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Prevalence of *Entamoeba histolytica* and Hook Worm Infection in Two Communities of Kwande Local Government Area of Benue State Nigeria

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Authors' contributions

This work was carried out in collaboration between all authors. Author BNI designed the study and performed the statistical analysis. Authors BNI and AO wrote the protocol and wrote the first draft of the manuscript. Authors AO, EUA and MOI managed the analyses of the study. Authors AO and BNI managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Entamoeba histolytica and hookworm are among the 10 most prevalent intestinal parasitic infections worldwide. They contribute to low productivity, malnutrition, miscarriages, reduced lifespan and sometimes death. A study on the prevalence of these two diseases was carried out in Kwande Local Government Area of Benue State, Nigeria. Faecal samples were collected and examined for *E. histolytica* and hookworm infections from 325 subjects after the structured questionnaire was administered and filled appropriately. The stool samples were analysed using the direct wet smear in normal saline and sedimentation techniques while information on age, sex, occupation and location-related prevalence were obtained from the questionnaires. The results were statistically analysed using SPSS version 20 and mini tab 17th edition. On the whole, a prevalence of 25.5% and 6.2% were recorded for *E. histolytica* and Hookworm respectively. Children between ages 1-10 years had the highest incidence of amoebiasis (35.5%), while persons aged 41-50 years recorded highest prevalence for hookworm infection (12.2%) The infections were statistically significant concerning sex and occupation ($p < 0.05$). Females were less infected as

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compared to the males with a prevalence of 20.5% and 35.8% for *E. histolytica* and 1.9% and 15% for hookworm infection respectively (P<0.05). Farmers had the highest prevalence of 40.3% for *E. histolytica* and 16.8% for hookworm infection while traders recorded the lowest infection rates of 12.7% and 0.00% respectively (P<0.05). The prevalence of *E. histolytica* was higher in Mbawer, a farming community (29.6%) while a higher prevalence of hookworm infection was recorded in Adikpo Township (7%), the values, however, were not significantly different (p>0.05). Poor hygiene practices, lack of awareness and basic social amenities, as well as water sources in the study area, contributed to the spread of the infections. This study recommends awareness creation, public enlightenment programs on environmental sanitation and personal hygiene.

Keywords: Hookworm; Entamoeba histolytica; prevalence; communities; Kwande; Benue State.

1. INTRODUCTION

Intestinal parasitic infections are common worldwide with high prevalence in tropical and developing areas of the world, where the atmospheric conditions and reduced standards of living favour their reproduction, spread and survival [1]. Amoebiasis and hookworm infection are widely spread in areas with warm temperatures ranging from 22°C to 26°C and a humidity of between 85%-100% under which the infective stages can survive in the presence of moisture for as long as six to seven weeks, a period long enough to infect the next host [2]. Poorly sanitised environments, poor personal hygiene, unhealthy socio-cultural habits, public ignorance, lack of social amenities (such as potable water, toilet facilities etc.) and illiteracy especially of persons in rural villages where these infections are endemic are the primary causes of their persistence [3]. The diseases result in poor living conditions, malnutrition, low productivity, reduced lifespan, miscarriages, poor academic performances as well as reduced physical and mental development and even death (especially in children) [4,5]. A baseline study was carried out in Mbawer community and Adikpo Township where rural and modern lifestyles co-exist to provide information for strategic planning for the prevention and control of Amoebiasis and Hookworm infection in the study area.

2. MATERIALS AND METHODS

2.1 Study Area

Kwande Local Government Area is located between latitude 6:30° N and 7:10° N longitude 90° E to 9:40° E. It's bounded by other Local Government Areas with Ushongo on the North, Katsina-Ala on the Northwest. On the South it is bounded by Cross River State and on the East by the Republic of Cameroon. It is a mountainous area with cool weather conditions that support agricultural activities. (Gazette, No 5) (Land survey office Makurdi, unpublished data).

2.2 Study Population

Three hundred and twenty five (325) participants were determined using [6]. Of these number, males were 120 and 205 were females, participants were within the age range of 1-60 years old. Stool samples were collected randomly from farmers, households and school children from the two communities in Kwande Local Government Area of Benue State.

2.3 Sample Collection and Ethical Consideration

Ethical clearance and informed consent were obtained from relevant authorities in the Local Government Area and only volunteers engaged in the study. Stool samples were collected randomly from farmers, households and school children, in tight covered sterilized plastic containers after giving proper orientation to the participants on method of collection to prevent contamination of samples with urine and other contaminants. Samples were collected on sterile sticks provided and put into the containers supplied and each was labelled with the location, occupation, age and sex of the participants.

Structured Questionnaires were also administered to ascertain level of awareness and existing control measures if any. Participates were again oriented on general information, transmission routes and preventive measure of the infections.

2.4 Sample Analysis

Ten (10) g of fresh stool samples were collected in the morning and analyzed within three hours microscopically for trophozoites and cysts of *Entamoeba histolytica* and ova of Hookworms respectively; using direct thin wet smears in

normal saline and Sedimentation as described by [7] from July through October, 2017. Results were recorded using the age, occupation, sex and location of the participants for easy and proper statistical analysis.

Data on prevalence of infections, percentage of awareness and on relationship between the following variables: Awareness and prevalence, Sex and prevalence, Age and prevalence, Occupation and prevalence, Location and prevalence.

2.5 Sedimentation Techniques

Fresh faecal specimen was emulsified by mixing about 1 g of stool with 7 ml of 10% formol saline and kept for 10 minutes for fixation, then strained through three folds of gauze. The filtrate was added to 3 ml of ethyl-acetate, centrifuged at 1500 rpm for 5 minutes and allowed to settle. The supernatant was removed and two drops of the sediments was placed on a slide and covered with a cover slip. The preparations were examined under a microscope using X 10 and X 40 objective and observations were recorded [8]

2.6 Data Analysis

Data were analyzed using SPSS version 20 and mini tab 17th edition. The results were further subjected to Chi-square analysis, T test and one-way analysis of variance (ANOVA).

3. RESULTS

Of 325 stool samples analyzed, 25.5% had cysts of *Entamoeba histolytica,* 6.2% had ova of hookworm, while 0.6% had both parasites. A total of 105 stool samples were infected with one or both parasites. Giving a prevalence of 32.3% out of the 325 stool samples analysed.

On age related prevalence the study shows that persons within ages 1-10 years had the highest prevalence for amoebiasis (35.5%), followed by ages 41-50 years (31.7%) while ages 31-40 years had the lowest prevalence for amoebiasis (15.%). On the other hand, participants within the ages 41-50 years recorded the highest prevalence for hookworm (12.2%), followed by the age group 1-10 years (10.52%). The age groups 51 years and above recorded 0% prevalence for hookworm infection (Table 2). The results did not show significant difference between amoebiasis/hookworm infection and age groups ($P<0.05$).

Table 3 shows that amoebiasis and hookworm infection were more prevalent in males as compared to females, with males having a prevalence of 35.8% and 15% respectively while the females had a prevalence of 20.5% and 1.9%. There was significant difference between sex and the prevalence of the infections in the participants ($p<0.05$).

3.1 Occupation Related Prevalence of Amoebiasis and Hookworm Infection

Occupation related prevalence of amoebiasis and hookworm infection is presented in Table 4. Out of 107 infected stool samples analyzed, farmers had the highest number of analyzed stool samples and also recorded the highest prevalence of infections for both parasites, 40.3% and 16.8% respectively, followed by students with prevalence of 20.6% and 2% for amoebiasis and hookworm infection respectively. There is significant difference between occupation and infection as shown by Chi-square analysis ($P<0.05$).

3.2 Location Related Prevalence of Infections

The prevalence of amoebiasis was higher in Mbawer community (29.6%) while higher prevalence of hookworm infection was recorded in Adikpo Township (7%). However, there was no significant difference in the prevalence of infection and the location of the participants ($P>0.05$).

Table 6 shows some risk factors such as use of shoes, water sources, defecation sites and other habits in the study areas that influence persistence and possible transmission routes of amoebiasis and hookworm infection.

Table 1. Prevalence of amoebiasis and hookworm infection in Adikpo and Mbawer communities of Kwande local government area

Parasites	No. examined	No. infected	Prevalence (%)
Entamoeba histolytica	325	85	25.50
Hookworm infection	325	20	6.20
Mixed infection	325	2	0.60
Total	325	107	32.92

Table 2. Prevalence of *E. histolytica* and hookworm infections in relation to age in Adikpo and Mbawer communities of Kwande local government area

Age group (years)	Total no. examined	*Entamoeba histolytica*		Hookworm infection	
		No. examined	Prevalence (%)	No. examined	Prevalence (%)
1-10	72	25	35.50	8	10.52
11-20	54	13	27.58	3	09.06
21-30	97	21	18.26	4	03.47
31-40	60	12	15.00	2	07.50
41-50	31	10	31.702	5	12.19
51-60	9	2	27.27	0	00.00
>60	2	2	100.00	0	00.00
Total	325	85	26.15	22	6.77
Df		6		5	
p<0.05		<0.01		<0.01	

Table 3. Prevalence of *E. histolytica* and hookworm infections in relation to sex in Adikpo and Mbawer communities of Kwande local government area

Sex	Total number examined	*Entamoeba histolytica*		Hookworm infection	
		No. examined	Prevalence (%)	No. examined	Prevalence (%)
Male	120	43	35.83	18	15.00
Female	205	42	20.49	4	01.91
Total	325	85	26.15	22	06.77
Df		5		3	

Table 4. Prevalence of *E. histolytica* and hookworm infections in relation to occupation in Adikpo and Mbawer communities of Kwande local government area

Occupation	Total number examined	*Entamoeba histolytica*		Hookworm infection	
		No. examined	Prevalence (%)	No. examined	Prevalence (%)
Farmers	119	48	40.30	20	16.80
Traders	79	10	12.70	0	0.00
Students	102	21	20.60	2	2.00
Others	25	6	16.00	0	0.00
Total	325	85	26.15	22	6.77
Df		5		3	

Table 5. Prevalence of *E. histolytica* and hookworm infections in relation to location in Adikpo and Mbawer communities of Kwande local government area

Location	Total number examined	*Entamoeba histolytica*		Hookworm infection	
		No. examined	Prevalence (%)	No. examined	Prevalence (%)
Adikpo	227	56	24.70	16	7.05
Mbawer	98	29	29.60	6	6.10
Total	325	85	26.15	22	6.77
Df		5		3	
p<0.05		0.76		0.35	

3.3 Awareness of Amoebiasis and Hookworm Infection and Their Occurrence

Out of 325 respondents, 14.5% were aware of amoebiasis, 6.1% were aware of hookworm infections while 6.4% were aware of both amoebiasis and hookworm infection respectively. 10.7% of those who were aware of the infections were infected with either one or both parasites while 16.3% of those who were aware of the infections were not infected.

4. DISCUSSION

The prevalence of amoebiasis and Hookworm infection in two communities in Kwande Local Government Area of Benue State was investigated. The study presented a prevalence of 25.5% and 6.20% for amoebiasis and hookworm respectively. The rate for amoebiasis could be attributed to the use of human faeces as manure, poor hygiene and even illiteracy. Infection could result from the use of human faeces and animal dung as organic manure during cultivation of fruits and vegetables as its practiced in different parts of the developing world. [9,10,11,12,13] had reported high prevalence of amoebiasis in different parts of West Africa, and these they all attributed to sources of water and non-availability of sewage disposing facilities.

Prevalence of amoebiasis in this study is much higher than records from Gamo in South Ethiopia where the rate was less than 50% of records from the study area [14]. These could be attributed to the availability of basic social amenities in the later. In similar studies [15,16] had however reported low prevalence rate in Makurdi and South Ethiopia, which they also attributed to urban nature of the settlements and availability of modern sanitary facilities.

Overall prevalence of hookworm was low when compared with amoebiasis, contrary to reports by [15,17] who had both reported very high rate in different parts of Benue State. Reports of the later were similar to [18,19] in studies carried out in different parts of Oyo State. The findings of [20] carried out in Eku, Delta State also reported high rate of hookworm infection. Reports from [21] which appears to be more recent, reports low hookworm infection rate of 6.6 % in Plateau State and this compares with results from the study area. The low rate can be attributed to peculiarities in the study populations, age group, and advocacy over a period of time which probably has led to improved sanitary practices. Looking at the medium of infection, it is much easier to control hookworm infection than amoebiasis.

Table 6. Risk factors associated with parasitic infection in Adikpo and Mbawer communities of Kwande local government area

Risk factor	No. of respondent (%) Yes	No. of respondent (%) No
Hand washing		
(After defecating)	290 (89.20)	35 (10.80)
(Before eating)	265 (81.50)	9 (2.80)
Hand washing aids		
(Soap and water)	244 (75.00)	81 (25.0)
(Ash and water)	16 (5.00)	309 (95.0)
(Water only)	65 (20.00)	260 (80.0)
Fruit washing	304 (93.50)	21 (6.51)
Use of faeces as manure	119 (36.60)	206 (63.40)
Type of toilet facility		
(Open defecation)	73 (22.50)	252 (77.50)
(Pit latrine)	30 (9.20)	295 (90.80)
(Water system)	222 (68.30)	103 (31.70)
Sources of water		
(Stream)	92 (28.30)	233 (71.70)
(Hand dug well)	214 (65.80)	111 (34.20)
(Borehole)	19 (5.80)	306 (94.20)
Use of same water source for domestic and other purposes	206 (63.40)	119 (36.60)
Use of shoes	295 (90.80)	30 (9.20)

Table 7. Relationship between awareness and infections

Infection	No examined	No. aware (%)	Infected (%)
Amoebiasis	325	47 (14.50)	23.70
Hookworm infections	325	20(6.10)	7.00
Mixed infection	325	21(6.40)	8.90
Total	325	88(27.08)	

The age group with the highest prevalence of amoebiasis was 1 – 10 years. The reasons are quite obvious. Children at this age are exposed to all kinds of un-hygienic practises such as playing in the sand, swimming dirty water bodies, eating unwashed fruits, putting dirty and contaminated hands or objects into their mouth, drinking water from unhygienic water sources and so on. [10,17,20,22] had reported high infection rate in this age group, which they attributed excessive outdoors activities, foraging in garbage dumps, and eating with unwashed hands. The age group with the highest prevalence for hookworm infection and also second highest infection for amoebiasis was the 41 – 50 years old. This could be related to a decrease in personal hygiene of persons in this age bracket who are often more occupied with fending for the family and survival issues, engaging more in agricultural activities and local trades that exposes them to contaminated soils, water and unhealthy waste disposal facilities. They may also have children in the 1-10 years age group that serve them food and drinks who could be sources of infections.

Gender differences in the prevalence of both infections were recorded. It was higher in males. Males of different age groups are more engaged in outdoor activities such as playing football, swimming, fishing, hunting and farming which exposes them to infection. Generally females can be more careful than males. Most farmers admitted eating on the farms without proper hand washing, and defecating if need be, using leaves as anal cleaning materials which are usually small and slippery, resulting in contamination. The female population attend ante-natal classes during pregnancy where personal hygiene is taught and emphasized. There are also health intervention programs mostly targeted at women. These enlighten them and help reduce risk of exposure to infections. Reports from [12,23,24,25,26] all collaborate these findings.

Farmers recorded the highest prevalence and these could be attributed to their exposure to soil infested with human faeces, contaminated water sources and other un-hygienic practices. Students also recorded high infection rates resulting from poor sanitary conditions, inadequate toilet facilities, as well as indiscriminate open defecation and so on. These were collaborated by [17].

Dual infections were only recorded in two participants (0.60%) which is much lower than records form the findings of [17] (31.21%), [14] (5.5%), [25] (8.66%) and [27] (7.21%). This might be attributed to the significant drop in hookworm infection as compared to amoebiasis.

5. CONCLUSION

This research has established the occurrence of amoebiasis and hookworm infection in two communities (Mbawer and Adikpo) of Kwande Local Government Area of Benue State.

The factors more directly associated with the risk of amoebiasis and hookworm infections shown to be age, location, toilets and occupation, suggests that paying attention to sanitation may likely have a positive influence on the well-being of the populace. Public enlightenment and awareness were carried out in the course of the study which will help individuals who participated in learning the prevention and reducing the spread of the infections. Amoebiasis and hookworm infections are widespread and persistent due to poor personal and environmental hygiene practices, lack of essential amenities, and weather conditions that favour survival of their developmental (infective) stages. This study, therefore, recommends continuous advocacy on the need to maintain clean environments and personal hygiene. Relevant agencies should provide potable water and health care facilities to facilitate routine checks on the population.

CONSENT

As per international standard or university standard, patient's written consent has been collected and preserved by the authors.

ETHICAL APPROVAL

As per international standard or university standard, written approval of Ethics committee has been collected and preserved by the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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