic practices mainly in the source of drinking water and the type of toilet facilities. Previous study [12] had reported poor hygienic practice in a similar study in Oju Local Government Area of Benue State. However, the prevalence of polyparasitism in the study area was low and it was in agreement with [12] who reported a low prevalence in Oju of Benue State but differs with that of Nguhiu, et al. [13] in 2014 in Kenya who reported polyparasitism rate of 71.4%. The females had higher prevalence than the males, this could be as a result of the domestic roles (cooking, laundry, cleaning up the children after defecation) women play in a household which could pre-expose them to the infective stages of the various parasites. Age group 1-10, had the highest prevalence of intestinal/urinary infection. This age group are children and the infection rate could be attributed to their playful attitude and sometimes there geophagic nature. The older age group had a low infection rate, this could be that as they grow older they acquire immunity against some of the parasitic infections or they become careful with their environments and practice good sanitary habits. Occupational wise, farmers had the highest prevalence compared to the other occupations sampled. The reason could be as a result of their farming activates, most farmers in the area do not use modern system of farming. Most often they go to farm with their lunch and other eatables eating them in the farm with/ without cleaning their hands properly. This could accidentally introduce the parasites egg through oral route. The availability of amenities like portable water supplies and health facilities in the area could be a contributing factor to the low prevalence of polyparasitic infection, and also the regular deworming activities that are frequently carried out in Health institutions and communities in Benue State could be responsible for this result [12].

Table 5. Prevalence of parasitic infection with respect to socio-environmental factors in the L.G.A

Factors	Participants (%)	infected	p-value
Toilet facilities			
Water system	96(27.4)	30(31.5)	0.001
Pit toilet	173(49.4)	73(4.2)	
Bush (Open defecation)	77(22)	37(48.1)	
Bush/pit	4(1.1)	2(50.)	
Total	**350**	**142(40.6)**	
Source of water			
Borehole	28(8)	3(10.7)	
Borehole/Stream	-	-	
Stream	140(48.3)	56(40)	0.001
Well	80(22.8)	34(42.5)	
Reservoir	50(14.3)	21(42)	
Well/Stream	52(14.8)	28(53.9)	
Total	**350**	**142(40.6)**	
Hand washing			
Wash	210(60)	70(33.3)	
Do not wash	80(22.8)	51(63.8)	0.67800
Do not remember to wash	80(22.8)	21(26.3)	
Total	**350**	**142(40.6)**	
Knowledge of parasites			
Has knowledge	167(47.7)	59(35.3)	
No knowledge	183(52.3)	83(45.4)	0.535
Total	**350(33.3)**	**142(40.6)**	

The high prevalence of *Entamoeba histolytica* and *Entamoeba coli* in the study is in agreement with previous report [12,14] that the most common protozoan parasites were *Entamoeba coli* and *Entamoeba histolytica* (causal agent of amoebiasis). Prevalence of parasitic infection with respect to socio-environmental factors, shows that with respect to toilet facilities there was a significant difference in parasitic infection based on socio-environmental factors ($p<0.05$). Bush/pit (Open defecation and pit toile) had the highest infection rate, while water system had the least. This is in contrast with earlier study [12] that reported that higher level of infection among people that practice only open defecation in Oju LGA of Benue Nigeria. This could also account for the high prevalence of *E. histolytica and E.coli* in the area as run water can wash their cyst into wells and streams. Infection rate was highest among participant that use stream as their source of water. This is in positive correlation with the higher prevalent among the people that use open/ pit toilet, similar result had been reported in Abakaliki [15]. If the rate of open defication is not checked, the health of people in this area might be at risk mainly if there is an outbreak of disease like cholera. With respect to hand washing there was no significant difference in infection ($p>0.05$), the result shows that the prevalence of intestinal/urinary parasites is not associated with hand .With respect to having the knowledge of parasite there was no significant difference in infection rate between those who have knowledge and those who do not, therefore, irrespective of the level of individual awareness on intestinal parasites, such individual could also be infected with intestinal and urinary parasites.

5. CONCLUSION

There was high prevalence of intestinal parasites in Okpokwu L.G.A. however; the prevalence of polyparasitism was very low in Okpokwu local government area of Benue Nigeria. More hygienic practices in the area will go a long way in reducing the rate of parasitic infection in the area.

CONSENT AND ETHICAL APPRROVAL

A letter of introduction was obtained from the Department of Biological Sciences, Benue State University, and Makurdi for the purpose of the research. Letter seeking for permission to carry out the study was also written to the Chairman of Okpokwu Local Government Area (LGA) and the objectives of the study were discussed.

After approval from the LGA, contacts were made with the Village heads and objectives of the study were also discussed with them. Following the discussion, permission was given from the community leaders and the heads of households were met and the objectives of the research were also discussed. After approval, the study participants were randomly selected from each household. Then the randomly selected participants were informed of the objectives of the study and their consents were sorted.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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